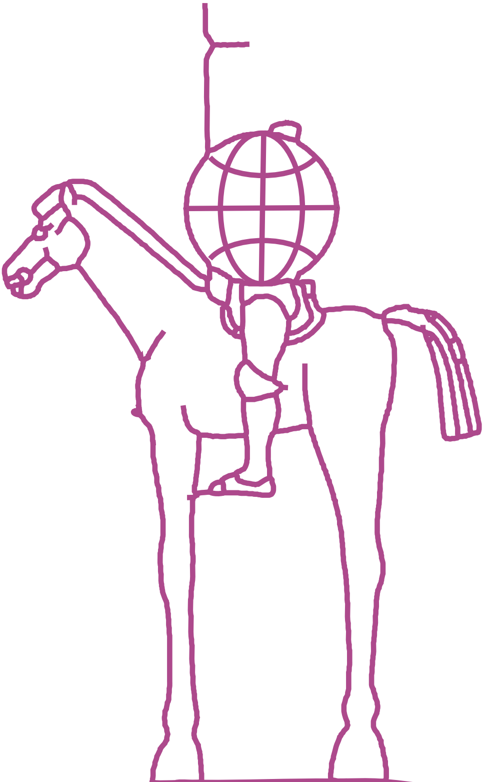
MASARYK UNIVERSITY

Proceedings of 25th Central European Conference

Useful Geography: Transfer from Research to Practice



12th–13th October 2017, Brno

Proceedings of 25th Central European Conference

Useful Geography: Transfer from Research to Practice

12th–13th October 2017, Brno

Hana Svobodová (ed.)

Masaryk University
Brno 2018

ISBN 978-80-210-8908-2
ISBN 978-80-210-8907-5 (paperback)
https://doi.org/10.5817/CZ.MUNI.P210-8908-2018

The organizers of the 25th Central European Conference:

Department of Geography, Faculty of Education, Masaryk University, Brno, Czech Republic

Department of Geography and Regional Development, Faculty of Natural Sciences, Constantine the Philosopher University in Nitra, Slovak Republic

Program Committee:

Prof. Martin Boltižiar, Department of Geography and Regional Development, Faculty of Natural Sciences, Constantine the Philosopher University in Nitra, Slovak Republic

Assoc. Prof. Alena Dubcová, Department of Geography and Regional Development, Faculty of Natural Sciences, Constantine the Philosopher University in Nitra, Slovak Republic

Assoc. Prof. Eduard Hofmann, Department of Geography, Faculty of Education, Masaryk University, Brno, Czech Republic

Assoc. Prof. Jaromír Kolejka, Department of Geography, Faculty of Education, Masaryk University, Brno, Czech Republic

Assoc. Prof. Alfred Krogmann, Department of Geography and Regional Development, Faculty of Natural Sciences, Constantine the Philosopher University in Nitra, Slovak Republic

Assoc. Prof. Hana Svatoňová, Department of Geography, Faculty of Education, Masaryk University, Brno, Czech Republic

Dr. Hana Svobodová, Department of Geography, Faculty of Education, Masaryk University, Brno, Czech Republic

Reviewers:

Prof. Martin Boltižiar, Department of Geography and Regional Development, Faculty of Natural Sciences, Constantine the Philosopher University in Nitra, Slovak Republic

Dr. Jaromír Čapek, Department of Military Geography and Meteorology, Faculty of Military Technology, University of Defence, Brno, Czech Republic

Dr. Rastislav Čief, Department of Geography, Faculty of Education, Catholic University in Ruzomberok, Slovak Republic

Mgr. Radek Durna, Department of Geography, Faculty of Education, Masaryk University, Brno, Czech Republic

Assoc. Prof. Eduard Hofmann, Department of Geography, Faculty of Education, Masaryk University, Brno, Czech Republic

Dr. Martin Hubáček, Department of Military Geography and Meteorology, Faculty of Military Technology, University of Defence, Brno, Czech Republic

Dr. Jiří Jakubínský, Department of Carbon Storage in the Landscape, Global Change Research Institute – CzechGlobe, Brno, Czech Republic

Dr. Tomáš Janko, Institute for Research in School Education, Faculty of Education, Masaryk University, Brno, Czech Republic

Assoc. Prof. Jaromír Kolejka, Department of Geography, Faculty of Education, Masaryk University, Brno, Czech Republic

Assoc. Prof. Alfred Krogmann, Department of Geography and Regional Development, Faculty of Natural Sciences, Constantine the Philosopher University in Nitra, Slovak Republic

Dr. Silvie R. Kučerová, Department of Geography, Faculty of Science, Jan Evangelista Purkyně University in Ústí nad Labem, Czech Republic

Dr. Aleš Létal, Department of Geography, Faculty of Science, Palacký University Olomouc, Czech Republic

Dr. Libor Lněnička, Department of Geography, Faculty of Education, Masaryk University, Brno, Czech Republic

Dr. Darina Mísařová, Department of Geography, Faculty of Education, Masaryk University, Brno, Czech Republic

Prof. František Petrovič. The Department of Ecology and Environmental Sciences, Faculty of Natural Sciences, Constantine the Philosopher University in Nitra, Slovak Republic

Assoc. Prof. Marian Rybanský, Department of Military Geography and Meteorology, Faculty of Military Technology, University of Defence, Brno, Czech Republic

Mgr. Kristýna Rybová, Department of Geography, Faculty of Science, Jan Evangelista Purkyně University in Ústí nad Labem, Czech Republic

Dr. Hana Svobodová, Department of Geography, Faculty of Education, Masaryk University, Brno, Czech Republic

Ing. Zdeněk Šilhan, Department of Regional Economics and Administration, Faculty of Economics and Administration, Masaryk University, Brno, Czech Republic

Prof. Václav Talhofer, Department of Military Geography and Meteorology, Faculty of Military Technology, University of Defence, Brno, Czech Republic

Mgr. Libor Trtek, Department of Geography, Faculty of Education, Masaryk University, Brno, Czech Republic

All papers have been peer-reviewed.

The authors of individual papers are responsible for technical, content, and linguistic correctness.

CONTENT

INTRODUCTION

During the days 12th–13th October, 2017, the 25th edition of the Central European Conference, entitled "Useful Geography: Transfer from Research to Practice", took place at the Pedagogical Faculty of Masaryk University in Brno. The main organizer in the odd year is the Department of Geography, Faculty of Education, Masaryk University, Brno, Czech Republic, in partnership with the Department of Geography and Regional Development, Faculty of Natural Sciences, Constantine the Philosopher University in Nitra, Slovak Republic. The cooperation of Czech and Slovak geographers continues further in the area of exchange of new geographic knowledge, information and contacts. In addition to Czech and Slovak geographers, the conference was attended by colleagues from Poland and Russia.

The conference itself was conceived rather unusually compared to the previous years. The model of the presentation of linearly ordered papers in the thematic sections was abandoned and was given a space for discussion and deeper reflection of current geography problems through three panel discussions:

Physical geography and its applications (in cartography, GIS, education, planning, safety)

Socio-economic geography and its application (in professional practice, education, planning)

Regional geography and its application (in cartography, GIS, education, planning, management)

The proceedings itself, unlike the narrowly focused panels, is thematically conceived very widely – it contains contributions from four sub-geographic disciplines:

Geography as a science, didactics of geography

Physical geography, landscape research

Cartography, GIS and digital technologies

Human geography

In total 48 papers are published and I believe that each geographer can find a lot of new information and interesting ideas that could be used mainly in transfer from research to practice.

Hana Svobodová, editor

TRADITIONAL, DISAPPEARING AND EMERGING HUMAN GEOGRAPHY TOPICS AT GRAMMAR ACHOOLS AND IN UNDERGRADUATE GEOGRAPHY TEACHER TRAINING PROGRAMMES

Rastislav Čief, Branislav Nižnanský

Katolícka Univerzita Ružomberok, Technická Univerzita Liberec, Hrabovská cesta 1, Ružomberok 034 01 / Studentská 2, Liberec 461 17

rastislav.cief@ku.sk, branislav.niznansky@tul.cz

Abstract: Traditional Human Geography was referred to as Socio-economic Geography in the didactic practice of the Soviet bloc. Thematic areas of the Socio-economic Geography curriculum included traditional topics: population and settlement, economy, manufacturing and non-manufacturing industries, services, tourism and foreign trade. The current curriculum of the subject of Geography has undergone the transformation of the content of the curriculum. The original topic of the population and settlements has been modified mainly under the influence of the development of Social Geography at the CU in Prague. In the field of Economic Geography, the thematic content has responded to the Industry Classification System, with emerging topics related to the quaternary and quinary sector of economy. There have emerged topics related to Cultural Geography, including the development of Political Geography. The paper presents the comparison of traditional, disappearing and emerging topics of Human Geography within the curricula of grammar schools and undergraduate Geography teacher training programmes.

Keywords: educational programme, topics of Human Geography, textbooks, study plans

1 INTRODUCTION

Human Geography belongs to fast-growing disciplines. The paper describes analysis of Human Geography topics in selected educational materials used at secondary schools and in undergraduate Geography teacher training programme. The analysis of changes in Human Geography topics at secondary schools was carried out on the basis of comparison of old and new Geography textbooks in the Slovak Republic. We also outlined the differences of topics in Czech textbooks. Human Geography in undergraduate programmes was analyzed on the basis of comparisons with the topics of the Bachelor State Exam. All of this was carried out within the context of "National Geography Standards (NGC 1996-2017)". While comparing the thematic areas and conceptual bases, we are pursuing the objective of monitoring the current trends by distinguishing traditional, disappearing and emerging topics and concepts of Human Geography in Geography education on the secondary level.

2 HUMAN GEOGRAPHY TOPICS IN GRAMMAR SCHOOL TEXTBOOKS IN THE SLOVAK REPUBLIC

The comparison of old and new Geography textbooks at grammar schools in the Slovak Republic has shown a characteristic feature, which is a significant reduction of the extent and the content in Human Geography, which also follows from the processed analysis, resulting in elaborated schemes (Tables 1-5).

Tab. 1: The topic of "Population" in grammar school textbooks 2006 and 2009

The development of population and prognosis of its development		
Spatial distribution of population		
Population dynamics	⇨	Development, distribution and movement of the population
Natural movement of the population		
Mechanical movement of the population		
Structure of the population		
Population structure by sex and age		
Racial structure of the population	⇨	Population by sex, age, nationality and language
Linguistic and national population structure		
Educational structure of the population		
Religious structure of the population	⇨	Religions of the world

Source: Mládek 2006 **Source: Tolmáči 2009**

In a traditional topic of "Population", there is a significant reduction in the text (Three chapters within six pages instead of original eleven chapters within thirty-two pages). The following concepts have been omitted: Neolithic Revolution, ecumene, unecumene, subecumene, specific mortality, infant mortality, fertility, demographic cycle, demographic revolution, demographic transition and re-emigration. In the older textbooks, the procedural knowledge dimension was represented by a formula for calculating population movement, which is not present in the new textbooks. Also, the graphical comparison of the changes in the share of continents in the total population of the world has disappeared.

Preserved concepts are: population explosion, population density, natality, mortality, life expectancy, natural movement, mechanical movement, total movement, age pyramid, progressive type, stationary type, regressive type, race, europoid, mongoloid, equatorial, nation, nationality, language family, religion, Christianity, Catholicism, Protestantism, Orthodoxy, Islam, Hinduism, Buddhism, Judaism.

Newly added adjectives "monotheistic, polytheistic" suggest an effort to describe the concept of religion better, which is so important within the education now (but obscure in the past).

We need to say that in connection with the current issue of migration, the curriculum reduction within the topics of "formula for calculating population movements" and "demographic cycle theory" was not chosen appropriately.

Tab. 2: The topic of "Settlements" in grammar school textbooks 2006 and 2009

Basic concepts and units	
Structure of settlements	
Size structure	
Functional structure	
Hierarchical structure	
Spatial structure of the town	
Morphology - a town plan	Settlements
Functional division of the town	
Horizontal and vertical growth of the town	
Urbanization process	
Understanding of urbanization and its indicators	
Development trends in urbanization in the world	

Source: Mládek 2006 **Source: Tolmáči 2009**

In another traditional topic of "Settlements", there is a significant reduction in the text (one chapter within two pages instead of original twelve chapters within sixteen pages). The following concepts have been omitted: municipality, Zipf's law, Christalle's Central place theory, monogenetic, polygenetic, functional division of the town, suburbs, satellite town and suburban zone.

Preserved concepts are: settlement, municipality, settlement, urbanization, city, metropolis, agglomeration, conurbation, megalopolis, polyfunctional, monofunctional, village and countryside.

A newly added and important concept (15% of the text on settlements) in the new textbook is "slums". Interestingly, the older textbook criticizes the concept of "village" as archaic, but it is used again in the new textbook and is no longer marked as archaic. We have identified several disappearing concepts (not used in the new textbook) related to suburbanization (suburban, suburban zones, satellite town, suburban zone). But according to the authors, the topic of suburbanization can be classified as an emerging topic.

Tab. 3: The topic of "Primary and Secondary Sector" in Grammar School Textbooks 2006 and 2009

	Economy
Importance of agriculture and basic characteristics Types of agricultural landscape Types of agricultural plants Selected types of farms in the world	→ Primary sector
Basic division of industrial production Definition of industrial production Origin and development of industrial production Main types and sectors of the economy Location of industrial production The main factors affecting the location of industrial production Energy Energy as a location factor in industrial production Development of the world Energy economics Spatial distributed of industry The main areas of industrial concentration in the world	→ Secondary sector

Source: Mládek 2006 **Source: Tolmáči 2009**

In the next traditional topic "Primary and Secondary Sector", there is a significant reduction in the text (three chapters within four pages instead of original sixteen chapters within twenty-five pages). The omitted concepts are: types of agricultural landscape, arable, grasslands, land with mixed crops, permanent coppice, suburban agricultural land, self-supplying, market, extensive, intensive, farm, plantation, manufactory, industrial revolution, mechanization, automation and industries.

Preserved concepts are: agriculture, crop production, livestock production, food, feed, technical crops, delicacies, cattle, sheep, pigs, poultry, energy, renewable and non-renewable resources, localization factors, global economy and multinational companies.

The new concepts can be found within the extended characteristics of the primary sector (fisheries, forestry, mining, world granaries). These concepts, similarly to the other two added (Asian tigers, economic crisis), have been considered to be more traditional than emerging in Human Geography.

Tab. 4: The topic of "Tertiary and Quaternary Sector" in Grammar school textbooks, 2006 and 2009

Main types of transport The role of transport in organizing the life of society Factors affecting localization of traffic routes and facilities Basic division of transport World Transport Systems Transport systems in different regions of the world Tourism Historical development of tourism The importance of tourism Forms of tourism Areas of tourism Services Social Services - social infrastructure Technical infrastructure Foreign Trade	⇨	Tertiary and quaternary sector

Source: Mládek 2006 **Source: Tolmáči 2009**

In another traditional topic "Tertiary and Quaternary Sector", there is also a significant reduction in the text (one chapter within two pages instead of original fifteen chapters within nineteen pages). The omitted concepts are: special types of transport, direction of transport development, forms of tourism, agritourism, mineral and thermal spas, climate spas and trip tourism.

Preserved concepts are: transport, rail transport, road transport, air transport, water transport, pipeline transport, services, tourism, seaside areas, mountain areas and tourism of settlements.

The disappearance of all concepts related to all forms of tourism is questionable within the context of the rise of tourism and related free-time activities. No new concepts have been found within the topic of "tertiary and quaternary sector" (a current and emerging topic in modern Geography).

Tab. 5: The topic of "Political Geography" in grammar school textbooks, 2002, 2006 and 2009

Spatial differentiation of the socio-economic development of the world Cultural-geographic (complex) regions of the world World Development Models		
Basic stages of development in the 20th century Picture of the current world political map Political and other country groupings	⇨	Political map
Economic systems Economic integrations		
Differences in the development of the economies in the world Major issues of human society		

Source: Mariot 2002 and Mladek 2006 **Source: Tolmáči 2009**

Another traditional topic of “Political Geography” also saw a significant reduction in the text (one chapter within two pages instead of original ten chapters within twenty-seven pages). The following concepts have been omitted: countries of the first world, countries of the second world, humanitarian aid, cultural and geographic regions, models of the world development, consumer society, global ecological problems, republic, parliamentary type, presidential type, constitutional monarchy, absolutist monarchy, unitary state, federation, liberalization, privatization, convertibility, inflation, OPEC, OECD, Comecon and OAU.

Preserved concepts are: rich north, poor south, states, colonies, third world countries, decolonization, European Union, UN, and dictatorship. The new concepts are: strategic interests, superpowers, globalization, terrorism, organized crime and unnaturally created borders.

The topic's inclusion is very inconsistent in terms of the placement level of the topic within the textbook and its dramatic changes in chapter titles, omitted and added concepts. For example, why has a significant concept of (if not one of the most important) “humanitarian aid” been omitted, while the concepts with a rather negative meaning have been added?

3 HUMAN GEOGRAPHY TOPICS IN THE SECONDARY SCHOOL TEXTBOOKS IN THE CZECH REPUBLIC

We conducted a comparison of the content of secondary school textbooks focused on Human Geography in the Czech Republic that have lead to the following comments.

The title of the discipline of Human Geography itself is different. The authors of the textbooks of “Economic Geography” (currently used at Business Academies) address the discipline with the concept of “Social (Sociogeographic) discipline” (Skokan 2006) or “Social Geography (Bičík 2005)”. The former textbook partially introduces the social disciplines. (See Table 6, left column) The textbook of Geography for Secondary Schools 2 introduces the socio-economic part as a subchapter of “Human Geography” to the main unit of “Socio-Economic Geography” (See Table 7).

Tab. 6: Sub-disciplines of Human Geography and Economic and Geographic Topics named in the textbook of “Economic Geography”

Social (sociogeographical) disciplines	Division of labor
Social and Economic Geography	social ↔ local/international
Population Geography	
Cultural Geography	
Political Geography	Economic structure
etc. (Skokan 2006)	sectoral ↔ territorial

Source: Skokan 2006

Out of the three secondary school textbooks dealing with the topics of Human Geography, the textbook written by the authors S. Mirvald et al. (2003) is the most detailed in terms of the extent and the contents. Its content, apart from two chapters, is very similar to the analyzed Slovak textbooks. On the other hand, the approach to creating chapter titles is different. Human Geography topics use mainly traditional concepts. We can mention the concepts of structural changes and the international division of labour, just to name a few concepts we didn't come across in the analysis of Slovak textbooks. Very close economic-geographical concepts were also found in the titles of the textbooks written by L. Skokan (See Table 6, right column).

In the contents of the analyzed Czech textbooks, we found two topics that are different from traditional topics of Human Geography: "Landscape and the Environment" and "Applied Geography" (See Table 7). While the topic of "Landscape and the Environment" can be found separately in secondary school textbooks in the Slovak Republic, the topics of "Applied Geography" are represented only by the issue of spatial planning within the topic of "Landscape and the Environment".

These two topics, which were found in three analyzed Czech textbooks, are structured very similarly. But there are only about four chapters dealing with the issues of "Landscape and the Environment" and "Applied Geography" in the textbook of L. Skokan et al., while there are ten chapters in the textbook written by S. Mirvald et al.

Tab. 7: Contents of S. Mirvald's et al. textbook focused on Socio-economic Geography

Socio-Economic Geography (Mirvald 2003)	**World Economy**
Human Geography	Conditions of spatial distribution of agricultural production
The world population is growing and its distribution is uneven	Agriculture in moderate and polar belt
People change the place of residence and employment	Agriculture in subtropical and tropical belt
Nations of the world and the role of religion in their lives	Economic use of oceans and seas
Rural settlements	Water industry
Urbanization process and urban settlements	Wood industry
Settlement systems	Conditions for industrial layout
	Structural changes in industry
	Energy - the basis of industrial production
Landscape and the Environment	Industrial regions of the world
Human interactions - nature	Transport - human activity of the future
Man cares about the country	Conditions for the transport networks deployment
Global problems of mankind	Spatial distribution
Sustainable development	Services to the inhabitants
	Transfer of messages and information
	International division of labor
	World Economic Integration
Applied Geography	Prerequisites of tourism
Regional Policy and Regional Development	Tourism distribution in the world
Geographic information systems	**Exercises and Excursions**
Socio-economic regionalization	Research on the effects of laundry detergents use on the surface water quality
Globalization of the world	Excursion to an industrial plant
Civilization - the future basis for the division of the world?	Research on the impact of the transport route on the landscape
Models of the world development	Research on the attractiveness of settlements for tourism

Source: Mirval 2003

Tab. 8: NGS - US National Geographic Standard

The World in Spatial Terms	**Human Systems (NGS 1994)**
How to use map and other geographic representations, tools and technologies to acquire, process and report information from a spatial perspective	The characteristics, distribution and migration of human populations on Earth´s surface
How to use mental maps to organize information about people, places and environments in the spatial context	The characteristics, distribution and complexity of Earth´s cultural mosaics
	The patterns and networks of economic independence on Earth´surface
How to analyse the spatial organization of people, place and environments on Earth´s surface	The processes, patterns and functions of human settlement
Places and Regionas	How the forces of cooperation and conflict among people influence the division and control of Earth´s surface
The physical and human characteristic of places	**Environment and Society**
The people create regions to interpret Earth´s complexity	How human actions modify the physical environment
How culture and experience influence people´s perceptions of places and regions	How physical systems affect human systems
Physical Systems	The changes that occur in the meaning, use, distribution and importance of resources
The physical processes that shape the patterns of Earth´s surface	**The Uses of Geography**
The characteristics and spatial distribution of ecosystems on Earth´s surface	How to apply geography to interpret the past
	How to apply geography to interpret the present and plan for the future

Source: © NGC 1996-2017

The chapters with these topics (Mirvald 2003) can be considered as emerging topics. Their characteristics, such as interdisciplinarity and focus on the issues of the landscape, including its human-geographic components, are a response to the current requirements of geographical education. The very content structure of this textbook is very similar to the second part of the list (Table 8, right column) of the topics of the US National Geographic Standard (NGS, © NGC 1996-2017). The difference in the contents of the chapters dealing with the issues of a man in the country and the issues of Geography in the NGS and in S. Mirvald's textbook (2003) highlight the novelty of the topics and their up-to-date response within the context of traditional topics of Human Geography. See the chapters of "Landscape and the Environment" and "Applied Geography" (Table 7) and thematic units of "the Environment and Society" and "The Use of Geography" (Table 8).

4 THE TOPICS OF HUMAN GEOGRAPHY IN UNDERGRADUATE GEOGRAPHY TEACHER TRAINING PROGRAMMES

The analysis of the topics of Human Geography and their occurrence in undergraduate programmes was carried out on the basis of the topics of the Bachelor State Exam. We analyzed the topics in the Department of Regional Geography of the Comenius University in Bratislava and the Departments of Geography at the Catholic University in Ružomberok and the Technical University in Liberec.

In all three cases, students choose one question from Human Geography, which is one out of the three thematic areas of the State Exam (33% of the curriculum at Bachelor State Exam). The requirements of Slovak universities include the knowledge of 24 (27) shorter or more detailed topics. The Department of Geography in Liberec (KGE TUL) requires a debate on one theme out of previously known fifteen themes consisting of one main topic and three subtopics.

All three departments require traditional topics of "Population" and "Settlements" with a traditional, already mentioned conceptual basis. The KGE TUL themes also include a regional element within the topics of

“Population Geography of the Czech Republic” and “Settlement Geography of the Czech Republic”.

The topics of the “Population” and “Settlements” make up almost half of the extent of the analyzed assignments provided to students on the department’s web site. The second part is again focused on traditional topics of primary up to tertiary sectors, beginning with agriculture and ending with tourism.

It cannot be said that any of the above mentioned topics is a disappearing one in regard to the analyses made. On the contrary, in Liberec topics we find interconnection of the population mobility in relation to the functional spatial structure of the settlement with respect to the concepts of Time Geography. Similarly, the concepts related to the “exploitation of resources in the context of uneven development and the issues of the development of peripheral areas of the Czech Republic” or “the role of infrastructure and development barriers” can be considered as emerging concepts.

In some topics dealing with Human Geography in the Department of Regional Geography at UK in Bratislava we can find some not quite traditional (from the point of view of previous analysis) Human Geography concepts, e. g. agro-complex or social and technical infrastructure. In “Applied Geography”, an emerging topic is for example the topic of “The map of the usage of the Earth, its preparation and its construction, the forms of the usage of the Earth”.

5 CONCLUSION

Seeing the results of comparisons of older and newer textbooks (and Bachelor State Exam topics), it is very difficult to predict the trends of emerging and disappearing topics of Human Geography. We can see a rather conservative structure of the topics and the main trend is in the reduction of the content and extent of the curriculum, with exceptional addition of selected concepts (e.g. monotheistic, polytheist, extended characteristics of primary sector, etc.). Sometimes we observe an almost inadequate expansion, as in the case of the concept “slums”.

A very similar conservative model of conceptual construction was also found in three documents used by all three Geography departments in the Slovak Republic and the Czech Republic which included Human Geography topics. Virtually, the whole contents of the given topics consisted of the concepts which we described in the analysis of Slovak secondary school textbooks. As shown above, we can see the transfer of the original extent and the contents from the secondary school leaving examination to the level of the Bachelor State Examination.

In selecting educational materials and their following deeper analysis, we find important to focus on the following issues:

1. Conceptual basis of traditional concepts of Human Geography in Geography for secondary schools and undergraduate Geography teacher training programmes, its variants, its key concepts and occasionally or exceptionally occurring concepts.

2. The need to link the concepts and topics of Human Geography with the topic of “Man and country” (or “Environment and Society”), the key concepts of this topic, its interdisciplinary view.

3. Partial issues of the topic of “Applied Geography” (The Uses of Geography): geoinformation technologies, spatial planning, globalization, regional policy and regional development, sustainable development, renewable resources, etc. Human Geography aspects of these topics and the orientation of Human Geography to addressing the issues of a landscape, settlements and human society within the context of new trends in Human Geography.

These conclusions indicate a relatively great power of the paradigm of traditional Human Geography. Where the foundations of Human Geography are being laid, which is at secondary schools and in undergraduate teacher training programmes, the construction of its conceptual basis is based on traditional concepts. It is disturbed only exceptionally and to a minimal extent by topics which still have to defend their position in Human Geography.

REFERENCES

BIČÍK, I. a kol. 2005. Hospodářský zeměpis. Globální geografické aspekty světového hospodářství. Učebnice pro obchodní akademie a jiné střední školy. Nakladatelství ČGS s.r.o. 96 s. ISBN 80-86034-52-6.

BIZUBOVÁ, M., KUSENDOVÁ, D., RUŽEK, I., RUŽEKOVÁ, M. a TRIZNA, M. 2008. Geografia pre 1. ročník gymnázií. 1.vydanie. SPN: Bratislava. 96 s. ISBN 978-80-10-01429-3.

LAUKO, V. a TOLMÁČI, L. 2004. Geografia pre 2. ročník gymnázií. Slovensko. 2.vydanie. Orbis Pictus Istropolitana. 64 s. ISBN 80-7158-468-1.

MARIOT, P. et al. 2002. Geografia pre 2. ročník gymnázia, I. diel. 4.vydanie. Orbis Pistus Istropolitana. 88 s. ISBN 80-7158-402-9.

MLÁDEK et al. 2003. Geografia pre 1. ročník gymnázií, 2.diel. Humánna geografia. 3.vydanie. SPN, Bratislava. 103 s. ISBN 80-10-00235-6

MLÁDEK et al. 2006. Geografia pre 1. ročník gymnázií, 2.diel. Humánna geografia. 4.vydanie. SPN, Bratislava. 109 s. ISBN 80-10-00767-6

MIRVALD, S. et al. 2003. Geografie 2 pro střední školy Socioekonomická část. SPN: Praha. ISBN 80-7235-008-0.

National geography standards 1994, NGC 1996-2017.

SKOKAN, L. et al. 2006. Hospodářský zeměpis 1 pro obchodní akademie a ostatní střední školy. 4. vydání, Fortuna: Praha 135 s. ISBN 80-7168-861-4.

TOLMÁČI, L., LAUKO, V., GURŇÁK, D. a KRIŽAN, F. 2011. Geografia pre 3. ročník gymnázií. 1.vydanie. VKÚ, Harmanec. 119s. ISBN 978-80-80-8042-610-1

TOLMÁČI, L., GURŇÁK, D. a KRIŽAN, F. 2009. Geografia pre 2. ročník gymnázií. 1.vydanie. VKÚ Harmanec. 112 s. ISBN 978-80-8042-580-7

Shrnutí

V příspěvku je popsána analýza témat humánní geografie ve vybraných edukačních materiálech používaných na středních školách a na bakalářském stupni studijního programu Učitelství geografie. Analýza změn témat humánní geografie středních škol je provedena na základě porovnání starých a nových učebnic geografie v SR. Načrtnuty jsou i rozdíly v obsahu a rozsahu témat

v českých učebnicích. Humánní geografie v bakalářských programech je analyzována podle témat bakalářských státnic. To vše v kontextu dokumentu „National Geography Standards (NGC 1996–2017)“. Porovnáním tematických okruhů a pojmových bází sledujeme cíl monitorovat aktuální trendy odlišením témat a pojmů v humánní geografii tradičních, ustupujících a nastupujících v realizaci obsahu geografického vzdělávání na středoškolské úrovni.

Při výběru a analýze dalších edukačních materiálů považujeme za důležité, se zaměřit na následující problémy:

1. Konceptuální báze tradičních pojmů humánní geografie v středoškolské a bakalářské geografii, její varianty její klíčové pojmy a občasně případně výjimečně se vyskytující pojmy.

2. Propojení pojmů a témat humánní geografie s tématem „Člověk a krajina“ případně „Environment and Society“, klíčové pojmy tohoto tématu z hlediska humánní geografie, jeho interdisciplinární záběr.

3. Parciální problémy tématu „Aplikovaná geografie“ (The Uses of Geography): geoinformační technologie, územní plánováni, globalizace, regionální politika a regionální rozvoj, udržitelný rozvoj, obnovitelné zdroje apod. Humánněgeografické aspekty uvedených témat a orientace humánní geografie na geografická řešení problémů krajiny, sídel a lidské společnosti.

Uvedené závěry indikují poměrně velkou sílu paradigmatu tradiční humánní geografie. Tam, kde se kladou její základy, tj. na středních školách a v bakalářském stupni přípravy učitelů, je konstrukce její pojmové báze téměř beze zbytku postavená na tradičních konceptech.

PUPIL’S DIFFICULTIES IN PERFORMING PROBLEM-BASED LEARNING TASKS IN GEOGRAPHY: RESULTS OF THE QUALITATIVE ANALYSIS

Tomáš Janko[1], Petr Knecht[2], Silvie Rita Kučerová[3], Jan Daniel Bláha[4]

Masaryk University Faculty of Education
[1] janko@ped.muni.cz, [2] knecht@ped.muni.cz

Jan Evangelista Purkyně University in Ústí nad Labem
[3] silvie.kucerova@ujep.cz, [4] jd@jackdaniel.cz

Abstract: The authors conducted 22 unstructured heuristic interviews with the 7th and 8th grade pupils of the Czech lower secondary schools. During the interview the pupils were asked to perform a problem-oriented learning task with the help of visuals in the contemporary Czech geography textbooks and Czech *School Atlas of the World*. The aim was to determine where exactly the pupils fail when performing the assigned learning task. The interviews were analysed using a qualitative content analysis with open coding as a methodological tool. This working paper is an outcome of the research project Visual Geographic Information and its Role in Geographic Education (GA16-01003S) funded by the Czech Science Foundation (GAČR).

Key words: didactics of geography, geography education, learning tasks, lower secondary school pupils, problem solving

INTRODUCTION

Both our our interest and motivation to conduct research, presented in this working paper, result from the needs of teaching practice. Czech geography teachers still tend to hold a conservative attitude towards using cognitively more difficult tasks (Řezníčková, 2009). The same problem applies to geography textbooks (Průcha, 2014) and geography curriculum (Hanus & Marada, 2013). This contrasts with the theories of learning which hold that learning is effective in particular if questions and tasks with different levels of difficulty are preferably in an appropriate balance (comp. Mullis et al., 2009 and others). International comparative research proves that Czech pupils fail to solve more difficult problem-based learning tasks on a long term basis (Martin et al., 2012). Problem-based learning is considered an ideal rather than regular teaching method at levels of lower and upper secondary education (Hübelová, Janík, & Najvar, 2008). This research tries to respond to the above-mentioned shortcomings. The aim is not only to develop the theory and identify where exactly pupils fail while performing problem-based learning tasks, but also to solve a practical problem and discover how to design educational tools to support pupils’ learning. Taking into account the current state of knowledge, we want to examine pupils’ learning in the authentic educational context.

THEORETICAL BACKGROUND

Ainsworth (2006) states that based on mapping an extensive research field, the researcher's interest should focus primarily on research questions revealing subject specific characteristics of the particular learning content related to the principal aim of the learning task (or more precisely to the learning objectives). The aim of such research is to apply its findings while designing learning materials. Problem-based geography tasks are supposed to have some distinctive features reflecting the objectives and content of geography as a school subject. It is assumed that processes of teaching and learning geography are so distinctive that they are possible to analyse only by means of research tools reflecting this distinctive feature (cf. Lambert, 2010, p. 85). This claim is in line with the content-oriented approach to the quality of teaching which "aims at taking into consideration the contextualization of teaching and learning processes, i.e. the fact that they always take place on a certain substance basis which can be established through acting and communicating. Teaching and learning cannot therefore be of a high quality if its content is empty. Putting emphasis on the content ought not to interfere with our regard for the pupil or the process, and thus for the methods of teaching. The reason for this is that pupil's learning as well as a teaching process and its methodology takes place within the particular content structured in learning tasks. Accordingly, a teacher can approach a pupil or methods of teaching only through the pupil's involvement in the content." (Janík et al., 2013, p. 161)

THE STUDY

Research objective

The research methodology might be termed the basic research on applied problems (Mayer, 1997; 2008). The objective of the research was to identify the problems the lower secondary school pupils face when performing problem-based learning tasks in geography.

Research sample

The research sample consisted of 22 eighth grade pupils of the lower secondary schools in the Czech Republic (aged 13–14 years). Sampling was purposive – the pupils attended three different elementary schools from different regions of the Czech Republic. Both pupils' legal representatives and pupils were presented an informed agreement which included information about the purpose and benefits of the research for the participating pupils. The type of sampling did not allow for any generalisation of research findings, e.g. according to the demographic characteristics of the pupils. We did not seek to achieve maximal structural variation, even though it should be required. We were limited by the informed agreements from pupils' parents and the pupils' willingness to cooperate. Only one pupil was always interviewed, but in some cases another pupil was present at an interview in particular for organisational reasons. Teachers were not present.

METHOD

A heuristic interview (Moustakas, 2015, pp. 313–314) was used for data collection. It is a technique for clearing up and solving problems in which participants/respondents are motivated by means of open questions, learning tasks, arguments, and counter-arguments. A heuristic interview helps a pupil discover mistakes, coincidences, and nature of phenomena; draw conclusions and make generalisations. Pupils ought to answer the question: In which of these cities: Kiev, Moscow and Oslo is the biggest difference in summer and winter temperatures? Stimulating material (one page from a textbook and appropriate map extracts from the school atlas) was available to the pupils. A researcher encouraged pupils to work with stimulating material, follow its structure, formulate hypotheses, and give reasons for their arguments with the help of follow-up and adequate questions.

Data analysis

Consequently, audio recording was transcribed with the help of oTranscribe application (http://otranscribe.com/). The interviews were analysed using a qualitative content analysis with open coding as a methodological tool. We tried to find similarities and analogies through the research data during the analysis of interviews. We also tried to capture the moments which were surprising, unique, different and relevant to the specified research question.

FINDINGS

When performing problem-based learning task in geography, pupils faced the following kinds of difficulties: (a) linking pieces of visual information if they are not in one place, (b) correct interpretation of both visual and verbal messages, (c) substitution of wrong notions and misconceptions with the presented subject matter, (d) basic understanding of the subject matter.

Ad (a): Linking pieces of visual information if they are not in one place

The first kind of pupils' difficulties concerned their low ability to work with different types of representation, in particular when individual types of representation occurred in different places. Efficiency of learning materials is higher, provided that all necessary pieces of information are presented in one place, which results from the recommendations for designing visual materials in textbooks supported by research (Sweller, 2005; Mayer, 2011). Therefore, work with an atlas is an inseparable part of geographical education (Lambert, 1999).

An illustrative example of interviews no. 1:

> T: Yes, exactly. What are you going to do with it?
> P: Well, I don't know.
> T: How to solve it?
> P: Well, by finding it on the Internet.
> T: Hmm, is there any other possibility when we have here…?
> P: So, by having a look at the atlas.
> …

T: And the atlas is here – actually, these are map extracts, extracts of maps from the atlas.
P: Well, I don't know a lot about it.
T: What do mean by not knowing a lot about it?
P: I think that there are very small… like these. It has too small fonts and it is pretty confusing. It could be more illustrative, hmm, I don't know.

Ad (b): Correct interpretation of both visual and verbal messages

The second kind of pupils' difficulties concerned their low ability to read and interpret maps. This problem has already been discussed in studies by Hanus and Marada (2014).

An illustrative example of interviews no. 2:

T: You've managed to read it from the map perfectly well. Good.
P: Well, I won't probably find here how many degrees there are in January here.
T: Can you read it from the map of July temperature?
P: I don't think so. Or maybe yes, but… I don't think so… Or is it possible?
T: and when we have a look at this map. Will it help us?
P: No.

Ad (c): Substitution of wrong notions and misconceptions with the presented subject matter

The third kind of pupils' difficulties concerned pupils' low willingness to accept scientifically justified explanation of geographical phenomena and processes which are contrary to pupils' existing/wrong notions. Ozturk and Alkis (2010) drew attention to the fact that the subject matter of geography is often interpreted wrongly by pupils.

An illustrative example of interviews no. 3:

P: Well, I think this text here is contradictory. Because it is written here that the Atlantic Ocean cools the land in the summer but warms it in the winter. And then that the influence of the ocean decreases in an easterly direction. So again it the other way round. In short, the ocean is much warmer in the summer and much colder in the winter. It should be better explained.
T: How could it be better explained?
P: I don't know.

Ad (d): Basic understanding of the subject matter

The fourth kind of pupils' difficulties revealed that pupils may have certain problems to understand instructions to a learning task. In particular, a serious difficulty lied in identifying a problem for solving and structuring the subject matter into intermediate steps.

An illustrative example of interviews no. 4:

> P: Now I don't know the answer to this question. I wouldn't guess it. But here I can see that precipitation sometimes occurs there near Moscow. For example, here you can see that precipitation occurs in the winter.
> T: Hmm.
> P: So and here you can see how, for example… It is so in the summer. I don't know. I would recognize it only…, I simply recognize it mostly because I remember it.

CONCLUSION

Most pupils felt that performing the presented learning task was difficult. Pupils were limited to a certain extent in situations where they have to find information alone with the help of more modes of representation and consequently give reasons for their geographical statements. Research has revealed that the four kinds of difficulties we describe here are possible to overcome through an appropriate teacher's intervention. Considering the pupils' learning needs, the role of a teacher appears as crucial for pupils' performing problem-based learning tasks. A hypothesis that special attention should be paid to both the type of learning content and the type of related learning task has been confirmed (cf. Sikorová, 2011). In future, it is necessary to examine whether the different aim of a learning task may be reflected in the different requirements for design of geographic information presented to pupils in learning materials.

Acknowledgements: The working paper is an outcome of the research project Visual Geographic Information and its Role in Geographic Education (GA16-01003S) funded by the Czech Science Foundation (GAČR). The authors wish to thank the foundation for their support of this research.

REFERENCES

AINSWORTH, Shaaron. DeFT: A conceptual framework for considering learning with multiple representations. *Learning and Instruction*, 2006, vol. 16, no. 3, pp. 183-198. ISSN 0959-4752. https://doi.org/10.1016/j.learninstruc.2006.03.001

JANÍK, T., J. SLAVÍK, V. MUŽÍK, J. TRNA, T. JANKO, V. LOKAJÍČKOVÁ, J. LUKAVSKÝ, E. MINAŘÍKOVÁ, J. SLIACKY, Z. ŠALAMOUNOVÁ, S. ŠEBESTOVÁ, N. VONDROVÁ, P. ZLATNÍČEK. *Kvalita (ve) vzdělávání: obsahově zaměřený přístup ke zkoumání a zlepšování výuky*. Brno: Masarykova univerzita, 2013. ISBN 978-80-210-6349-5.

HANUS, Martin, Miroslav MARADA. Mapové dovednosti v českých a zahraničních kurikulárních dokumentech: srovnávací studie. *Geografie,* 2013, vol. 118, no. 2, pp. 158-178. ISSN 1212-0014.

HANUS, Martin and Miroslav MARADA. Mapové dovednosti: vymezení a výzkum. *Geografie,* 2014, vol. 119, no. 4, s. 406-422. ISSN 1212-0014.

HÜBELOVÁ, D., T. JANÍK, P. NAJVAR. Pohledy na výuku zeměpisu na 2. stupni základní školy: souhrnné výsledky CPV videostudie zeměpisu. *Orbis Scholae*, 2008, vol. 2, no. 1, pp. 53-72. ISSN 1802-4637. https://doi.org/10.14712/23363177.2018.221https://doi.org/10.14712/23363177.2018.221

LAMBERT, David. Exploring the use of textbooks in Key Stage 3 geography classrooms: A small-scale study. *Curriculum Journal,* 1999, vol. 10, no.1, pp. 85-105. ISSN 0958-5176. https://doi.org/10.1080/0958517990100107

LAMBERT, David. Geography education research and why it matters. *International Research in Geographical and Environmental Education,* 2010, vol. 19, no. 2, pp. 83-86. ISSN 0958-5176. https://doi.org/10.1080/10382046.2010.482180

MARTIN, M. O., I. V. S. MULLIS, P. FOY, G. M. STANCO. *TIMSS 2011 International Results in Science.* Chestnut Hill: TIMSS & PIRLS International Study Center, Boston College, 2012. ISBN 978-90-79549-18-4.

MAYER, Richard E. Multimedia learning: Are we asking the right questions? *Educational Psychologist,* vol. 32, no. 1, 1997, pp. 1-19. ISSN 0046-1520. https://doi.org/10.1207/s15326985ep3201_1

MAYER, Richard E. Applying the science of learning: Evidence-based principles for the design of multimedia instruction. *American psychologist,* 2008, vol. 63, no. 8, pp. 760-769. ISSN 0003-066X.

MAYER, Richard E. Instruction based on visualisations. In: MAYER, R. E. a P. A. ALEXANDER, eds. *Handbook of research on learning and instruction.* New York: Routledge, 2011, pp. 427-445. ISBN 978-0-415-80461-5.

MOUSTAKAS, Clark. Heuristic research: Design and methodology. In: SCHNEIDER, K. J., J. F. PIERSON a J. F. T. BUGENTAL, eds. *The handbook of humanistic psychology: Leading edges in theory, research, and practice*. London: Sage, 2015, pp. 309-319. ISBN 978-0-7619-2782-2.

MULLIS, I. V. S., M. O. MARTIN, G. J. RUDDOCK, Ch. Y. O'SULLIVAN, a C. PREUSCHOFF. *TIMSS 2011 Assessment Frameworks*. Boston: TIMSS & PIRLS International Study Center Lynch School of Education, Boston College, 2009. ISBN 1-889938-54-8.

OZTURK, Mustafa a Secil ALKIS. Misconceptions in geography. *Geographical Education,* 2010, vol. 23, pp. 54-63. ISSN 0085-0969.

PRŮCHA, Jan. Results and Prospects of Textbook Research in the Czech Republic. *Orbis Scholae,* 2014, vol. 8, no. 2, pp. 91-99. ISSN 1802-4637.

REZNICKOVA, Dana. The transformation of geography education in Czechia. *Geografie,* 2009, vol. 114, no. 4, pp. 316-331. ISSN 1212-0014.

SIKOROVA, Zuzana. The role of textbooks in lower secondary schools in the Czech Republic. *IARTEM e-Journal,* 2011, vol. 4, no. 2, pp. 1-22. ISSN 1837-2104.

SWELLER, John. Implications of cognitive load theory for multimedia learning. In: MAYER, R. E., ed. *The Cambridge handbook of multimedia learning.* Cambridge: Cambridge University Press, 2005, pp. 19-30. ISBN 978-0-521-54751-2.

Shrnutí

Cílem předběžného výzkumného sdělení je představit výsledky kvalitativní výzkumné sondy, která zjišťovala, s jakými problémy se žáci 2. stupně ZŠ vypořádávají při řešení problémově orientované geografické učební úlohy. Autoři realizovali 22 nestrukturovaných heuristických rozhovorů s žáky 7. a 8. ročníku ZŠ. V průběhu rozhovoru zkoumaní žáci řešili problémově orientovanou učební úlohu doprovázenou vizuáliemi zastoupenými ve vybraných současných českých učebnicích zeměpisu a ve Školním atlasu světa. Cílem bylo zjistit, v čem žáci nejčastěji selhávají při řešení nastolené učební úlohy. Rozhovory byly vyhodnoceny metodou kvalitativní obsahové analýzy. V příspěvku jsou prezentovány výsledky prvotních analýz realizovaných rozhovorů, které umožní odpovědět na otázku: Jaké obtíže mají žáci při řešení učebních úloh týkajících se příslušného geografického tématu? Příspěvek je součástí řešení projektu GA ČR Vizuální geografická informace a její role v geografickém vzdělávání (GA16-01003S).

THEORETICAL CONCEPT OF REGIONAL INEQUALITIES IN THE CONTEXT OF CREATING UNIVERSITY TEXTBOOK – REGIONAL DEVELOPMENT – FACTORS, INEQUALITIES AND CROSS-BORDER COOPERATION

Radoslav Klamár, Alena Madziková, Martin Rosič

Department of Geography and Applied Geoinformatics, Faculty of Humanities and Natural Sciences, University of Prešov, 17. novembra 1, 08001 Prešov, Slovakia

radoslav.klamar@unipo.sk, alena.madzikova@unipo.sk, martin.rosic@unipo.sk

Abstract: The aim of this paper is to present one of three principal chapters of an upcoming university textbook titled Regional Development – Factors, Inequalities and Cross-Border Cooperation. Each of the platforms in question whether the factors of regional development, regional inequalities or cross-border cooperation use their own research instruments and a set of research methods that are important to be comprehensibly outlined to students as one linked system. In the paper presented the attention is drawn to the stage of dealing with one of them, namely the problem of regional inequalities in works by domestic and foreign authors while the structure of summarizing study has been designed as the basis for the contents of the upcoming university textbook chapter. Apart from defining terms inequality or regional inequalities the attention is focused on their attributes, classification, characteristics of the most often used evaluation indicators and the selection of statistical instruments and criterion for their measuring.

Key words: factors of regional development, regional inequalities, cross-border cooperation, indicators, statistical criterion for evaluation, university textbook

1 INTRODUCTION

The problem of regional development, development factors, regional inequalities and cross-border cooperation has been debated and evaluated from various point of views whether the economic, social or spatial one. Each of said areas has own particularities and uses own set of research methods that provide different evaluation approaches, analysis and own "solutions manuals". This trend is also reflected in the increased attention to said problem within university education in the form of creating a specialisation module Regional Development and Regional Policy. It should support the integration of education, the increase and improvement of content coherence in the given area and support education and upbringing of future experts in the field of regional development. One of the means to achieve the goal is to prepare quality study materials for students in the form of a comprehensive university textbook titled *Regional Development – Factors, Inequalities and Cross-Border Cooperation* that would approach the given areas of regional development as one interlinked system aiming to eliminate fragmentation and to increase the consistency of teaching content and would present it in a comprehensible manner to students.

Within this context, the submitted paper focuses on one of three principal chapters of university textbook which is the chapter paying close attention to the problem of regional inequalities. The structure of the summary study is outlined as the base for creating the contents of the chapter under preparation. Apart from defining terms “disparity” or “regional inequalities” the attention is paid to their attributes, classification, characteristics of most frequently used evaluation indicators and the selection of statistical instruments and measures to measure them. The study text is grounded in more papers by authors of domestic or foreign provenance who work in the field.

2 REGIONAL INEQUALITIES

2.1 Definition, Attributes and Classification of Regional Inequalities

The result of various regional factors differentiation and different availabilities of regions are regional disparities or inequalities. The term “disparity” is widely used despite non-existence of one generally acceptable definition.

The word originates in the 16th century in the French word “disparité” originating in Latin “disparitas” meaning “dividend”. A similar origin of the term in the Latin term disparity (us) is searched by Michálek (2012) having the meaning of “dividend” or “inequality”. In English language there are more synonym: unlikeness, incongruity, inequality, difference or dissimilarity. Kutscherauer (2008) understands inequalities in a broad sense as “a difference or inequality of events or processes whose identification and comparison have a rational meaning (recognition, psychological, social, economic, political)”. In foreign literature the term “inequality” was defined by e.g. Dunfort (1993), Milanovic (2005), Baštová et al. (2011), Ancuţa (2012) etc.

Apart from the need to define the term “regional inequalities” it is also important to know their attributes. Michálek (2013) considers the basic attributes of regional inequalities to be the sphere of their occurrence – territoriality, their measurability and topicality. Kutscherauer (2008) adds suggestibility, the way of origination, impacts and a particular attribute or a viewpoint in the form of non-quantifiable spheres of monitoring regional inequalities (e.g. prestige, power, fame etc.).

From the geographical point of view, territoriality related to vertical and horizontal classification of regional inequalities is especially important (Michálek, 2013). The horizontal aspect mostly comes out of two classifications while, considering their nature, they can be divided into material and non-material inequalities and considering the sphere of their occurrence they can be divided into territorial, economic and social. Similarly, Kutscherauer (2008) divided regional inequalities into social, economic, territorial and physical on the grounds of paper by Wishlade, Youill (1997) and Molle (2007).

2.2 Regional Inequalities Evaluation Indicators

As for the evaluation of regional inequalities in connection with their decomposition into economic, social and territorial inequalities, it is possible to use a set of simple indicators or to construct more sophisticated integrated indicators. The method of indicators selection depends on the preferences and experiences of particular researcher. Even the number of selected indicators is important. The low number may distort the real situation and, vice versa, the high number may cause the loss of evaluation clarity.

When evaluating the economic performance and monitoring regional inequalities, it is possible to rely on numerous ***economic indicators***. The most representative one is **gross domestic product (GDP)** whereby the economic development rate and inhabitants´ standard of living is evaluated. Regional GDP is calculated as the total of added values in the industries in the region and taxes on products reduced by subventions on products. For the needs of inter-regional comparisons it is re-calculated per inhabitant in purchasing power parities that eliminate the effects of different price levels in countries. The advantages of using GDP are as follows: comparability – it is used by a majority of countries in the world; availability of statistical data needed for its calculation; general acceptability as a complex indicator. On the other hand, it has some drawbacks: the effect of commuting to work (in the target region of commuting to work also the workers coming from other regions contribute to the regional GDP); in the regions with high share of DFI the GDP includes the profit made that is eventually transferred to the country of the owner; apart from earnings, the GDP calculation does not include the items such as health, leisure time, freedom etc.

GDP is such an essential indicator that there are papers evaluating regional inequalities only using this indicator (e.g. Tvrdoň, Skokan, 2011, Canaleta et al., 2004, Barrios, Strobl, 2009, Buyst, 2011 and others). However, the vast majority of papers combine GDP with other indicators. In Slovakia, regional inequalities have been evaluated using GDP in Matlovič et al. (2008), Matlovič, Matlovičová (2005, 2011), Klamár (2008, 2011, 2016), Rajčáková, Švecová (2012, 2014), Habanik et al. (2013), Matlovičová et al. (2014) and others. When evaluating inequalities in the Czech Republic more papers relied on GDP, mostly on the regional level in e.g. Baštová et al. (2011), Svatošová, Boháčková (2012), Měrtlová (2012). In Hungary, there were papers such as Nemes-Nagy (2006), Kebza et al. (2015), Dusek et al. (2013), in Romania Goschin et al. (2008), Antonescu (2010), Ancuţa (2012), Patache (2013), Neagu (2013), in Slovenia Wostner (2005), in Austria Steiner (2005) and in Spain Villaverde, Maza (2009).

Numerous papers contained GDP as the indicator in inter-regional comparisons in more countries. Slovak regions were often a part of wider comparisons within V4 countries regions as in Tvrdoň, Skokan (2011), Poledníková, Lelková (2012), Zdražil, Kraftová (2012), Poledníková (2013). Other comparisons evaluated the wider region of Central and Eastern Europe (e.g. Petrakos et al., 2005, Kropková, Sojková, 2008, Kallioras, 2010). As for countries outside Europe the evaluation using GDP in papers by Bradshaw, Vartapetov (2003) can be mentioned and as for inequalities in Russia Zubarevich, Safronov (2011) in Russia, Ukraine a Kazakhstan, Swastyardi (2008) in Indonesia, Rodríguez-Oreggia (2005) and Tello, Ramos (2012) in Mexico and Milanovic (2005) in China, India, USA, Indonesia, Brazil.

Another economic indicator used when evaluating inequalities is **gross value added.** It is calculated as a difference between production in basic prices and intermediate consumption in purchase prices (Matlovič et al., 2008). This indicator is much less frequent compared to GDP in e.g. Matlovič et al. (2008), Klamár (2008), Klamár, Rosič (2009), Rajčáková, Švecová (2012) and Měrtlová (2012). As an indicator it is closely linked with GDP (it makes approx. 90% of GDP), the rest are net product taxes. As indicators they develop similarly, but only in exceptional events of dramatic growth or decrease of taxes their development differs.

The third economic indicator is **gross fixed capital formation**. Gross fixed capital formation includes the acquisition of fixed assets reduced by the decrease in fixed assets by producers during a given period of time. Fixed assets are tangible assets that were produced as outputs in the production process and will be used in other production processes repeatedly or permanently longer than one year (Michálek, 2013). Gross Fixed Capital Formation calculated on the basis of per-capita is one of the key indicators for considering the competitiveness of a region in the national context. It mainly expresses the willingness of companies to develop and invest in their production, business or development activities in the given region (Mariš, 2011). It well reflects the perspectives of the future development. This indicator was used in evaluations in Matlovič, Matlovičová (2011), Měrtlová (2012), Poledníková, Lelková (2012), Rajčáková, Švecová (2012), Zdražil, Kraftová (2012) and Matlovičová et al. (2014).

Another used economic indicator for evaluating regional inequalities is **foreign direct investments (FDI)**. They are deemed to be one of the most important accelerators of economic development. For public, they are often simplified as the main factor of job vacancies formation. FDI can contribute to the solution of the whole range of problems in numerous sectors and areas. FDI as an indicator is operated with in papers by Sucháček (2005), Klamár (2008), Matlovič, Matlovičová (2005, 2011), Rajčáková, Švecová (2012), Padová et al. (2012), Habanik et al. (2013), Matlovičová et al. (2014).

Even **labour productivity** is one of such economic indicators. Labour productivity represents the efficiency of work done that is expressed by the rate of production volume and time consumption (Michálek, 2013). It is possible to increase the work productivity by the increase of output volume (using production or organisation innovations) or by decreasing the input volume. It can sometimes occur even without any significant innovations e.g. as a result of dismissals, when a lower number of workers has to produce the same production volume. Labour productivity as the indicator of regional inequalities has been used when making evaluations in Boldrin, Canova (2001), Poledníková (2013). Employee´s labour productivity in industry was used by Matlovič et al. (2008), Klamár (2008), Rajčáková, Švecová (2012), Klamár (2011, 2016), employee´s labour productivity in construction business was used in Matlovič et al. (2008), Klamár (2011, 2016).

Other economic indicators can be found only in a few papers e.g. number of organisations focused on profit making per 1000 inhabitants, the number of self-employers per 1000 inhabitants (Matlovič, Matlovičová, 2005, 2011, Klamár, 2008, 2011, 2016, Matlovič et al., 2008, Padová et al., 2012, Rajčáková, Švecová, 2014), monthly labour costs per one employee (Matlovič et al. 2008, Matlovič, Matlovičová, 2011, Klamár, 2011, 2016), the number of enterprises having 250 and more employees (Matlovič, Matlovičová, 2011, Matlovičová et al., 2014) and tax collection (Matlovič, Matlovičová, 2005).

Another group are ***social indicators*** of regional inequalities. Social inequalities are frequently considered to be the core ones (Dunfort 2009 In Michálek, 2013) because they are the result of economic development, immediately reflect life conditions of inhabitants and the social climate of regional communities.

The significant interconnection of economic prosperity in the region and the social situation can be mainly demonstrated by indicators describing the labour market such as the employment/the unemployment rate and average monthly wages. These social indicators are the most available ones when evaluating regional inequalities and thus they are mostly used which enables to compare not only the regions in particular countries but also countries themselves. At the same time, they are indicators that are sensitively perceived by inhabitants.

The **unemployment rate** is, along with GDP, the key indicator when evaluating regional inequalities. Blažek, Uhlíř (2002) consider it to be the basic indicator of regional problems. It is calculated as a share of the unemployed work labour and a total number of economically active inhabitants. As it has a relatively high informative capability, it is used in international and interregional or even intraregional comparisons. Its mathematical construction differs on various levels having regard to the options of using available statistical indicators. And this is also its biggest limitation. When evaluating regional inequalities in Slovak regions, more authors used the unemployment rate e.g. Rajčáková, Švecová (2002, 2012, 2014), Ira et al. (2005), Matlovič, Matlovičová (2005, 2011), Rajčáková (2006), Klamár (2008, 2011, 2016), Matlovič et al. (2008), Padová et al. (2012), Habanik et al. (2013), Matlovičová et al. (2014), Madajová et al. (2014), in the Czech Republic it was Baštová et al. (2011), Svatošová, Boháčková (2012), Měrtlová (2012), Kebza et al. (2015) in Hungary, Goschin et al. (2008) and Ancuţa (2012) in Romania, Puljiz, Maleković (2007) in Croatia, Tello, Ramos (2012) in Mexico, Zubarevich, Safronov (2011) in Russia, Ukraine a Kazakhstan.

The second indicator linked with the labour market is the **employment rate**. It is calculated as the ratio of working people aged 15-64 years to the number of people aged 15-64 years. Its figure shows the efficiency of using work labour in regions. The regions with higher employment rate belong to more developed and advanced regions. The main limitations are in comparability with regard had to a slightly different construction of calculation on various regional levels. This indicator was used in a small number of papers e.g. Poledníková (2013), Matlovič et al. (2008), Klamár (2008, 2011, 2016), Poledníková, Lelková (2012), Patache (2013), Rajčáková, Švecová (2014).

The third frequently used social indicator with strong economic undertone is **average monthly wages.** It belongs to basic economic parameters using which we can illustrate the differentiated development of regions. It is an average monthly wages in enterprises having 20 and more employees (Matlovič, Matlovičová, 2005). The problem when exhibiting it is that it does not evaluate the needed middle of the wage range (average wage and a wage of average (middle) worker (mediane) shows a significant difference). In the Slovak Republic the median wage oscillates at about 80% of average monthly wages. Along with other indicators the average monthly wages is mentioned in the papers by Egger et al. (2005), Matlovič, Matlovičová (2005, 2011), Puljiz, Maleković (2007), Matlovič et al. (2008), Klamár (2008, 2011, 2016), Habanik et al. (2013), Rajčáková, Švecová (2012, 2014), Matlovičová et al. (2014), Madajová et al. (2014), Kebza et al. (2015).

Besides the indicator of average monthly wages, also the **disable income of households,** the **net monthly income** and **expenditures per person** are employed as indicators. These indicators have, apart from wages, an important expressive value because persons with no income living in common household with persons having income are also included in the evaluation. The net monthly incomes are made of net employment incomes, social benefit incomes, other incomes, positive difference between taken and paid-up loans. Net monthly expenditures per person are made of consumer expenditures and other expenditures without statutory contributions such as social welfare contributions including monetary gifts outside the household and paid-up loans. These evaluation indicators were used by Azzoni (2001), Felsenstein, Portnov (2005b), Matlovič, Matlovičová (2005, 2011), Nemes-Nagy (2006), Puljiz, Maleković (2007), Goschin (2008), Matlovič et al. (2008), Měrtlová (2012), Zdražil, Kraftová (2012), Matlovičová et al. (2014), Klamár (2016).

Selected demographic indicators are important social indicators even though compared with the unemployment rate or average monthly wages they are less frequent in papers. The **natural** and **migration increase/decrease** are used as indicators in papers by Ira et al. (2005), Rajčáková (2006), Rajčáková, Švecová (2002, 2014), Svatošová, Novotná (2012), Padová et al. (2012), Svatošová, Boháčková (2012), Kebza et al. (2015). Another demographic indicator is the **gross birth rate** which was used in Matlovič, Matlovičová (2005), Matlovič et al. (2008), Klamár (2011, 2016), Poledníková, Lelková (2012). The **ageing index** was used in Svatošová, Novotná (2012), Padová et al. (2012), Svatošová, Boháčková (2012). All three above specified indicators are closely linked with each other. From the duo of the natural and migration increase/decrease, the natural increase/decrease plays a more important role because it influences the population development in countries and their regions. The natural increase/decrease is significantly influenced by the gross birth rate that is more suitable when comparing territorial units and it is more used nowadays. The advantage is data availability, their mutual compatibility and comparativeness. The ageing index reflects continuous changes in the population age structure that are summarily called as ageing. They are changes at which the number (share) of older age groups increases, but on the other hand, there is a decrease in the children share. Ageing influences national economies, requires substantial changes in population social, health and pension insurance whereby it considerably influences regional disparities.

The important social category is housing. Quality and affordable housing is a significant factor influencing the manpower mobility as well as the quality of inhabitants´ life. The intensive residential construction activity and the number of finished flats on one side reflect the attractiveness of given region for permanent living and, on the other side, it brings the municipality favourable conditions for economic growth (Hamada, Kasagranda, 2014). Based on available data, the most frequent indicator is the **number of completed dwellings per 1000 inhabitants**. It can be found in papers e.g.

Matlovič et al. (2008), Klamár (2011), Matlovičová et al. (2014), Matlovič, Matlovičová (2011).

Within social indicators even less traditional indicators used can be found such as the income of health care insurance companies from contributions per inhabitant (Matlovič, Matlovičová, 2011, Matlovičová et al., 2014), the social support index and poverty (Madajová et al., 2014), the number of social beneficiaries per inhabitant (Padová et al., 2012), the poverty risk rate (Padová et al., 2012, Rajčáková, Švecová, 2014), the number of places in social care establishments and the number of crimes per 1000 inhabitants (Svatošová, Novotná, 2012, Svatošová, Boháčková, 2012, Rajčáková, Švecová, 2014).

The third group of indicators evaluating regional inequalities is made of **territorial indicators**. The selection of indicators to use is quite wide however the concrete selection is to the large extent dependent on the availability of statistical data. Most frequently used are indicators related to infrastructure (technical). Ira et al. (2005) state that infrastructure in certain territory expresses the qualitative and quantitative characteristics of development conditions in model regions (districts) and to certain extent it influences the quality of inhabitants´ life.

From the point of development of regions the important ones are the indicators of transport infrastructure; the mostly used one is **highways density on certain area** used in e.g. Rajčáková (2006), Klamár (2008), Svatošová, Novotná (2012), Poledníková (2013), Rajčáková, Švecová (2014), Kebza et al. (2015). **Railways density** was used in Klamár (2008), Rajčáková, Švecová (2014). Another infrastructure indicator is the **share of municipalities connected to water** and **sewage system** (Ira et al., 2005, Rajčáková, 2006, Klamár, 2008, Rajčáková, Švecová, 2012). Klamár (2008), Poledníková (2013), Rajčáková, Švecová (2012) used as an indicator the **number of households connected to the Internet.**

The individual authors used said indicators primarily to evaluate the level of disparities within the region´s economic and social development. Whether it was an evaluation within individual countries, or larger units (V4 countries or jointly newly acceded EU countries). Works comparing disparities of the EU countries and non-European countries are also represented. Works evaluating regional disparities in small countries have a specific position (e.g. Felsenstein, Portnov, 2005b). In some works the indicators used for evaluating disparities were in the context of competitiveness (Rajčáková, Švecová, 2014), regional politics and cohesion (Boldrin, Canova, 2001, Rajčáková, Švecová, 2014), globalisation (Steiner, 2005), trade liberalisation in relation to income (Egger, et al., 2005), unemployment to income (Puljiz, Maleković, 2007) and decentralisation (Canaleta et al., 2004, Gil et al., 2005). Specifically were used the indicators to evaluate disparities in relation to spatial polarisation and spatial gradient (Sucháček, 2005, Kebza et al., 2015). Summary works dedicated to the importance of individual indicators have a special position (Michálek, 2012, 2013, Hamada, Kasagranda, 2014).

In the recent years it has been evident that there are efforts to capture the level of regional development and reveal the lagging regions by a complex indicator that would take into consideration economic, social, demographic characteristics of the regions as well as selected parameters of technical infrastructure (e.g. Rajčáková, Švecová 2002, 2009). The segment of integrated indicators represents a higher level of identification and consequent evaluation of regional inequalities. It comes out of an appropriate interconnection (integration) of individual indicators or their substantial characteristics and features that are a complex view on a certain area of occurrence. Their essential attributes should be a sufficient comparative ability, mathematical manageability and information manageability (Michálek, 2013). Aggregate indicators are able to describe complex terms such as prosperity, effectiveness or sustainability. Their advantage is that they can be more easily interpreted than a whole set of partial indicators and enable a fast comparison of regions from the given aspect (Svatošová, Novotná, 2012).

2.3 Statistical Instruments and Measures to Measure Regional Inequalities

The given summary of the wide spectrum of indicators points out to various options for own selection. However, the choice of one particular set of indicators is only one of steps when evaluating regional inequalities. Concurrently with it, it is important to define the hierarchic level of evaluation units and, in particular, the **selection of statistical instruments** and **measures to measure inequalities.** In this respect, there are more statistical measures or indexes. Felsenstein, Portnov (2005b) give seven basic indexes. More concretely, they are the variation coefficient, the Williamson index, the Theil index, the Atkinson index, the Hoover coefficient, the Coulter coefficient and the Gini coefficient. Micheali et al. (2010) use as statistical measures the scatter, the standard deviation, the variation coefficient, the Gini coefficient, the Theil index, the Atkinson index, the cluster analysis and the neural network method when evaluating. Veselovská (2015) emphasises that the most frequently used inequality rate is the Gini coefficient. Other frequently used indexes are the Theil index, the Hoover index, the Atkinson index and the variation coefficient.

Regarding the abovementioned, there are more methods to measure regional inequalities. However, some measurement methods and statistical measures (indexes) are used more frequently in papers than others. It is due to the character of given methods, mathematical calculation difficulty, the interpretation of results, and the usage of the given method in other papers in the past and experiences of the researcher.

Most frequently used instruments are the standard deviation and the variation coefficient. The **standard deviation** is an average difference between values and diameter when ignoring signs (Blažek, 1996). But its application is problematic because it depends on the choice of measuring signs or measured values. Thus, it is not appropriate to be used when comparing various indicators or for long-term comparisons (Michaeli et al., 2010). When evaluating inequalities, the standard deviation was used by Blažek (1996), Rajčáková, Švecová (2014), Madajová et al. (2014).

More convenient instrument for the spatial analysis is the **variation coefficient** that is not dependent on measured values of input indicators. It represents the relative dispersion rate derived from the standard deviation (Michálek, 2012). The variation coefficient is, along with the standard deviation, a dimensionless measure but it is often expressed in a percentage. The following authors used the variation coefficient in their papers related to regional inequalities: Matlovič, Matlovičová (2005, 2011), Matlovič et al. (2008), Klamár (2011, 2016), Habanik et al. (2013), Matlovičová et al. (2014), Madajová et al. (2014). In the Czech Republic the coefficient was used in Blažek (1996), Štika (2004), Baštová et al. (2011), Svatošová, Novotná (2012), in Romania Ancuţa (2012), in Croatia Puljiz, Maleković (2007), in Spain Villaverde, Maza (2009), in Russia, Ukraine and Kazakhstan Zubarevich, Safronov (2011) and in Brazil it was in Azzoni (2001).

The second very often used index to measure regional inequalities is the **Gini coefficient**. The cause is the fact that there are relatively few instruments that are able to compare ratios and their spatial concentration (Dakos, 2007 In Michálek, 2012). In numerous studies there is a combination of the Gini and the variation coefficient when measuring regional inequalities e.g. Štika (2004), Matlovič, Matlovičová (2005, 2011), Matlovič et al. (2008), Klamár (2011, 2016), Habanik et al. (2013), Matlovičová et al. (2014). The Gini coefficient was also used in Padová et al. (2012) and Rajčáková, Švecová (2014) where it was combined with the standard deviation and the variation extent. The combination of the variation and the Gini coefficient was used to evaluate inequalities in the Czech Republic by Boháčková et al. (2011), while the comparison also included the Theil index. As for other papers that used the Gini coefficient can be quoted those that have already been mentioned in connection with the variation coefficient: Felsenstein, Portnov (2005b), Puljiz, Maleković (2007), Tvrdoň, Skokan (2011) and Zubarevich, Safronov (2011). The Gini coefficient was used when measuring regional inequalities in Romania in Goschin et al. (2008), Antonescu (2010), Neagu (2013), in Slovenia Wostner (2005), Milanovic (2005) in China, India, USA, Indonesia, Brazil, Tello, Ramos (2012) in Mexico and within selected countries Gil et al. (2005).

The third of most frequently used statistical measures or indexes is the **Theil index**. As given by Michálek (2012), the Theil index belongs to the group of indexes called “general entropy class” and points out to the disorderliness of the share of the studied indicator. It represents the weighted amount of inequalities within individual sub-groups or regions and, to certain extent, it solves the imperfection of the Gini coefficient lying in the fact that its calculated value for a country as a whole is different from the value of the Gini coefficients calculated for its particular regions. Therefore, one advantage of using the index is the limitation of the influence of the number of territorial units or regions to the variability rate. The Theil index combined with the variation coefficient and the Gini coefficient was used when evaluating regional inequalities in Štika (2004), Felsenstein, Portnov (2005b), Puljiz, Maleković (2007), Baštová et al. (2011), Tvrdoň, Skokan (2011), Habanik et al. (2013). The combination with only the Theil index when measuring regional inequalities can be found in Gil et al. (2005), Goschin et al. (2008), Milanovic (2005), Neagu (2013), Tello, Ramos (2012). Azzoni (2001), Villaverde, Maza (2009) used the Theil index and the variation coefficient and in Swastyardi (2008) there is only the Theil index used.

Less frequent index is the **Williamson index** that is a convenient modification to measure dispersion. It was used by Felsenstein, Portnov (2005a) when evaluating inequalities in 23 selected small countries including Slovakia. Even the **Hoover/Robin Hood index** can be used. It expresses what share from one studied social-economic indicator is necessary to regroup so that its spatial arrangement equal another studied indicator included in the measurement (Michálek, 2013). This index was described in detail by Felsenstein, Portnov (2005b), Nemes-Nagy (2006). In other papers such as ones by Villaverde, Maza (2009), Tello, Ramos (2012), Neagu (2013) it is possible to find the **Atkinson index** and in Goschin et al. (2008) can be found the **Herfindahl index** also taking into account the differences of regions sizes.

For evaluating regional inequalities, foreign literature contains the **method of convergence**. The method first evaluates the development of individual indicators characterising territorial differences and after that specifies whether the differences reduce (convergence) or, the other way round, enlarge (divergence) (Michálek, 2012). This approach can be found in Barro, Sala-i-Martin (1992), Boldrin, Canova (2001), Egger et al. (2005), Azzoni (2001).

The method of distance from the fictive object in our conditions was used by Matlovič, Matlovičová (2011). The nature of the method is based in the comparison of individual regions with a so-called fictive object (region) achieving the best values with all indicators (Matlovič, Matlovičová, 2011). Other methods that can be mentioned are the **cluster analysis** and the **factor analysis.** Those were used in Boldrin, Canova (2001), Ira et al. (2005), Kropková, Sojková (2008), Poledníková, Lelková (2012), Zdražil, Kraftová (2012). A relatively new approach to measuring inter-regional differences is the **method of neural networks.** It is a highly sophisticated evaluation method which, in essence, disables its effective usage in practice.

3 CONCLUSION

The presented problem of regional inequalities, their classification, selection of evaluation indicators and measuring methods introduces a short excursion making an initial platform for the creation of a chapter having the same name in the university textbook titled *Regional Development – Factors, Inequalities and Cross-Border Cooperation.* Regional inequalities as a chapter will naturally follow the introductory part on regional development factors whose identification, selection and evaluation will represent the important base for the selection of corresponding indicators entering into the evaluation of regional inequalities. The regional development factors and regional inequalities resulting from them enable to consequently point out to problematic lagging regions that are in many cases also peripheral border regions. One of the options to develop and economically integrate them is through cross-border cooperation with border regions on the other side of the border that very often have similar fate. Cross-border cooperation thereby creates the potential platform for searching for solutions for developing the regions and also the base for the last chapter of the university textbook integrally connected with the problem of regional development factors and regional inequalities.

The university textbook under preparation reacts for the needs of permanent and flexible education in the field of regional development and the transfer of latest knowledge into the education process. Its contents will be program-connected with already issued university textbooks (*Regional Development for*

Geographers, 2010; *Geography of Europe*, 2015) that have already informed of the problem of regional development, factors, inequalities and cross-border cooperation.

Acknowledgement: This article was supported by the scientific project KEGA 011PU-4/2017 "Integration of teaching and increase of the content coherence of the related disciplines of the specialized module of Regional development and regional policy" and scientific project VEGA 1/0077/17 "Political – spatial structure of the state in conditions of the globalization".

REFERENCES

ANCUŢA, C. 2012. Aspects regarding the socio-economic indicators used in approaching the territorial disparities. In: *Geographica Pannonica*, 16, Issue 1, pp. 26-34.

ANTONESCU, D. 2010. The Analysis of Regional Disparities in Romania with Gini/Struck Coefficients. In: *The Romanian Economic Journal*, 2, Issue 40, pp. 160-183.

AZZONI, C.R. (2001): Economic growth and regional inequality in Brazil. In: *The Annals of Regional Science*, 35, pp. 133-152.

BARRIOS, S., STROBL, E. (2009). The dynamics of regional inequalities. In: *Regional Science and Urban Economics*, 39 (5), pp. 575-591. . https://doi.org/10.1016/j.regsciurbeco.2009.03.008

BAŠTOVÁ, M., HUBÁČKOVÁ, V., FRANTÁL, B. (2011). Interregional differences in the Czech Republic, 2000-2008. In: *Moravian Geographical Reports*, 19 (1), pp. 2-16.

BLAŽEK, J., (1996). Meziregionální rozdíly v České republice v transformačním období. In: *Geografie – Sborník České geografické společnosti*, 101 (4), pp. 265-277.

BLAŽEK, J., UHLÍŘ, D., (2002). *Teorie regionálního rozvoje*. Praha: Karolinum, 212 p. ISBN 80-246-0384-5.

BOLDRIN, M., CANOVA, F. (2001). Inequalities and convergence in Europe's regions. Reconsidering European Regional Policies. In: *Economic Policy*, 16, Issue 32, pp. 205-253. s://doi.org/10.1111/1468-0327.00074

BRADSHAW, M. J., VARTAPETOV, K. (2003): A New Perspective on Regional Inequalities in Russia. In: *Eurasian Geography and Economics*, 44 (6), pp. 403-429. https://doi.org/10.2747/1538-7216.44.6.403

BUYST, E. (2011). Continuity and Change in Regional Disparities in Belgium During the Twentieth Century. In: *Journal of Historical Geography*, 37, pp. 329-337. https://doi.org/10.1016/j.jhg.2010.11.005

CANALETA, C. G., ARZOZ, P. P., GÁRATE, M. R. (2004). Regional economic disparities and decentralisation. In: *Urban Studies*, 41, pp. 71-94. https://doi.org/10.1080/0042098032000155696

DUNFORT, M. (1993). Regional Disparities in the European Community: Evidence from the Regio Databank. In: *Regional Studies*, 27 (8), pp. 727-743. https://doi.org/10.1080/00343409312331347915

DUSEK, T., LUKÁCS, R., RÁCZ, I., (2013). Development differences among the regions of Hungary. In: *Procedia Economics and Finance*, 9, pp. 264–277.

EGGER, P., HUBER, P., PFAFFERMAYR, M. (2005). A note on export openness and regional wage disparity in Central and Eastern Europe. In: *The Annals of Regional Science*, 39, pp. 63-71. https://doi.org/10.1007/s00168-004-0202-0

FELSENSTEIN, D., PORTNOV, B. (2005a). Understanding regional inequalities in small countries. In: *Regional Studies*, 39 (5), pp. 647-658. . https://doi.org/10.1080/00343400500151921

FELSENSTEIN, D., PORTNOV, B. (2005b): Measures of Regional Inequality for Small Countries. In: D. Felsenstein, B. Portnov (eds.): *Regional disparities in small countries*. Springer, ISBN 978-3-540-24303-8, pp. 47-62.

GIL, C., PASCUAL, P., RAPÚN, M. (2005). Does Decentralisation mater to Regional Inequalities? The case of Small Countries. In: D. Felsenstein, B. Portnov (eds.): *Regional disparities in small countries*. Springer, ISBN 978-3-540-24303-8, pp. 211-231.

GOSCHIN, Z., CONSTANTIN, D. L., ROMAN, M., ILEANU, B. (2008). The Current State and Dynamics of Regional Disparities in Romania. In: *Romanian Journal of Regional Science*, 2 (2), pp. 80-105.

HABANIK, J., HOSTAK, P., KUTIK, J. (2013). Economic and Social Disparity Develeopment Within Regional Development of the Slovak Republic. In: *Economics and Management*, 18 (3), pp. 457-464. https://doi.org/10.5755/j01.em.18.3.4203

HAMADA, R., KASAGRANDA, A. (2014). Vybrané ekonomické, demografické ukazovatele, ukazovatele infraštruktúrnej vybavenosti a vzdelanostnej úrovne obyvateľstva na meranie regionálnych disparít. In: V. Šilhánková, M. Maštálka (eds.): *Regionální politika na prahu nového programovacího období*, pp. 29-48. ISBN 978-80-87756-05-8

IRA, V., PAŠIAK, J., FALŤAN, Ľ., GAJDOŠ, P. (2005). *Podoby regionálnych odlišností na Slovensku (príklady vybraných okresov)*. Sociologický ústav SAV, Bratislava, 381 p. ISBN 80-855544-39-3

KALLIORAS, D. (2010). Regional inequalities in the new European Union member-states: Is there a “population size” effect? In*: European Spatial Research and Policy*, 17 (2), pp. 107-116. https://doi.org/10.2478/s10105-010-0013-5

KEBZA, M., KUBEŠ, J., NOVÁČEK, A. (2015). Východo-západní gradient sociální a ekonomické prostorové diferenciace Maďarska. In: V. Klímová, V. Žítek (eds.): *XVIII. mezinárodní kolokvium o regionálních vědách,* Hustopeče, Brno: MU ESF Brno, pp. 41-48.

KLAMÁR, R. (2008). Slovakia and the analysis of its disparities. In: *Folia geographica*, 12, pp. 145-162.

KLAMÁR, R. (2011). Vývoj regionálnych disparít v Slovenskej republike s osobitným zreteľom na regióny východného Slovenska. In: *Folia geographica*, 18, pp. 89-170.

KLAMÁR, R. (2016): Development tendencies of regional disparities in the Slovak Republic. In: *Geographica Pannonica*, 20 (3), pp. 136-151. https://doi.org/10.5937/GeoPan1603136K

KLAMÁR, R., ROSIČ, M. (2009). Regional disparities in Prešov region according to the structure of industry. In: *Folia geographica*, 14, pp. 121-154.

KROPKOVÁ, Z., SOJKOVÁ, Z. (2008). Skúmanie regionálnych disparít v rámci nových členských krajín Európskej Únie. In: *Acta oeconomica et informatica*, 1, pp. 10-14.

KUTSCHERAUER, A. (2008). Regionální disparity v územním rozvoji ČR – jejich vznik, identifikace a eliminace. Výzkumná studie DÚ 4. VŠB-Technická univerzita Ostrava. 145 p.

MADAJOVÁ, M., MICHÁLEK, A., PODOLÁK, P. (2014). Úroveň regionálnych disparít na Slovensku a jej zmena v období rokov 2001-2011. In: *Geographia Slovaca*, 28, pp. 127-152.

MATLOVIČ, R., MATLOVIČOVÁ, K., KLAMÁR, R. (2008). Vývoj regionálnych disparít začiatkom 21. storočia na Slovensku vo svetle vybraných indikátorov. In: *Regionální studia=Czech regional studies*, 2, pp. 2-12.

MATLOVIČ, R., MATLOVIČOVÁ, K. (2005). Vývoj regionálnych disparít na Slovensku a problémy regionálneho rozvoja Prešovského kraja. In: *Folia geographica*, 8, pp. 66-88.

MATLOVIČ, R., MATLOVIČOVÁ, K. (2011). Regionálne disparity a ich riešenie na Slovensku v rozličných kontextoch. In: *Folia geographica*, 18, pp. 8-88.

MATLOVIČOVÁ, K., ŽIDOVÁ, A., KOLESÁROVÁ, J. (2014). Dynamika regionálnych disparít na Slovensku v predkrízovom období a ich riešenie vybranými nástrojmi regionálnej politiky. In: *Geographia Slovaca*, 28, pp. 63-100.

MARIŠ, M. (2011). Spatial disparities of regional development in the Slovak Republic. In: *Determinanty kvality života na vidieku: medzinárodná vedecká konferencia*, Nitra, ISBN 978-80-552-0667-7, p.23.

MĚRTLOVÁ, L. (2012). Porovnání regionálních disparit v regionech České republiky. In: V. Klímová, V. Žítek (eds.): *XV. mezinárodní kolokvium o regionálních vědách*, Valtice, Brno: MU. pp. 81-90.

MICHAELI, E., MATLOVIČ, R., IŠTOK, KLAMÁR, R., HOFIERKA, J., MINTÁLOVÁ, T., MITRÍKOVÁ, J. (2010). *Regionálny rozvoj pre geografov*. Prešov: Prešovská univerzita v Prešove, 717 p. ISBN 978-80-555-0065-2

MICHÁLEK, A. (2012). Teoreticko-konceptuálne východiská výskumu priestorových a regionálnych disparít. In*: Acta Geographica Universitates Comenianae*, 56 (1), pp. 25-43.

MICHÁLEK, A. (2013). Indikátory identifikácie a merania regionálnych disparít (niekoľko poznámok k výberu indikátorov). In: *Geografický časopis* 65 (4), pp. 363-381.

MILANOVIC, B. (2005). *World Apart: Measuring International and Global Inequality*. Princeton: Princeton University Press. 52 p. ISBN 978-0691130514

MOLLE, W. (2007). European Cohesion Policy. London: Routledge, 347 p. ISBN 978-0-415-43812-4.

NEAGU, O. (2013). Measurement of TerritorialConvergence. An Analysis in the case of Romania. In: *Annals of the "Constantin Brâncuşi" University of Târgu-Jiu, Economy Series*, 3, pp. 117-125.

NEMES-NAGY, J. (2006). Regional Inequalities: General Models and the Case of the Transition Countries. In: *Romanian review of regional studies*, Vol. II (1), pp. 23-34.

PADOVÁ, J., PIROVÁ, B., POTOMOVÁ, J. (2012). Analýza regionálnych disparít na príklade vybraných ukazovateľov v období rokov 2004-2010 na území Slovenskej republiky. In: V. Klímová, V. Žítek (eds.): *XV. mezinárodní kolokvium o regionálních vědách*, Valtice, Brno: MU. pp. 69-80.

PATACHE, L. (2013). Employment and Regional Inequality in Romania. In: *Acta Universitatis Danubius. Economica*, 9 (4), pp. 259-266.

PETRAKOS, G., PSYCHARIS, Y., KALLIORAS, D. (2005). Regional Inequalities in the EU Enlargement Countries: An Analysis of Small Versus Large New Member States. In: D. Felsenstein, B. Portnov (eds.): *Regional disparities in small countries*. Springer, ISBN 978-3-540-24303-8, pp.233-247.

POLEDNÍKOVÁ, E. (2013). Evaluation of Visegrad Four convergence in the context of EU cohesion. In: *Ekonomická revue,* 16, pp. 19-28.

POLEDNÍKOVÁ, E., LELKOVÁ, P. (2012). Evaluation of regional disparities in Visegrad four countries, Germany and Austria using the cluster analysis. In: V. Klímová, V. Žítek (eds.): *XV. mezinárodní kolokvium o regionálních vědách*, Valtice, Brno: MU. pp. 36-47.

PULJIZ, J., MALEKOVIĆ, S. (2007). Regional Income and Unemployment Disparities in Croatia In: *7th International Conference "Enterprise in Transition*". University of Split, May 24-26, 2007, 18 p.

RAJČÁKOVÁ, E. (2006). Regionálne disparity na Slovensku – vývoj a súčasný stav. In: *Geografická revue*, 2(2), pp. 425-448.

RAJČÁKOVÁ, E., ŠVECOVÁ, A. (2002). Postavenie okresov a krajov Slovenska z hľadiska hodnotenia vybraných sociálnych a ekonomických znakov. In: *Geographia Slovaca*, 18, pp. 167-175.

RAJČÁKOVÁ, E., ŠVECOVÁ, A. (2009). Regionálne disparity na Slovensku. In: *Geographia Cassoviensis*, Vol. III (2), pp. 142-149.

RAJČÁKOVÁ, E., ŠVECOVÁ, A. (2012). Regionálne disparity a konkurencieschopnosť regiónov Slovenska. In: V. Klímová, V. Žítek (eds.): *XV. mezinárodní kolokvium o regionálních vědách*, Valtice, Brno: MU. pp. 59-68.

RAJČÁKOVÁ, E., ŠVECOVÁ, A. (2014). Regionálne dispatity na Slovensku v kontexte kohéznej politiky EÚ 2007-2013. In: *Geographia Slovaca*, 28, pp. 101-126.

RODRÍGUEZ-OREGGIA, E. (2005). Regional disparities and determinants of growth in Mexico. In: *The Annals of Regional Science*, 39, pp. 207-220. https://doi.org/10.1007/s00168-004-0218-5

STEINER, M. (2005). The Globalisation of Austrian Regions: New Policy Challenges and Opportunities In: D. Felsenstein, B. Portnov (eds.): *Regional disparities in small countries*. Springer, ISBN 978-3-540-24303-8, pp.283-295.

SUCHÁČEK, J. (2005). Core-Periphery in the Czech Republic. In: *New Members – New Challenges for the European Regional Development Policy*, *Sborník příspěvků*, CERS, pp. 394–399.

SVATOŠOVÁ, L., BOHÁČKOVÁ, I. (2012). Metodologické přístupy k hodnocení regionálních disparit. In: V. Klímová, V. Žítek (eds.): *XV. mezinárodní kolokvium o regionálních vědách*, Valtice, Brno: MU. pp. 11-18.

SVATOŠOVÁ, NOVOTNÁ (2012). Regionální disparity a jejich vývoj v České republice v letech 1996-2010. In: *Acta Universitatis Bohemiae Meridionalis*, 15, pp. 103-110.

SWASTYARDI, D. (2008). Regional Inequality in Indonesia: Is the General Allocation Fund (DAU) Likely To Have An Impact? A Research Paper, in partial fulfillment of the requirements for obtaining the degree of Masters of Arts In Development Studies. The Hague, The Netherlands, 60 p.

ŠTIKA, R., (2004). Regionální rozdíly v Česku v 90. letech v kontextu novodobého vývoje. In: *Geografie – Sborník České geografické společnosti*, 109 (1), pp. 15-26.

TELLO, C., RAMOS, R. (2012). Wage inequality and economic growth in Mexican regions. In: *Investigaciones Regionales*, 24, pp. 115-152.

TVRDOŇ, M., SKOKAN, K. (2011). Regional disparities and the ways of their measurement: the case of the Visegrad four countries. In: *Technological and Economic Development of Economy*, 17 (3), pp. 501-518.

VESELOVSKÁ, Z. (2015). Sociálne nerovnosti a možnosti ich merania. In: *Geographia Cassoviensis*, Vol. IX (1), pp. 69-79.

VILLAVERDE, J., MAZA, A. (2009). Measurement of regional economic disparities. In: *UNU-CRIS Working Papers W-2009/12*, 45 p.

WISHLADE, F., YOUILL, D. (1997). Measuring Disparities for Area Designation Purposes: Issues for the European Union. In: *Regional and Industrial Policy Research Paper*, 24, Glasgow: University of Strathclyde. 33p.

WOSTNER, P. (2005). The Dynamics of Regional Disparities in a Small Country: The Case of Slovenia. In: D. Felsenstein, B. Portnov (eds.): *Regional disparities in small countries*. Springer, ISBN 978-3-540-24303-8, pp.169-185.

ZDRAŽIL, P. KRAFTOVÁ, I. (2012). Konvergují regiony zemí V4? In: V. Klímová, V. Žítek (eds.): *XV. mezinárodní kolokvium o regionálních vědách*, Valtice, Brno: MU. pp. 48-58.

ZUBAREVICH, N.V., SAFRONOV, S.G. (2011). Regional Inequality in Large Post-Soviet Countries. In: Regional Research of Russia, 1(1), pp. 15-26. https://doi.org/10.1134/S2079970511010138

Shrnutí

Príspevok predstavuje jednu z troch nosných kapitol pripravovanej vysokoškolskej učebnice s názvom Regionálny rozvoj – faktory, nerovnosti a cezhraničná spolupráca. Každá z riešených oblastí, či už ide o faktory regionálneho rozvoja, regionálne disparity i cezhraničnú spoluprácu využíva vlastný súbor výskumných metód, ktoré je potrebné zrozumiteľným spôsobom priblížiť študentom ako jeden prepojený systém. V predkladanom príspevku je pozornosť sústrená na stav riešenia jednej z nich, a to problematiky regionálnych disparít, pričom štruktúra prehľadovej štúdie je koncipovaná ako základ pre vytvorenie obsahovej náplne pripravovanej kapitoly vysokoškolskej učebnice. Okrem definovania pojmu regionálne

disparity sa pozornosť zameriava na ich atribúty, klasifikáciu, najčastejšie využívané hodnotiace ukazovatele a výber štatistických nástrojov a mier na ich meranie.

USEFUL GEOGRAPHY IN EDUCATION

Jaromír Kolejka

Masaryk University, Faculty of Education, Department of Geography, Poříčí 7, 603 00 Brno, Czech Republic

kolejka@ped.muni.cz

Abstract: The usefulness of geography in a professional community demonstrates the applied geography. The applied geography and its outcomes positively interfere with a number of human activities as a rule when it comes to solving various spatial and spatial-temporal tasks. The applied geography gained wide recognition of both other Earth-studying disciplines and, in particular, the users of research results in practice. Similarly, it is necessary to gain an understanding of geography as a system of the knowledge and skills applicable to the everyday life of ordinary citizens. In this area, the contemporary geography faces a number of difficulties. There is a need to deliberately consider appropriate tools to promote "the useful geography" among the widest public, preferably by demonstrating its usefulness in solving model tasks. Some selected solutions are offered in this contribution.

Key words: project learning, search study, practical skills

1 INTRODUCTION

There is no doubt among geographers that geography is a beneficial scientific discipline with many outcomes in practice in an unlimited variety of applications. However, the general public and often professionals from other branches rarely see the practical side of geography. Relatively little is contributed by the predominant factual form of geography teaching at all levels of schools, which presents geography as a set of knowledge about the countries of the world, accompanied by an excursion into the professional geographic terminology. Graduates of geography study receive a significant amount of topographic facts, they learn to use the basic terms used in the individual partial or auxiliary geographic disciplines, their basic meaning and use are introduced to pupils and students. Relatively little lessons are devoted to the methodological part of education, which should be focused on the use of geographic knowledge when dealing with various life situations.

The geographic education has long been standing up for an ongoing challenge: strengthening the skill side of school geography. In principle, two forms of strengthening the skills of young geographers are offered: 1. The field training where pupils and students acquire practical habits both in the stay and in the move in the field, as well as in the field collection of data; 2. The project education is designed to initiate geographic thinking to address specific spatial or temporal-spatial tasks, typically in the form of a multiparametric study (Svatoňová et al. 2012).

Since the field education issue is the subject of another contribution in this publication, it is necessary to focus on the project education in this paper. The topics addressed with regard to the need to promote geography as a useful discipline need to be directed to the questions that put the reality of life before students and their families, relatives or pther people. It should not be about some abstract or thematically distant tasks, but about targeting events that ordinary people can normally get in touch with. There are also some exceptional events that may occur in the place of residence, in the neighborhood of the school or during the recreation elsewhere. Examples of motivational geographic studies are offered in this contribution. The paper is focused on two representative examples only from an endless range of possibilities: the location of the object and the localization of human activity in the area.

2 GEOGRAPHIC TOOLS OF DECISION-MAKING

The methodology of geography is based on three general tools:

a) the spatial approach,

b) the knowledge synthesis, and

c) the hierarchy and location.

These tools need to be used in any decision making procedures in the territory, and their usage personifies the essence of geographic thinking.

The use of the "spatialial approach" instrument means that decision-making respects the territorial distribution of factors having effect on the intention what the decision-making deals with. The spatial distribution of areas and objects within the territory represents the landscape structure. There four landscape structures were formed in the landscape:

1. natural – primary (spatial distribution of landscape units – areas with different natural features: terrain, geological structure, soils, water and energy conditions, atmosphere and biota);

2. economic – secondary (represented by the spatial distribution of areas with different human utilizing – with a different "land cover", e.g. forest, meadow, arable land, built-up area, water body etc.);

3. social – tertiary (which consists of spatial distribution of areas to which different individual or common interests apply and the restrictions bound to these areas, e.g. nature conservation, natural resources protection, limits given by technical and transport infrastructure, private ownership of land, etc.);

4. spiritual – quaternary (this structure means the spatial distribution of areas that are perceived differently by humans, positively or negatively, always subjectively and differentiated from person to person).

The use of the "synthesis" tool is represented in the art of putting things into functional (causal, synergistic) and spatial (neighbouring, synchronic) contexts, searching and finding relationships between objects and phenomena, and using indicators of objects and phenomena unless documented in the territory. "Everything is related to everything" in the environment and it is necessary to know that changing one factor will cause others to change. This fact can build “geographic foresight” of the phenomenon or object development. While it is not possible for the general public to have a qualified prognosis of a phenomenon, it is about data, knowledge and experience based on the idea of why things are here and exactly here, and how things may evolve. To this end, it is necessary to cultivate the art of working with causal and neighbouring contexts in the territory among students and pupils. They may play a key role in decision making.

The use of the “hierarchy” tool means the art to move from the “overhead” (not the same as the “overview”) to detail and vice versa, and to understand that different levels of resolution apply partially or completely different criteria for objects and phenomena assessment, and hence decision making. In particular, this aspect of the geographic view of the territory must be imparted not only to pupils and students of geography but also to their teachers. Other methods and data are applicable at the local level of resolution, other at the chorological and regional level, others at the global level. Additionally, there are relationships between these levels that need to be clarified during geographic education.

3 HORIZONS OF GEOGRAPHIC DECISION MAKING

The landscape is not just a human environment. Man in landscape/territory:

- works,
- lives,
- resting.

However, he/she the landscape/territory:

- uses,
- transforms,
- enriches and deprives,
- threatens and is threatened.

A decision making is included in all these processes regardless some processes have an accompanying character for purposeful human activities. Most decisions in the landscape are spatial in their nature and are based on spatial data. Depending on the time urgency, the sequence of decision horizons can be distinguished:

- operative – instantaneous (in seconds, minutes, hours),
- short-term – tactical (in days, months),
- medium-term – outlook (in years, five-year),
- long-term – strategic (in decades).

The activities of persons skilled in the above-mentioned geographic tools, teachers of geography among others, then include:

- creating spatial data (geodata),

- purposeful interpretation of existing geodata,
- provision of local spatial knowledge (territorial know-how),
- application of general spatial knowledge (expert know-how).

It is clear that the issue of correct decision making is very broad and complicated, even for professionals. The transforming such issues into the geographic education necessarily requires adequate simplification and at the same time rewording for different age categories of pupils or students. Ideally, many examples of how to demonstrate the process of the geographic decision-making in the form of a game may be found that will have both a team and later a form of work in small groups. The simplification may be made on the basis of prioritization in all steps of the solution, while the attractivity can be achieved by linking with other teaching subjects at the elementary school or the high school, where geography is the subject being taught.

4 GAMES WITH A USEFUL GEOGRAPHY – FOR THE DEVELOPMENT OF GEOGRAPHIC THINKING

One of the ways, in which the usefulness of geography may be demonstrated to pupils or students when deciding on the territory´s future, is a simple search study (Kolejka, 2014). In such a case, the strategic decision making is to optimize the land use. The aim of such a classroom work is to stimulate the children's territorial imagination to solve the task, to support the need to work with different data, their purposeful evaluation and synthesis to get a clear result. Depending on the age of the students, the teacher's share in the preparation and execution of the teaching changes.

The search study serves to make pupils or students aware of the fact that there are several factors affecting the location of each object and the phenomenon that it can not be satisfied with the sole criterion of selecting, assessing and thus localizing human activities in the landscape. There are a number of themes for possible tasks such as:

- what a new vineyard needs,
- where to build a house,
- where is the downhill ski slope,
- where we plant orchards,
- what threatens the flood,
- where will be a large crop of wheat,
- where is a risk of soil erosion,
- where the tractor goes through,
- and many others.

Relatively little preparation requires a task: Where to build a house in the valley. The teacher prepares a chart of the possible situation (Fig. 1) and organizes a discussion forum in the class of geography, in which the pupils will individually express themselves on the individual potential locations of the house, mentioning pros and cons for individual solutions (1 to 5).

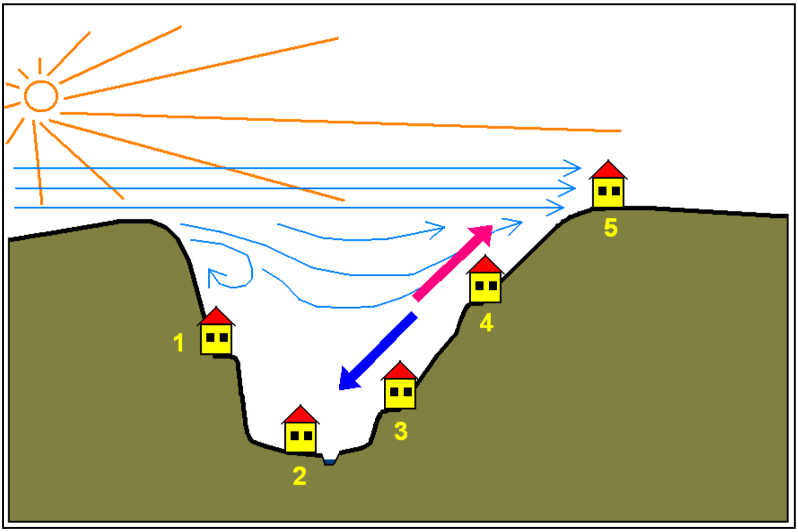


Fig. 1. Drawing of a geographical situation to discuss and solve the task of finding and justifying the best location of a new house.
Source: own processing

Students can comment on the effect of the relief on sunlight on different slopes and what arises of it for the use of the house. What role the wind plays? What happens in the upper and lower part of the valley? What role does the convenience of the population and access to natural resources (water, land) play? The issue of potential natural hazards, cumulation of exhaust fumes, and the impact of the nature and human beings on the environment in general can be developed in the discussion. They learn rational spatial thinking and the result of knowing is that the ideal solution does not usually exist and that compromises are to be expected.

A more complex (multiparametric) but more specific task is to conduct a search study. It consists of answering the sequence of five basic questions:

1. Why? : what is the object of the assessment (house, garage, erosion, landslide, escape)?

2. What? : does affect the choice of location for activity setting up?

3. How? : to evaluate influencing factors?

4. How much? : all criteria are met?

5. Where? : what is the shape and position of a suitable area, line, point?

The answer to the first question means precising and targeting the study. It means the aim of the study. The establishing a representative set of key criteria for assessing the (in)suitability of a site for the intended purpose is the answer to the second question. The third question requires an assessment scale. The simplest scale contains “yes” and “no” only. The fourth question finds the answer in the integration of partial evaluation of the territory according to the criteria. It can be the sum, the product, the intersection of the values of all monitored partial evaluations. The fifth question is answered by compiling a map showing the result.

An example of this type of game is to find a suitable area for setting up a new vineyard using fictive data. Criteria are: geology (Fig. 2), soils (Fig. 3), slope (Fig. 4), aspect (Fig. 5), relative elevation above the bottom of the valley (Fig. 7). The scale is “yes” “no” (evaluated thematic maps will be converted to black-and-white Boolean images). The integration is done by overlaying black-and-white images (maps) of the assessed territory (black colour means “no”, white “yes”). The result of overlaid images is a simple map, where only the white color means: Yes, this area meets all the criteria and is suitable for setting up a vineyard (Fig. 8).

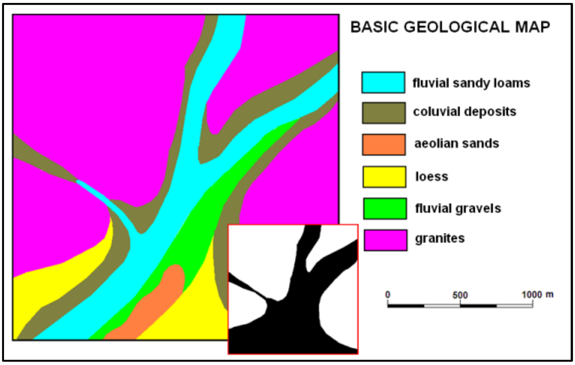


Fig. 2. Geological map and its purpose-interpreted black-and-white image with white areas suitable for the vineyard, black areas are not suitable.
Source: own processing

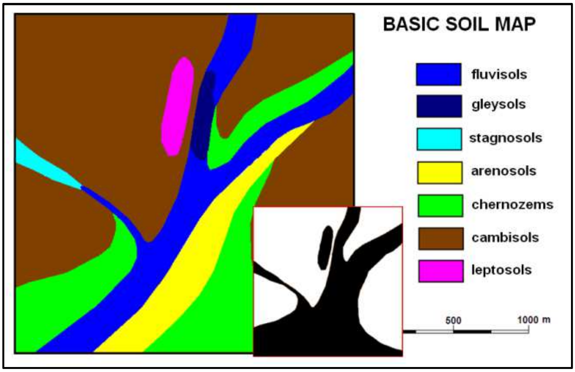


Fig. 3. Soil map and its purpose-interpreted black-and-white image.
Source: own processing

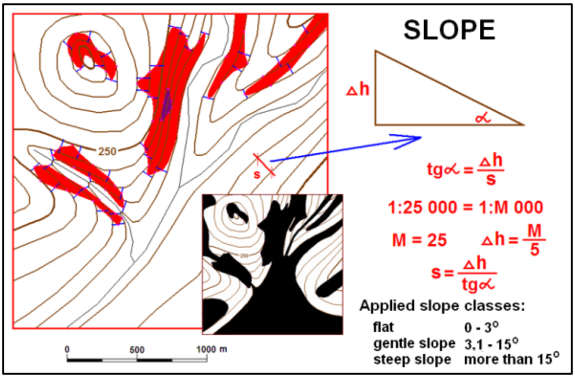


Fig. 4. Slope map and its purpose-interpreted black-and-white image (the moderate slope is the best one).
Source: own processing

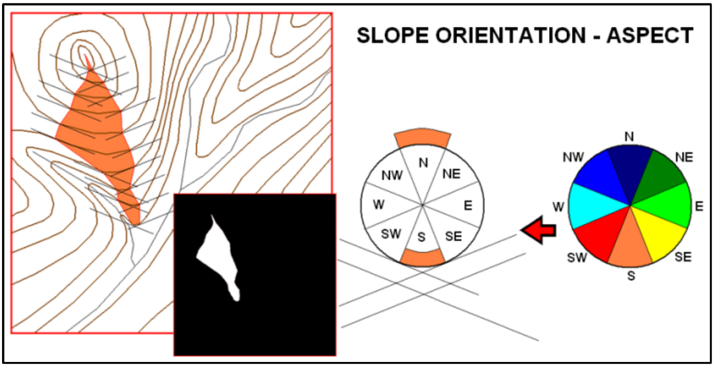


Fig. 5. Aspect map and its purpose-interpreted black-and-white image (the southern slope is the best one).
Source: own processing

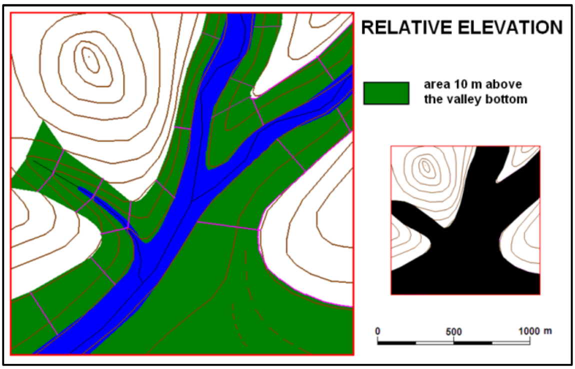


Fig. 6. Map of the areas with the relative elevation of 10 m above the bottom of the valley and its black and white version.
Source: own processing

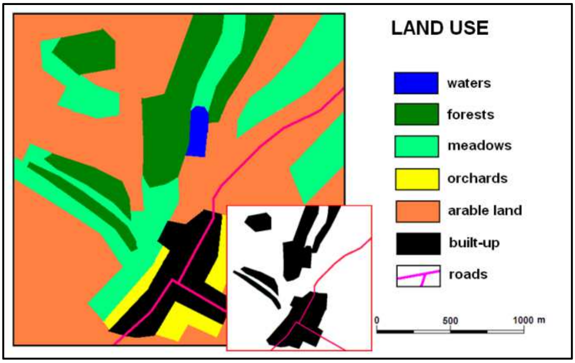


Fig. 7. Land use map derived from the topographic maps and its black and white versions with appropriate and inappropriate areas for the vineyard.
Source: own processing

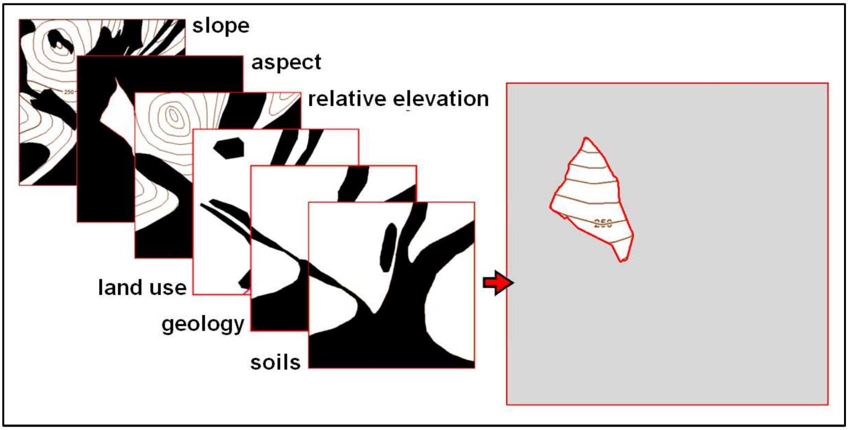


Fig. 8. Integration of purpose-interpreted thematic maps (black-and-white masks) by overlayong on each on other (left) leading to the definition of the area meeting all the criteria for setting up a vineyard (right).
Source: own processing

The demonstrated search procedure can be done in several ways:

a) in the form of "cutouts" for pupils of the 6th–7th classes of the elementary school (12–13 years old pupils) in connection with the subject "art education",

b) in the computer classroom for pupils of the 8th–9th (14–15 years old pupils) in conjunction with the "basics of computer science" using the paint brush tool in MS Office,

c) in a computer room for students of high schools with the education in the "computer science" or geoinformatics (16–20 years old studentss) using GIS shareware or school versions of the GIS SW.

In all alternatives, a significant co-participation of a geography teacher is necessary. The teacher has to prepare all the teaching materials, especially the initial thematic maps (to collect them for the theme the "local landscape"). Their purpose-interpretation into Boolean black-and-white maps may be done in the previous class in the form of discussions with pupils or students to teach them the interpretation of thematic maps and the process of purposeful assessment of landscape features. Alternatively, he prepares these intermediates by himselves and explains their content and meaning to pupils. However, the optimal environment for the successful implementation of the search study is the geographic study ciecle at the elementary and secondary school.

5 CONCLUSION

Another very interesting area of using geographic knowledge and skills in everyday life is the risk assessment in the landscape. It is not a matter to professionally determine the accurate degree of one or the other risk for a normal citizen, but to avoid dangerous places if necessary. Threats can come from both the natural and human environments. Already at schools, pupils and students can be prepared for a purposeful interpretation of available thematic maps (e.g. flood zones according to geological and soil maps, landslides, insects, etc.). Another option is to raise pupils' and students' awareness of potential risk indicators (biotic flood, landslide, rock fall, etc. indicators, social indicators of excluded localities, theft, terrorism, etc.). All of these phenomena have a spatial character, they are tied to certain combinations of localizing factors, and it is only about recognizing them and using them for making the right decisions. There is a wide space opened for geography in the sense, which other disciplines are unable to fill.

Acknowledgment: The research and development of multiparametric pupils´ practices is part of the project "Preparation of Geography and Biology Teachers for Outdoor Education", Grant MUNI/A/1262/2016 supported by the Faculty of Education, Masaryk University in Brno, Czech republic.

REFERENCES

KOLEJKA, J. *Nauka o krajině pro studující geografie magisterských učitelských oborů.* 1. vyd., Brno: Masarykova univerzita, 2014, ISBN 978-80-210-6659-5.

SVATOŇOVÁ, H., HOFMANN, E., KOLEJKA, J., LNĚNIČKA, L., MÍSAŘOVÁ, D., NAVRÁTIL, V., PLUCKOVÁ, I., RUDA, A., RYCHNOVSKÝ, B., SVOBODOVÁ, H., SVOBODOVÁ, J. *Integrovaná přírodověda 3 - Město a venkov. Učitelův námětovník*. 1. vyd., Brno: Masarykova univerzita - Muni Press, 2012, ISBN 978-80-210-5795-1

Shrnutí

Užitečnost geografie v odborné komunitě prokazuje aplikovaná geografie. Aplikovaná geografie a její výsledky pozitivně zasahují do množství odvětví lidské činnosti zpravidla tam, kde jde o řešení prostorových a časoprostorových úkolů. Aplikovaná geografie tam získala uznání jak dalších disciplín zkoumajících Zemi, tak zejména uživatelů výzkumných výsledků v praxi. Podobně je zapotřebí získat pochopení geografie jako souboru znalostí a dovedností použitelných v každodenním životě běžného člověka. V této oblasti se soudobá geografie potýká s řadou nesnází. Je zapotřebí cílevědomě uvažovat o vhodných nástrojích propagace „užitečné geografie" mezi nejširší

veřejností, nejlépe cestou demonstrace její prospěšnosti při řešení modelových úkolů. Nabídku vybraných řešení přináší tento příspěvek.

Geografie s výhodou využívá svých hlavnívh metodických nástrojů: prostorovosti, syntézy a hierarchie. Geografie (znalosti o dovednosti) by měla v každodenním životě napomáhat správnému prostorovému rozhodování. Takové člověk potřebu při svých hlavních životních aktivitách (bydlení, práci a odpočinku) v celém jejich rozmanitém podrobném spektru. Člověk při těchto svých aktivitách krajinu/území využívá, přetváří, obohacuje i ochuzuje, ohrožuje a sám je jí ohrožován. Z hlediska času pak rozhodování nabývá forem rozhodování operativního – okamžitého (pro sekundy, minuty, hodiny), krátkodobého – taktického (pro dny, měsíce), střednědobého – výhledového (pro roky, pětiletí) a dlouhodobého – strategického (pro dekády). Činnosti člověka znalého geografických cědomostí a dovedností, tedy m.j. učitele geografie, pak zahrnují vytváření prostorových dat (geodat), účelovou interpretaci existujících geodat, poskytování místních prostorových znalostí (územní know how) a aplikaci obecných prostorových znalostí (expertní know how).

Je zřejmé, že problematika správného rozhodování je velice široká a komplikovaná, a to i pro odborníky. Transformace takové problematiky do geografického vzdělávání nutně vyžaduje náležité zjednodušení a současně přeformulování pro rozdílné věkové kategorie žáků či studentů. V ideálním případě lze najít příklady, jak proces geografického rozhodování v území demonstrovat v podobě hry, která bude mít jak společnou kolektivní část, tak později formu práce v malých týmech.

V příspěvku jsou demonstrovány dva příklady pěstování geografického myšlení u žáků a studentů geografie cestou výuky v učebně. Formou diskuse lze se se žáky dohadovat, které místo v údolí je nejvhodnější pro postavení obytného domu (obr. 1). Další možností je jednoduchá vyhledávací studie. Ta slouží k tomu, aby si studující zeměpisu uvědomili, že na polohu, funkci a chování každého objektu a jevu působí více faktorů, že se nelze spokojit pouze s jediným kritériem výběru, hodnocení a tím i lokalizace aktivit člověka v krajině. Vyhledávací studie spočívá v tvorbě odpovědí na posloupnost pěti základních otázek:

Proč? : kde může být objekt/proces/jev (dům, garáž, eroze, sesuv, útěk)?

Co? : ovlivňuje výběr místa pro jeho založení?

Jak? : hodnotit ovlivňující faktory?

Kolik? : kriterií je splněno?

Kde? : jaký tvar a polohu má vhodný pozemek, linie, bod?

Příkladem tohoto typu hry je vyhledávání vhodné plochy pro založení vinohradu. Kritérii jsou tyto faktory: geologické podloží (obr. 2), půda (obr. 3), sklon svahu (obr. 4), orientace svahu (obr. 5), výška nad dnem údolí (obr. 6) a současné využití ploch (obr. 7). Stupnice je „ano“ „ne“ (vyhodnocené mapy se změní ma černobílé booleánské obrazy). Integrace se provádí nakládáním na sebe černo-bílých obrázků (map) území (černá barva znamená „ne“, bílá barva „ano“). Výsledkem nakládání obrázků na sebe je jednoduchá mapa, kde pouze bílá barva znamená: Ano, tato plocha vyhovuje všem kritériím a hodí se pro založení vinohradu (obr. 8).

DEVELOPMENT STUDIES AND DEVELOPMENT GEOGRAPHY IN THE SYSTEM OF EARTH SCIENCES

Zdeněk Opršal, Pavel Nováček

Department of Development & Environmental Studies, Faculty of Science, Palacký University Olomouc, 17. listopadu 12, 771 46 Olomouc

zdenek.oprsal@upol.cz

Abstract: There is an ongoing debate on the future of geography as a science. The Earth is almost explored and therefore the space for the application of geography is relatively narrower than in the past. At the same time, there are fields of geography such as Development Studies and Development Geography which bring new impetus. Development geography deals with the study of the spatial aspects of development, or more precisely of insufficient development of economically less advanced countries. Until recently, this issue has not been an important part of teaching and research activities at Czech universities, but the situation has changed in the last decade. The paper provides an overview of recent evolution and position of Development Studies and Development Geography in the system of Earth Sciences, taking into consideration the Czech context. It reviews the debate on the mission of Development studies and development geography and considers the role of geography in our perceptions of developing countries and their problems.

Key words: Development geography, Development studies, Earth sciences, Czech Republic

DEVELOPMENT STUDIES IN THE CONTEXT OF A CHANGING WORLD

Development studies is a relatively new branch of social sciences. Shuurman (2002) states that the roots of the Development studies can be tracked into the second half of the 1950s and in the first half of the 1960s, building on the experience of the restoration of Western European economies that took place after the Second World War. According to Daněk (2000), the intellectual environment of the 1940s which was in favour of decolonization was also important and allowed to create an interdisciplinary field of development studies. The aim of the newly constituted discipline was to provide post-colonial countries with a theoretical and methodological basis for their policy to overcome economic and social backwardness (Daněk, 2000). Development studies responds to external stimuli stemming from the dynamic relationships between the different actors of the developed and developing world. The discipline also provides a theoretical basis for alternative development concepts, strategies, and development policies. Interaction between the theoretical discipline of developmental studies and the real world is two-sided and constant, therefore Development studies is inherently a very dynamic discipline.

The emergence of development studies is linked to the success of the concept of modernization. This concept, encouraged by the successful reconstruction of Western Europe after the Second World War, is based on the idea that the follow-up of "Western" ways of economic and industrial development is equally appropriate for the transformation of less developed countries. Modernization theory gained popularity especially in the 1950s and 1960s and in a modified form returned in the eighties. The idea of modernization still affects powerful international development institutions, in particular the World Bank and the International Monetary Fund. (Martinussen, Pedersen 1999; Rapley 2007; McKay 2004).

Modernization theories began to be criticized in the 1960s from many different perspectives. The strongest criticism came from the "dependency school" that has its roots in Latin America. The authors of this school pointed out that the growth of prosperity in developed countries is possible only at the expense of the developing countries, which are maintained in artificial dependency. (McKay 2004; Potter 2003). According to Schuurman, various academic centres of Third World studies were founded and influenced mainly by leftist professors and their students (Schuurman 2002). Discussions on the nature and impact of development aid and the roles of development policies from the position of "dependency school" become a common topic within the Third World studies centres. Proponents of the "dependency school" got into criticism themselves at the end of the seventies and in the eighties because they failed to explain the growth of newly industrialized countries in southern and south-east Asia. The unprecedented growth of so called Asian tigers (Taiwan, South Korea and others) has shown that blaming globalization for poverty in the developing world cannot be fully justified. (McKay 2004).

The 1980s were marked by neo-liberalism, embodied by the Structural Adjustments Programmes (SAP) of the World Bank and the International Monetary Fund. These programs, focusing on the macroeconomic stabilization of participating countries, have become a prerequisite for providing preferential loans needed to overcome the debt crisis. However, the negative effects of SAP became obvious already in the 1980s. Reduced state budget expenditures of developing countries due to SAP requirements have affected mainly the social sectors (health, education, public services). As a result, poverty has grown among the poorest people and, in many cases environmental degradation occurred. The contribution of the Structural Adjustments Programmes for economic growth of developing countries remains the subject of debate. Another major blow to neoliberal approaches was the debt crisis that hit South and Southeast Asia in 1997. The model promoted by the most influential international financial organizations failed, and once again there were calls to re-evaluate and adjust existing approaches (Rapley 2007).

During the 1990s, there has been a reflection of existing development theories and strategies. The debate was fuelled by a disillusion with the unsatisfactory results of development cooperation, which was reflected in a decrease in the volume of development aid in early 1990s. Under the impression of strong criticism, alternative concepts of developmental studies as well as practice (grassroots development, empowerment, participation, etc.) arise or strengthen their position. (Potter 2004; Riddell 2007). One of the main consequences of the revision of existing approaches to development was the rejection of universal developmental theories. A distinctive feature of today's development studies and developmental practice is the diversity of approaches where classical and alternative theories and strategies coexist. Another major feature of current situation in the field of development studies is an increased focus on “new” issues such as migration, remittances, clime change or tax evasions.

In the context of the inability of major developmental theories to explain the causes of transformation and stagnation in developing countries (Martinussen 2007) and the disillusion regarding inadequate results or the failure of existing development strategies, the discussion about the “development studies crisis”. The most radical criticism was raised against the very concept of development from post-development left-wing scholars (e.g. Escobar 1994). The critics blame the discipline of development studies creating artificial distinction between the “more advanced” North (or West) and the “backward” rest of the world that has to develop. Development has thus become a tool for the continuation of colonialism. For some authors, this means the end of development studies, because there is nothing like development, only a development discourse full of effort to colonize. Others emphasize the need to listen more closely to those “who should be to be developed”, to be receptive to their needs and understanding of development and not to impose alien ideologies or universal strategies (Daněk 2000).

DEVELOPMENT GEOGRAPHY AS A PART OF DEVELOPMENT STUDIES

SDevelopmental studies build on the tradition of various more traditional scientific disciplines such as economics, sociology, anthropology or geography. Development geography can be considered as part of broadly defined field of Development studies. However, Development geography is specific with its emphasis on the time and space dimension of economic and social inequalities within developing countries and between economically advanced economies and developing countries. The emergence of a distinctive discipline of Development geography came later than that of development studies. Since the mid-20th century, geographers have begun to address wider development issues, not just narrowly targeted regional topics. The development of a “new” discipline began in 1960s and 1970s, but only slowly gained its shape and identity. Marcus Power sees as a forerunner of developmental geography Tropical regional geography as a forerunner of Developmental geography. In his work, he is mapping the transformation of colonial and tropical geography in Great Britain into development geography, which has been underway since the end of the Second World War until the 1970s (Power 2004).

According to Lawson, development geography has been a latecomer to the interdisciplinary family of development studies (Lawson 2007). Development geography was inspired by dominant theories and strategies of modernism and economic development in the early stages of its formation in the 1970s and 1980s. In the 1990s, critical approaches within the development geography gained dominance. These approaches according to Lawson (2007) combine Marxist political and economic analyzes with alternative feminist and postcolonial theories (thus representing one of the opinion schools of postcolonialism). Critical development geography emphasizes the importance of uniqueness, diversity, subjectivity, knowledge, and opposes dominant neoliberal discourse in development. (Lawson 2007). Lawson lists the typical features of development geography. Development geography has always been highly interdisciplinary, with distinctive elements of geographic research methods. Development geography has not yet had a stable identity in relation to diverse development concepts (Lawson 2007), and it is only now defining its position among other directions of human geography.

Developing geography has been since 1990s labelled also as "postcolonial geography". Livingstone notes that "geography was an imperialistic science par excellence ... [because] ... discovery, topographic and social exploration, cartographic imagery, and regional inventory ... fully served the needs of colonists" (Livingstone in Potter 2004: 55). Daněk adds that (especially in Africa) borders were often drawn on the tables of European politicians and geographers. These borders, rather than the natural ethnic or natural boundaries, served the interests of colonial powers. Illustrative examples are the Caprivi Strip in the Namibia or the borders of Senegal and the Gambia (Daněk 2000). Inappropriately or vaguely defined borders or incorporation of different, sometimes hostile ethnic groups into one state unit eventually become the cause or pretext of armed conflicts.

The criticism of negative consequences of classical colonial (or tropical) geography is reflected in the works of British authors (or authors from former British dependent territories). An important representative of postcolonialism (or postdevelopmentism) is Edward Said, who introduced the construct of orientalism into social theory. Orientalism "created" subordinate colonial cultures and Western concepts of their superiority (Corbridge in Daněk 2000: 41). Another important author is the anthropologist Arturo Escobar, who opposed the discourse of development as such, claiming that the Third World was created by the "development" implemented by the rich First World (Escobar, 1995). British geographers (for instance Simon 2007, Raghurama Madge 2006, Sidaway 2007) have been discussing postcolonial challenges for Development studies and Development geography. The discussion focuses on methods of development research, dissemination and impact of its findings and lessons in less developed countries.

Postcolonial or critical geography also pay attention to the impact that contemporary geography has on shaping people's awareness and imagery of developing countries. In this context, Power (2003) quotes Holloway and Hubard (in Power 2003: 6), and talks about "mental maps" where geography have significant influence. Cartographic projections used in most school maps are tailored to the latitude of Europe and North America – this fact shapes students' inaccurate ideas about the real proportions of most Third World countries. The very term "Third World" is considered by some scholars to be inappropriate, as it implies the superiority of the "First World" i.e. western industrialised countries despite the fact that the original term Third World was introduced by the French demographer Alfred Sauvy as an alternative to the First and Second Worlds during the Cold War period. After the collapse of the Soviet bloc, the Second World vanished, but the term Third World survived and maintained a slightly pejorative meaning.

DEVELOPMENT STUDIES AND DEVELOPMENT GEOGRAPHY IN EUROPE AND THE CZECH REPUBLIC

Despite the criticisms of development discourse, these developmental studies and Developmental geography are enjoying interest of students mainly in Western Europe. A significant number of institutions focusing on Development studies or development research associate the European Association of Development Research and Training Institutes (EADI). A good overview of the Development studies and study system in the UK is provided by the Development Studies Association (DSA, 2017). Studies focusing on the issue of developing countries have a strong presence in the Nordic countries, because Nordic societies are supportive towards foreign aid. The biggest traditions of Development studies programmes have countries that were formerly colonial powers - especially in Great Britain, the Netherlands and France.

Tab. 1: Countries of origin and number of the institutional and associate members (in brackets) of the EADI, in alphabetical order

Austria (6)	Hungary (2)	Romania (2)
Belgium (6)	Ireland (2)	Serbia (1)
Croatia (2)	Italy (7)	Slovenia (2
Czech Republic (3)	Luxembourg (1)	Spain (7)
Denmark (4)	Malta (2)	Sweden (4)
Finland (4)	Netherlands (15)	Switzerland (8)
France (9)	Norway (9)	Turkey (1)
Germany (20)	Poland (3)	United Kingdom (18)
Greece (2)	Portugal (2)	

Source: EADI (2017)

The Development studies usually take the form of Master's degree graduate programs. The specializations of Development studies at bachelor level (undergraduate programs) are less frequent. This system reflects the belief that a development study is a specialization that extends the knowledge of other disciplines (typically economics, international studies, sociology, anthropology or geography). As a result there is also a large number of various study combinations including complementary or secondary specializations. Institutions with the greatest tradition of Development studies include the Institute of Social Studies (ISS) in the Netherlands, the London School of Economics (LSE) or the Institute of Development Studies (IDS) at the University of Sussex in Brighton (both in the UK).

Study programs focused on Development studies are also offered within the field of geography. An example is the International Development Studies Master Program at the Department of Social Geography and Planning at Utrecht University (Netherlands), the Human Geography, Planning and Development (International Development Studies) Master's degree program at the University of Amsterdam (the Netherlands) International Development Studies at the Department of Geography and International Development Studies at Roskilde University (Denmark), Master Studies in Development Studies at the Department of Geography at the Norwegian University of Science and Technology in Trondheim (Norway). In the UK, Geography and Development offers the Geography and Development Department of Geography to the already mentioned prestigious University of Sussex. Bachelor's Degree Program International Development Studies is offered by the Department of Geography and Development Studies at the University of Chester. Study programs of geography-based Development studies can also be found in the United States of America, Australia, Canada and New Zealand.

Developmental studies in Central and Eastern Europe have a significantly shorter tradition therefore also a weaker representation in EADI compared to Western counterparts. The Table 1 reveals that only 12 institutional and associate EADI members were from post-communist countries, while western European countries hosted 130 members in 2017. The Czech Republic belongs among other post-communist countries to one of the most experienced and relatively progressive donors (Opršal a kol. 2017, Harmáček a kol. 2017). As for the Czech academic institutions, the longest tradition of studies focused on needs and problems of developing world within the Czech Republic can be ascribe to the Faculty of tropical agriculture (former Institute of tropics and subtropics) at the University of Live Sciences in Prague. The roots of the tropical agriculture study programme go back to communism and the programme are still predominantly based on education and research in agriculture.

The first Czech academic institution specifically focused on Development studies can be thus considered the Department of Development and Environmental Studies at the Faculty of Science, Palacký University Olomouc. The Department was established in September 2007 however the history of Development studies in Olomouc dates back to 2003, when the study program International Development Studies was founded within the Department of Geography. The study program indirectly followed the tradition of the Summer schools of development cooperation which were organised at the Palacký University Olomouc since 1998 (Nováček 2014). The Department of Development and Environmental Studies has bachelor, master and doctoral study programmes in International Development Studies, bachelor programme Environmental Studies and Sustainable Development and master programme Foresight for Environment and Development. All study programs are accredited within the program of Geography and the study plans mirror the competence of geographic sciences.

In the course of time, development-oriented courses and programs have found their way to other Czech universities. Mendel University in Brno, Faculty of Regional Development and International Studies offers bachelor and since 2011 also master programme International Territorial Studies. Most recently the Global Migration and Development Studies programme started at Faculty of Science, Charles University in Prague, building on the long-standing tradition of migration and geographic research and education. The list should also include the secondary specialization Development Studies at the University of Economics in Prague. Finally growing number of individual development-oriented courses can be found at Czech universities. These include Department of Social Geography and Regional Development at University of Ostrava, Department of Geography at Faculty of Economic, University of West Bohemia or Department of Geography at Masaryk University in Brno. Enhanced tertiary education in international development-related issues is important for the Czech Republic's ability to cope with developmental and other global challenges as defined by Agenda 2030 in the form of Sustainable Development Goals (Lebeda 2015). It is positive that geographers across the Czech Republic are actively involved in this education.

REFERENCES

DANĚK, Petr. Nerovnoměrný rozvoj světa: kolonialismus, neokolonialismus a diskurz rozvoje. In: JEHLIČKA, Petr, TOMEŠ, Jiří a DANĚK, Petr. *Stát, prostor, politika. Vybrané otázky politické geografie.* Praha: Univerzita Karlova, Přírodovědecká fakulta, 2000, s. 49-64. ISBN 80-238-5566-2.

Development Studies Association. [online]. DSA [Cit. 27.10.1017]. https://www.devstud.org.uk/conferences/2017/index.shtml

ESCOBAR, Arturo. *Encountering Development: The Making and Unmaking of the Third World.* Princeton: Princeton University Press, 1994. 320 s. ISBN 978-0691150451.

HARMÁČEK, Jaromír, SYROVÁTKA, Miroslav a OPRŠAL, Zdeněk. Analýza faktorů selekce a alokace české rozvojové pomoci s využitím panelových dat a metod Probit a Tobit. *Politická ekonomie*. 2017. 65(2), 179-197. ISSN 0032-3233.

LAWSON, Victoria. *Making Development Geography*. London: Hodder Arnold, 2007. 256 s. ISBN 978-0340809648.

LEBEDA, Petr. MDGs, SDGs and the Change of Paradigm. *Development, Environment and Foresight*, 2015, (1)2, 73-76, ISSN: 2336-6621.

List of EADI Members by Country. [online]. EADI [Cit. 20.10.1017]. Dostupné z: https://www.eadi.org/members/_netherlands

MARTINUSSEN, John Degnbol a PEDERSEN, Poul Engberg. *Aid. Understanding International Development Cooperation*, 1999. London, New York: Zed Books, 350 s. ISBN 978-1842770399.

MARTINUSSEN, John. *Society, State and Market: A Guide to Competing Theories of Development*. London, New York: Zet Books, 1997. 400 s. ISBN 978-1856494427.

McKEY, John. Reassessing Development Theory: "Modernisation" and Beyond. In: KINGSBURY, Damien, REMENYI, Joe, MCKAY, John, a HUNT, Janet: *Key Issues in Development*. 2004. Basingstoke, New York: Palgrave Macmillian, 2004, s. 45-67. ISBN ISBN 1-4039-0045-0.

NOVÁČEK, Pavel. Úvod. In NOVÁČEK, Pavel. (ed.) *Rozvojová studia – vybrané kapitoly*. Olomouc: Univerzita Palackého v Olomouci, Přírodovědecká fakulta, 2014, s. 11-13. ISBN: 978-80-244-3958-7.

OPRŠAL, Zdeněk, HARMÁČEK, Jaromír a SYROVÁTKA, Miroslav. Geography of Czech aid: Where and why Czechia promotes development? *Geografie*. 2017. 122(2), 169-189. ISSN 1213-1075.

POTTER, Robert, BINNS, Tony, ELLIOTT, Jennifer a SMITH, David. *Geographies of Development*. Second edition, 2004. Harlow: Prentice Hall: Pearson Education. 509 s. ISBN 978-0130605696.

POWER, Marcus. R*ethinking Development Geographies*. London, New York: Routledge, 2003. 273 s. ISBN 978-0415250795.

POWER, Marcus. *Rethinking Development Geographies*. Routledge, 2003. London, New York: Routledge, 273 s. ISBN 978-0415250795.

RAGHURAM, Parwati a MADGE, Clare. Towards a method for postcolonial development geography? Possibilities and challenges. *Singapore Journal of Tropical Geography*. 2006, 27(3), 270-288. ISSN 1467-9493.

RAPLEY, John. *Understanding Development. Theory and Practice in the Third World*. Third Edition, 2007. Boulder, London: Linne Rienner, 265 s. ISBN 978-1588265388.

RIDDELL, Roger. *Does Foreign Aid Really Work?* Oxford, New York: Oxford University Press, 2007. 505 s. ISBN 978-0199544462.

SCHUURMAN, Frans. The impasse in development studies. In: DESAI, Vandana, POTTER, Robert, (eds.) *The Companion to Development Studies.* London: Hodder Arnold, 2002, s. 12-15. ISBN 978-0340760512.

SIDAWAY, James. Spaces of postdevelopment. *Progress in Human Geography*. 2007. 31(3), 345-361. ISSN 0309-1325.

SIMON, David. Beyond antidevelopment: Discourses, convergences, practices. *Singapore Journal of Tropical Geography*. 2007, 28(2), 205-218. ISSN 1467-9493.

Shrnutí

V současné době se setkáváme s různými názory na budoucnost geografie jako vědní disciplíny. Země je již téměř prozkoumána, a proto se prostor pro uplatnění geografie relativně zužuje. Zároveň se v geografii objevují směry, které přinášejí nové podněty. Jedním z těchto směrů je také rozvojová geografie (*Development Geography*). Rozvojová geografie je jedním z proudů Rozvojových studií (*Development Studies*), který se soustředí na časoprostorovou dimenzi ekonomických a sociálních nerovností a vztahů v rámci rozvojových regionů a mezi hospodářsky vyspělými zeměmi (tzv. globálního Severu) a rozvojovými zeměmi (tzv. globálního Jihu). Disciplína rozvojové geografie se tak začíná utvářet v šedesátých a sedmdesátých letech, ale jen pomalu získávala svou jednotnou podobu a vlastní identitu. Marcus Power (2003) vidí jako předchůdce rozvojových směrů v geografii tropickou geografii. Rozvojová geografie v 70. letech se stala poměrně pozdním příchozím do interdisciplinární rodiny rozvojových studií (Lawson 2007). V devadesátých letech se vyvíjí kritické přístupy k rozvojové geografii. Tyto přístupy spojují marxistické politicko-ekonomické analýzy s alternativními feministickými a postmodernistickými teoriemi. Kritická rozvojová geografie zdůrazňuje význam jedinečnosti, různorodosti, subjektivity a staví se proti dominantním neoliberálním diskurzům v rozvoji (Lawson 2007).

Významné množství institucí, které se orientují na rozvojová studia nebo rozvojový výzkum, sdružuje European Association of Development Research and Training Institutes (EADI). Dobrý přehled o rozvojových studiích a systému studia ve Velké Británii dává platforma Development Studies Association (DSA). Studia orientovaná na problematiku rozvojových zemí mají velké zastoupení v severských zemích, ve kterých je společnost tradičně příznivě nakloněna řešení globálních problémů včetně chudoby a nerovností. Největší tradici mají rozvojová studia v zemích, které byly v minulosti koloniálními mocnosti – zejména ve Velké Británii, Nizozemí a Francii.

Rozvojová studia realizovaná na geografických pracovištích lze nalézt na Utrecht University a University of Amsterdam v Nizozemsku, Roskilde University v Dánsku, Norwegian University of Science and Technology (v norském Trondheimu), University of Sussex a University of Chester ve Velké Británii. Rozvojová studia a rozvojová geografie ve střední a východní Evropě výrazně kratší tradici, a proto i slabší zastoupení v EADI ve srovnání se západními protějšky. Pouze 12 institucionálních a přidružených členů EADI pocházelo v roce 2017 z postkomunistických zemí, zatímco na západoevropské země připadalo 130 EADI členů.

Největší tradici v České republice má Česká zemědělská univerzita v Praze (Institut tropů a subtropů, dnes Fakulta subtropického zemědělství), ta se však převážně zaměřuje na zemědělský sektor v rozvojových zemích. Za první českou akademické pracoviště specificky zaměřené na rozvojová studia, resp. rozvojovou geografii, může být proto považována Katedra rozvojových a environmentálních studií, která je součástí Přírodovědecké fakulty Univerzity Palackého v Olomouci. Historie rozvojových studií v Olomouci se datuje do roku 2003, kdy vznikl samostatný obor Mezinárodní rozvojová studia. Rozvojová studia si později našly cestu na další české akademické pracoviště – Mendlovu zemědělskou Univerzitu v Brně v podobě oboru Mezinárodní teritoriální studia a Univerzitu Karlovu v Praze ve formě Globálních migračních a rozvojových studí. Druhý jmenovaný obor staví na dlouhodobé tradici výzkumu migrace pražskými geografy. Mimo akreditované obory v oblasti rozvojových studií lze na geografických pracovištích českých vysokých škol nalézt řadu individuálních předmětů zaměřených plně nebo dílčím způsobem na problematiku rozvojových zemí a mezinárodního rozvoje. Zahrnutí problematiky mezinárodního rozvoje do terciálního vzdělávání je důležitým pro posílení schopnosti České republiky vyrovnat se s rozvojovými a dalšími globálními výzvami, jak je definuje Agenda 2030 ve formě Cílů udržitelného rozvoje (Lebeda 2015). Je pozitivní, že se geografická pracoviště v celé České republice aktivně zapojují do tohoto vzdělávání.

EUROPEAN UNION IN THE PRACTICAL LIFE OF PRIMARY SCHOOL PUPILS (AT THE 2ND LEVEL OF PRIMARY SCHOOLS IN SLOVAKIA)

Iveta Rakytová

Catholic University, Faculty of Education, Department of Geography, Ružomberok, Slovakia
iveta.rakytova@ku.sk

Abstract: Geography is one of the school subjects, which gives space for shaping the relationship of pupils to the larger space than their home country - the Slovak Republic. It enables students to understand the functioning of Slovakia within the larger region – in our case within the European continent. The Slovak Republic is a member of several international groupings, but it is influenced by membership in the European Union. Geography is uniquely predisposed to join patriotism on one side, and the feeling of being part of a larger grouping on the other. For this to work, it is necessary that students have sufficient knowledge of not only the country where they live, but also the community of states they are part of. The aim of the paper is to find a way how to transform the theoretical knowledge acquired by pupils about the European Union into the subject of Geography at the 2nd level of primary schools in the Slovak Republic into practical life.

Keywords: European Union, primary school, geography

1 INTRODUCTION

Lately, the European Union is a subject to different pressures and discussions about its need and importance. The negative views came mostly to light after the referendum of Great Britain citizens about leaving the Union. Therefore, it would be appropriate to look for an answer to the question: How to strengthen the pro-European thinking amongst young generation?

The Slovak Republic chaired the European Union in the second half of the year 2016. An interest in this aspect as well as the fact that the Slovak Republic is a part of the European Union is very low amongst young people. To find the answer to the question why it is so is not as straight forward. The generation of these days commonly uses phrases such as: "Why do I need it?" "What's in it for me?" Beside this a question arises: "Is it better to be a European or a Slovak? Or is it possible to be both?" To nurture and form a positive but truthful view towards the European Union, as the community of the states of Europe, to feel as its citizen and to be its part, brings about the subject of Geography. To be the European does not mean not to be Slovak, and vice versa.

As evidenced by surveys of the Eurobarometer in the year 2013 and 2014, 65% of European citizens feel as Europeans (2013), and 51% expressed in 2014 that they foresee themselves, in the future, as a member of their own country first and only then as a European citizen. (figure 1).

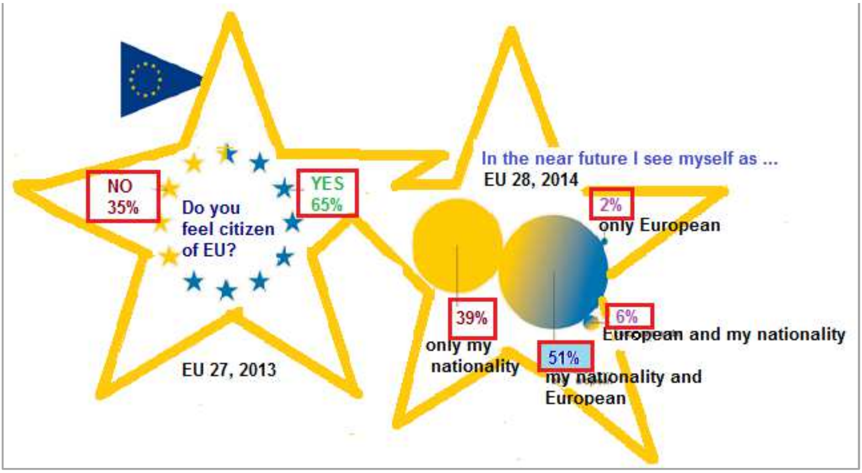


Fig. 1. Do the citizens of the EU feel like the EU citizens?
Source: edited by:
http://ec.europa.eu/commfrontoffice/publicopinion/archives/eb/eb82/eb82_first_en.pdf [cit.2017-09-19]
http://ec.europa.eu/commfrontoffice/publicopinion/archives/eb/eb79/eb79_publ_en.pdf [cit.2017-09-19]

In Slovakia, the results of the Eurobarometer 84 (2016) revealed that only 46% of Slovak citizens feel to be connected to the European Union. However, many more than that consider themselves to be the EU citizen, approximately two thirds (69%). Whereas, it is more **young people and people with the higher education** that feel to be the EU citizens. **Almost 81% of young people in the age of 15–24 feel to be the EU citizens.** It is, however, only some half of the Slovaks (52%), that are familiar with their rights as a EU citizen. (http://www.tns-global.sk/sites/default/files/files/ts1609_eurobarometer_standard.pdf [cit.2017-09-19])

The basis for this review preparation came to us, beside others, mostly through the works of Mentza, O. (2006a, 2006b, 2007a, 2007b). In one of which he is asking an interesting question (2007), what do we really consider to be Europe? According to him Europe can be understood in several dimensions: (Fig. 2)

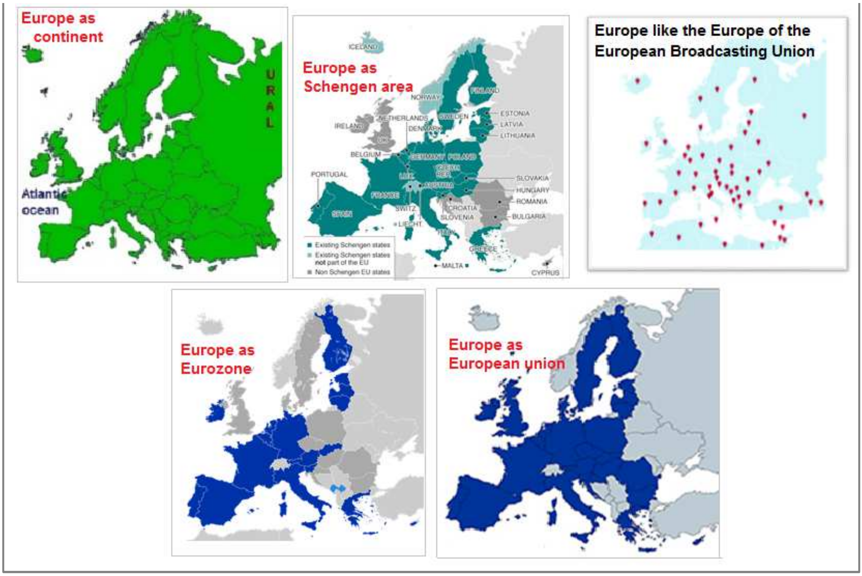


Fig. 2. Different definitions of EUROPE.
Sources: http://www.infoglobe.sk/stat/?fm=1[cit.2017-09-20], http://www.bbc.com/news/world-europe-13194723[cit.2017-09-20], https://www.ebu.ch/about[cit.2017-09-20], https://ec.europa.eu/slovakia/node/421_sk[cit.2017-09-20]

- as a continent which spreads from the Atlantic Ocean to the Ural,
- or smaller parts of Europe for example such as:
    - Europe of The Schengen Area, which represents countries that participate in the Schengen Agreement (www.schengenvisa.cc),
    - or so called “Euro-Land”, countries that share the same “Euro” currency,
    - or it is Europe in borders that are defined in much larger scope that the official borders of “Europe”, like the Europe of the European Broadcasting Union (www.ebu.ch) with its 74 members in 54 countries of Europe, North Africa and the Middle East (Foucher, 1993),
- or at last, it is Europe as defined by the borders of the European Union.

In the education of Geography in the Slovak Republic, Europe is understood as a continent and the European Union as a union of the European countries operating on the basis of the common market space, common policy and a united voice at the international forums.

Should pupils develop a relationship towards the European Union to learn to think on pro-European terms and get to know their rights of a EU citizen, it is necessary for them to have at least a basic understanding about the Union, of course appropriately to the age of pupils.

Our focus was on the secondary level of the elementary school, the 8th grade, where the pupils are presented with the facts on Europe as a continent. From the above mentioned brief list of how to understand the European borders, to separate the facts about Europe from those about the European Union is practically impossible, they are closely intertwined.

The goal of the presented review is to analyse the standpoint of the curriculum on Europe and the European Union in the subject of Geography at the secondary level of the elementary school in the Slovak Republic. Through the survey amongst pupils in the form of a didactic, test to verify the basic knowledge of pupils about the European Union. Consequently, to propose a scheme appropriate to the age of pupils, whereby the pupils would come to understand the meaning or actual benefits of their country being a member of the EU.

2 A POSITION OF THE CURRICULUM CONTENT ABOUT THE EUROPEAN UNION IN THE ISCED 2 IN THE SUBJECT OF GEOGRAPHY

2.1 The Geography Education in the Slovak Republic

The education in the Slovak Republic is carried out through the Government Educational Scheme (ŠVP). For the compilation of the ŠVP and the content of the education based on particular educational level, the Slovak Republic also joined the ISCED classification (International Standard Classification of Education), according to which the process is performed in Europe, and is also accepted by other international organisations (UNESCO, OECD).

In the article we are focused on the ISCED 2—the lower secondary education, which in Slovak terms means the secondary level of the elementary school—the 5th and the 9th grade.

The State Educational Scheme is the starting document for the preparation of schools' educational programs that represent second level of a two-tier education model. Through the use of elective lessons, a two-tier education model gives each school an opportunity to reflect specific regional or local conditions and requirements of pupils or parents in their school's curriculum. By means of educational areas and cross-cutting topics, in the teaching process, the interdisciplinary approach is preferred, that is a co-operation within individual learning subjects in the given educational area as well as between different areas.

http://www.statpedu.sk/sites/default/files/dokumenty/inovovany-statny-vzdelavaci-program/svp_nsv_6_2_2015.pdf[cit.2017-09-19]

The State Educational Scheme designates compulsory teaching subjects that are integrated into the individual learning areas. The **subject of Geography** is included in the **Man and the Society** area together with the history and the social studies. The main purpose of this educational area is to introduce students to the evolution of human society with the most important social phenomena and processes, which are reflected into the everyday life, and to perceive the world integrally in the mutual relationship between a man and the society in a given geographical area.

Knowing the past of its own nation as well as of the nations of Europe and the world, getting familiar with geographical characteristics of its own homeland and regions of the world, and forming positive civil attitudes, is a prerequisite for gaining the civil competences that belong to the key ones in the process of education. At the same time this knowledge develops and strengthens an awareness of belonging to the European civilisation and cultural environment.

2.2 The school subject Geography

The main task of the school subject Geography, in the educational scheme of the Slovak Republic, is to develop in pupils the knowing of the excellence and uniqueness of planet Earth.

The Geography allows students:

- to get to know a country in its all complexity,
- to develop basic geographical skill - work with map documents, which forms the basis of the geographical thinking and education,
- to get to understand that every place on Earth is unique. It differs from other places by its typical climate, flora and fauna; but also by its inhabitants with its own language, culture and the way of life, which allows to understand a nature of the causes of diversity and multiformity of the individual countries,
- to nurture a respect towards principals of democracy and the civil freedom, which if violated can cause war conflicts and global catastrophes.

The Geography forms personality of a young man by drawing his attention to the similarities but also peculiarities of described regions in comparison with the Slovak Republic, while noting its uniqueness in the context of Europe or the world.

At present, pupils in Slovakia gather their knowledge about Europe and the European Union in the 8th grade of the elementary school. There are only two requirements for pupils' knowledge and skills on the topic of the European Union. Essentially, those requirements are very neutral on the part of their knowledge and skills on this subject, and it is up to the teacher to pass on the information to pupils as considered appropriate. A pupil in the end of the 8th grade knows / or is capable of:

- ➢ *to explain the importance of the EU on specific examples,*
- ➢ *to take a stand on two major European challenges.*

Source: http://www.statpedu.sk/files/articles/dokumenty/inovovany-statny-vzdelavaciprogram/geografia_nsv_2014.pdf [cit.2017-09-19]

2.2.1 The European Union in the Geography textbook for the 8th grade of the elementary school

The European Union is a content of the 8th grade textbook for elementary schools. The curriculum is in the scope of five pages put into the thematic section “*Nature and man-made specifics of Europe*” under the topic of “*The Unification of Europe*”.

The important terms are found in the main part of the textbook, which represent the minimal knowledge that a pupil should learn:

- Which associations have sought to simplify trade and cooperation, for example the European Coal and Steel Association and the European Economic Community.
- There were 6 countries at the start of the process of Europe unification: France, Italy, The Netherlands, Belgium, Luxembourg and the former West Germany (NSR).
- The founding agreements were first signed by the representatives of individual states in Paris and later in Rome. An author of the European Unification Project was the Prime and the Foreign Minister of France.
- Who was Robert Schuman?
- Main EU institutions - the EU Council, the European Commission and the European Parliament and its headquarters, as well as the headquarters of the European Central Bank and the European Court of Justice.

To make it easier to remember, the text also includes a map of all the member states of the European Union along with the year of their accede to the Union. Only one of the symbols of the European Union – the pledge – is displayed in the text.

A separate section of the chapter on the European Union focuses on **current challenges within the European Union**. Textbook authors chose the following:

- Ensuring the compliance with the member states' budgeting rules. A disproportionate indebtedness of some states (especially Greece and Portugal, but also others), and the large resources needed for "the rescue" of these countries, which jeopardises the common currency of the most EU countries - the Euro currency. ***It is up to the teacher to explain how they jeopardise the common currency, appropriate the age of pupils.***
- The gradual offset of differences between member states of the Union and between their regions. Various projects have been formed to aid this purpose, which are financed by the European Union. ***What is missing, however, is the explanation of the Euro-Fonds as such.***
- The reform of member states' pension systems. In its scope, the age of retirement should change, although its full unification is unlikely. ***It would be advisable to explain why the retirement age is increasing!***
- The largest part of the budget resources of the European Union is expended in the agriculture. There is an interest in agricultural land to be cultivated so the country is maintained in a cultured state. Therefore, the Union provides substantial subsidies for the agriculture. ***The question is whether this is really one of the main problems of the EU and whether it is a topic about which the pupils should discuss.***

The conclusion of the chapter on the EU is dedicated to the presentation of the Euro currency and the explanation of the Schengen Area.

3 THE THEORY KNOWLEDGE OF PUPILS OF THE ELEMENTARY SCHOOL ON THE EU TOPIC

The pedagogical survey aimed at assessing theoretical geographic knowledge of pupils of the 8th grade of elementary schools on the European Union topic. The reason for the performance of this survey in this grade was the fact, that in this year pupils receive the information about this Union of states. By this survey we have attempted to identify and verify, through a non-standardised didactic exam, the level of the theoretical knowledge of elementary school pupils about the European Union, and to point out that pupils lack knowledge on the European Union and the importance of our country's membership in it.

The exam contained 10 tasks. We have evaluated the answers in the exam by the three-grade scale: correct answer 100%; partially correct answer - interval (30–100%); incorrect answer - interval (0–30%).

Test questions
(correct answers are ***bold, italics, underline***)

Circle the correct answer. For each question, there is only one correct answer, unless stated otherwise!

1. The European Union is:
a. a group of states located in Western Europe
b. a group of the most developed countries of Europe
c. an association of European countries operating in a common market, with common policies and a unified presence in international forums
d. an association based on a similar principle as the USA

2. The Schengen Agreement is:
a. An agreement between the EU which has enabled the abolition of border controls and the crossing of the internal borders without restrictions
b. An agreement on the use of a common currency among EU countries
c. An agreement on a common health insurance system
d. The agreement on the inclusion of the Slovak Republic in the European Union

3. The predecessors of the EU were (more than one answer is correct):
a. European Agricultural Community
b. European Coal and Steel Community
c. Euratom
d. European Economic Community

4. The de facto capital of the European Union is :
a. Prague
b. Paris
c. Brussels
d. Berlin

5. Which of the flags represents the European Union?
a. ***b.*** c. d.


6. The founding members of the EU were:
a. Germany, France, Belgium, Netherlands, Luxembourg, Italy
b. USA, France, Germany
c. Russia, UK, Germany, France
d. United Kingdom, USA, France

7.Which country is the seat of the European Parliament?
a. Germany
b. Belgium
c. Switzerland
d. The Netherlands

8. In which year did the Slovak Republic become a member of the European Union?
a. 2004
b. 2005
c. 2006
d. 2007

9. a. Which non-European country would like to join the EU?
Turkey
b. People of which country did deside to exit the European Union?
United Kingdom

10. The highest bodies of the EU are:
European Parliament, European Commission, European Court of Justice

Fig. 3. Test questions.

The exam was performed by 661 pupils of the 8th grade of elementary schools (out of 25 elementary schools) from different parts of Slovakia.

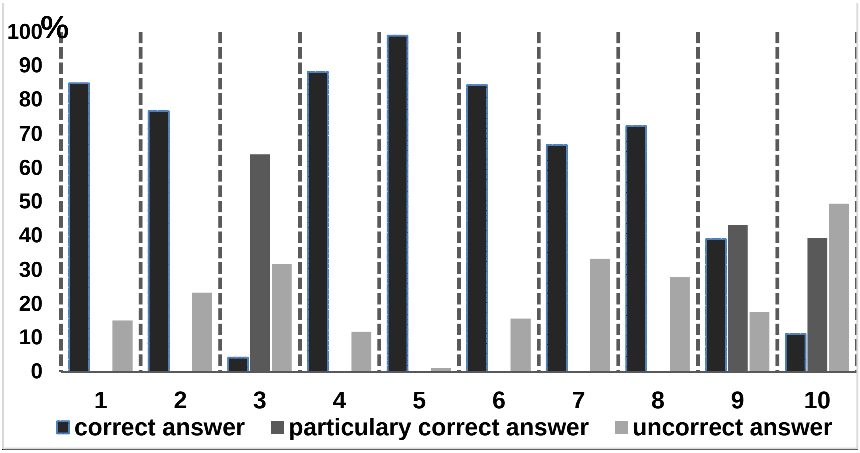


Fig. 4. The ratio of correct, incorrect and partially correct answers.

The pupils achieved the best results in question 5 about the flag of the EU. Questions 1, 4, and 6 also had over 80% of correct answers. The most common incorrect answer to question 1 was “a group of the most developed countries of Europe”. The most common incorrect answer to question 4 about the de facto capital of the EU was Berlin. For question 6 about the founding members of the EU, the most frequent mistake was to include the USA. 76.7% of pupils understand the concept of the Schengen area (question 2). The most common wrong answer to this question was “the agreement on the use of a common currency among EU countries”. More than two thirds of the students knew the year in which the Slovak Republic became a member of the European Union.

The pupils reached over 60% of correct answers in questions 7 and 8. In question 7, the most frequent mistake was that the main seat of the Parliament is located in Germany. There were also some mistakes in determining the date of Slovakia joining the EUin question 8.

Questions with multiple answers caused the most problems for the students. When asked about the three predecessors of the EU (question number 3), very few answers were correct – only 4.2%. For question 9, most of the incorrect answers reported Ukraine as a non-European country which would like to join the EU. On the contrary, nearly 90% of the pupils were informed about Brexit. For the last question about the bodies of the EU, nearly 50% could not list even one. Partially correct answers were dominated by 93% of the responses listing the European Parliament.

As shown by the analysis of the textbooks and the results of the didactic test, we can conclude that:

- The information provided to the students on the subject of the European Union is predominantly factual.
- Only the basic information is provided about the foundation and the operation of the European Union and about the fact that the Slovak

Republic is a part of this grouping. Some of the topics are, to our opinion, for students boring and harder to comprehend - eg. is it really necessary to inform about the pension system reform or about the extensive expenditures for the agriculture?

- ***Missing*** is the introduction ***of the transfer of information*** into the pupils' ***everyday life***.

4 WHAT SHOULD A PUPIL KNOW ABOUT THE EUROPEAN UNION – A PROPOSAL OF THE NEW STRUCTURE FOR THE CURRICULUM PRESENTATION ON THE SUBJECT OF THE EUROPEAN UNION

Based on the above listed analysis, both the knowledge of pupils about the EU in the ISCED2 in Geography and in the Geography textbook, we have arrived at the decision to propose a new structure for the curriculum presentation on the subject of the European Union.

This should give an answer to the question "Why is it necessary to include the European Union into the educational system, in our case into the subject of Geography, and how to transfer it into the practical life of pupils?"

Answers to this question, as well as proposals and activities on "how to do it", we have attempted to summarise into the following ideas that could be the backbone of the new chapter about the EU in the textbook of Geography:

1. We live in the European Union. It is all around us every day, and therefore it is necessary to know where we live, what surrounds us, comprehend the world in which we live. It is not enough to solely know my home, my region or my nation, but it is also important to possess a deeper knowledge on Europe as a whole, more precisely the European Union, about the countries that form it.

We should explain to pupils that, as pupils, they belong to many different groups at once. We can ask pupils to list organisations of which they are members of (for example a sports team, a dance group). Being a member of one group does not diminish their membership in another. The same is true of political memberships. As citizens of their town, district, state, and nation, pupils hold multiple political loyalties. Being a good, for example, Bratislava citizen makes one no less of a good Slovak or a good citizen of the EU. People's loyalties were to their city, their region and their nation. Today, these diverse people are also learning to develop a political loyalty to Europe as a whole. In an effort to help this process and to assist with the transition, the European Union adopted symbols for a unified Europe. We could ask pupils to try to design some symbols that would identify the EU entity (for example a flag, national anthem, a motto, national holiday, etc.).

2. We are citizens of the European Union that gives us certain rights as a citizen of this institution. The European Union is the fastest growing political system in the world. In years 1985 to 2017 the European Union has grown from 12 to today's 28 countries with an area of 4 382 217 km^2 taking 7th place in the world with approximately 508 mil. of its citizens ranking at the 3rd place in the world. (geohive.com).

Activity: Match a picture with an answer:

Countries which:

1. want to join,
2. form contemporary European Union,
3. do not want to become members of the EU or the countries that do not meet criteria for joining.

I am the EU citizen, what are my rights?

- *the right to study in the other member state,*
- *the right to have a residence in the other member state,*
- *the right to equality of treatment irrespective of nationality,*
- *the right to travel freely across the EU,*
- *the right to diplomatic and consular protection–and if I am outside the EU, where my country does not have its own diplomatic representation, help or protection can provide an embassy or consulate of another EU country,*
- *the right to communicate with any EU institution or body in any one of the official languages of the EU and to obtain an answer in this language,*
- *the right to information.*

3. The European Union–it is a union of various types of countries. It is necessary to understand the physiographic but also the socio-economic characteristics, which allows the explanation of different phenomena.

Activity:

Fill in:	**Fill in:**
the highest peak of the EU	landlocked countries of the EU
the vastest lowland of the EU	Which countries of the EU are a monarchy?
the longest river of the EU	Write down three countries of the EU with the largest number of the citizens!

Fill in:	**Fill in:**
the largest lake of the EU	Write down three counties of the EU with the lowest number of the citizens!
the largest state of the EU	5 largest cities of the EU
the smallest state of the EU	5 smallest cities of the EU

4. The European Union and its economy. The economy plays an important role in the lives of people and therefore it requires our attention. Pupils should therefore possess a basic knowledge about the functioning of the economy, what is The Schengen Area, the Euro currency, where and why firms open up their companies and branches, why do they move (eg. from the West to the East) etc., what does it mean a cheap labor or a common market space.

They should know the benefits of the membership in the Schengen area and whether the use the Euro as a currency. (figure 5)

Activity: You have won a trip across Europe during the holiday. You will visit Vienna, Munich, Geneva, Brussels, Paris, Madrid, London, Copenhagen, Prague, and Zagreb. How many different currencies will you need to obtain in order to be able to travel:

- in the year 1998,
- at present.

(a tool - the Exchange Rate dated the 1.10. 1998, before the Euro currency available at: https://www.nbs.sk/sk/statisticke-udaje/kurzovy-listok/kurzovy-listok/denny-kurzovy-listok-nbs[cit.2017-09-30])

5. The European Union and its politics - decisions taken in Brussels have an immediate or indirect impact on our lives. Therefore, the pupils should know **who decides about them:** the EU Council, the European Parliament, the EU Commission, the Court of Justice, etc.

6. The European Union is multicultural. Implementation of the European dimension is only possible if we try to understand the continent's multiculturalism and the respect for races, nations and nationalities or ethnicities. *The European Union is multilingual - every language of a member state is an official EU language.* At present, there are 24 official languages and, in addition, there are more than 60 native or non-native languages in each of the regions of the Union. The regional or minority languages are spoken by about 50 million people of the European Union. *http://www.europskaunia.sk/jazyky_eu[cit.2017-09-30]*

Activity 1: Determine languages based on listening. Recordings can be obtained on the web page: https://europa.eu/european-union/about-eu/figures/administration_sk#jazyky[cit.2017-09-30]

Activity 2: Find a sentence "Hello, my name is …" in all official languages of the EU.

7. The European Union is a global player, willing to promote its programme independently from the other partners - in an interest to achieve only the best for its members, without an interference to relationships with the other countries, groupings or communities.

The economic, political and democratic processes in the European Union became a role model for a lot of different regions of the world, eg. the Caribbean Community, the Association of South East Asian Nations or for the African Union. These regions have tried to imitate its successes and attempted to bring through the political and the economic integration that the European Union has accomplished.

Activity: Compare the EU with Russia, USA, China, Australia and the Unions such as ASEAN, CARICOM and the AU, according to the area, its population and the density.

Compare!	land area (km^2)	population (mil.)	population density (people per km2)
European Union	4479768	516195432	115,23
Russia	17098242	142257519	8,32
United States	9883517	326625791	33,05
China	9596960	1379302771	143,72
Australia	7741220	23232413	3,00
ASEAN*	4435618	625000000	140,9
CARICOM**	458480	17775192	38,77
African Union***	29922059	1225080510	40,94

*	ASEAN - Indonesia, Philippines, Malaysia, Singapur, Thailand, Brunei, Myanmar, Cambodia, Laos, Vietnam
**	CARICOM - Antigua and Barbuda, Bahamas, Barbados, Belize, Dominica, Guyana, Haiti, Jamaica, Montserrat, Surinam, Saint Lucia, St Kitts and Nevis, St Vincent and the Grenadines, Suriname, Trinidad and Tobago
***	The African Union (AU) - is a continental union consisting of all 55 countries on the African continent

An implementation of the European dimension allows for pupils to comprehend an influence

of the European Union on the world and vice versa, what is the impact of the world on the functioning of the EU.

All these statements have led us to produce a wall poster that would clearly point out the connection and the importance of the EU for our country and for the pupil himself. (figure 5)

To reinforce the curriculum, we have designed the, where through the correct answers pupils come to the finish line. Pupils mark or colour a window with the correct answer and through that they find the right path from the start to the finish. (figure 6)

Fig. 5. Design of the wall poster about European Union for elementary school.
Autor: Iveta Rakytová

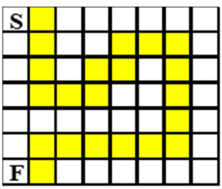
CONCLUSION

In the presented review we have tried to propose a new view on the teaching process of the curriculum about the European Union at the secondary level of the elementary school. It is our believe that at present times it is necessary to change the theory based approach to teaching of the relevant topic and focus more on the practical meaning, which is that we are a member of this grouping. Contemporary generation of young people is practical, they do not want to learn about things they consider useless and what they cannot use in their future lives.

START	Robert Schuman the main holder of the idea of the EU foundation	The EU anthem “Ode to Joy”	The EU flag = 15 yellow stars on the blue background	Euro currency is used by all EU states	The official language of the EU is English Language	In the EU lives less than 100 mil inhabitants	The SR uses 4 Euro coins
Jean Monet the main holder of the idea of the EU foundation	The EU anthem “Ode to Joy”	Number of the EU member states in 2016 = 6 states	The EU Day is 1st January	The SR started using Euro currency in year 2009	The Euro currency is used by the 19 member states	The EU has 24 official languages	An author of the EU anthem is Janko Matuška
Great Britain the founding state of the EU	Number of the EU states in year 2016 = 28 states	Travelling with Passport control	Basis for the EU formation was brought about by so called Maastricht Treaty	The EU Day is 9th May	Turkey is the EU member state	Number of inhabitants of the EU is approximately 504 mil.	Ukraine is the EU member state
The EEC was founded in year 1967	Travelling with no control within internal borders of the EU	The SR joined the EU in year 2004	The EU flag has 12 golden stars on the blue background	Basis for the EU formation was brought about by so called Brussels Agreement	Turkey cannot be the EU member because it is in Asia	Turkey would like to join the EU	The headquarters of the EU is in Vienna
	The EU flag 15 yellow stars on the blue background	Symbol of the EU currency ∃	Citizens of Germany decided to leave the EU in the referendum in year 2016	The youngest of the EU states is Bulgaria	The Motto of the EU is : “Different and yet the same”	As a capital of the EU is de facto considered Brussels	Founding member states: Belgium, France, Spain, Luxemburg, Germany, Greece
The EU flag = 12 blue stars on the yellow background	Symbol of the EU currency 	Citizens of Great Britain decided to leave the EU in the referendum in year 2016	The youngest member of the EU is Croatia	The Motto of the EU is: “United in diversity”	The predecessor of the EU was the European Economic Community.	Founding member states: Belgium, France, The Netherlands, Luxemburg, Germany, Italy	The predecessor of the EU was the Council for Mutual Economic Assistance
FINISH 	The EU flag 12 yellow stars on the blue background	SK EU2016	Citizens of Ireland decided to leave the EU in the referendum in year 2016	The youngest member state of the EU is Romania	The Motto of the EU is: “The strength lies in unity”	The predecessor of the EU was the European Agricultural Community	

Fig. 5. Game - Geographical Labyrinth about the European Union.
Source: Autor

The right way from start to finish



REFERENCES

ANDERSON, Lorin – KRATHWOHL, David. 2001. A taxonomy for learning, teaching, and assessing. A revision of Bloom's taxonomy of educational objectives. New York, ISBN 0-8013-1903-X. [online]. [cit.2015-05-17] Dostupné na internete http://www.kurwongbss.eq.edu.au/thinking/Bloom/blooms.htm

BROWN, John Seely, DOUGLAS, Thomas. 2011. A new culture of learning: cultivating the imagination for a world of constant change. CA: Create Space Independent Publishing Platform, 2011. 140 p. ISBN 10 1456458884

FERENCES BOURN, Doug. 2008. Education for sustainable development and global citizenship. Theory and Research in Education, 6 (2), p. 193–206. http://dx.doi.org/10.1177/1477878508091112

MENTZ, Olivier (2006a). Sprechen Sie europäisch? oder: Überlegungen zur Leistungsbeurteilung vor dem Hintergrund des Gemeinsamen europäischen Referenzrahmens für Sprachen. *Synergies Europe 1*, 47-55.

MENTZ, Olivier. (2006b). Sprechen Sie europäisch? oder: Überlegungen zur Leistungsbeurteilung vor dem Hintergrund des Gemeinsamen europäischen Referenzrahmens für Sprachen. *Synergies Europe 1*, 47-55.

MENTZ, Olivier (2007a). Europe Matters! 10 Reasons why school Geography should teach a European Dimension. In K. DONERT, P. CHARZYŃSKI & Z. PODGÓRSKI (eds.), *Teaching in and about Europe.* Toruń (Geography in European higher education, vol. 4), 25-35.

MENTZ, Olivier (2007b). Europalehramt – teacher training for a European future. In K. DONERT, P. CHARZYŃSKI & Z. PODGÓRSKI (eds.), *Teaching in and about Europe.* Toruń (Geography in European higher education, vol. 4), 20-24.

RUŽEK, Ivan., LIKAVSKÝ Peter. *Geografia pre 8. ročník základných škôl a 3. ročník gymnázií s osemročným štúdiom.* VKU Harmanec, učebnica. 2012

TUREK, Ivan. *Učiteľ a didaktické testy*. Metodické centrum, Bratislava, 1996 p. 78.

Internet sources:

State education program for upper primary school to the subject of geography ISCED2. [online] http://www.statpedu.sk/files/articles/dokumenty/inovovany-statny-vzdelavaci-program/geografia_nsv_2014.pdf [cit. 2017-09-19]

Standards for Geography at the second level of primary schools 2016. [online] [cit. 2016-11-10]. Available at: https://www.minedu.sk/data/att/7530.pdf

http://www.tns-global.sk/sites/default/files/files/ts1609_eurobarometer_standard.pdf[cit.2017-09-19]

http://www.euintheus.org/resources-learning/academic-resources/eu-lesson-plans-and-teaching-material/ [cit. 2017-09-20]

http://ec.europa.eu/commfrontoffice/publicopinion/archives/eb/eb82/eb82_first_en.pdf [cit. 2017-09-19]

http://ec.europa.eu/commfrontoffice/publicopinion/archives/eb/eb79/eb79_publ_en.pdf [cit. 2017-09-19] http://www.infoglobe.sk/stat/?fm=1 [cit. 2017-09-20]

http://www.bbc.com/news/world-europe-13194723 [cit. 2017-09-20]

https://www.ebu.ch/about [cit. 2017-09-20]

https://ec.europa.eu/slovakia/node/421_sk [cit. 2017-09-20]

http://lazikovaz.webnode.sk/regionalna-geografia-sveta/europska-unia/ [cit. 2017-09-20]

http://www.minv.sk/?tlacove-spravy&sprava=pripravy-suvisiace-s-predsednictvom-sr-v-rade-eu [cit. 2017-09-20]

https://europa.eu/european-union/about-eu/figures/administration_sk#jazyky [cit. 2017-09-30]

Shrnutí

Predložený príspevok sa zaoberá postavením učiva o Európskej únii v učive geografie na druhom stupni základných škôl vo Slovenskom republike. Na základe analýzy štátneho vzdelávacieho programu ISCED 2 pre geografii, analýzy učebnica pre 8. ročník ZŠ, kde je Európska únia zaradená v tematickom celku Európa, sme dospeli k záveru, že žiaci získavajú prevažne teoretické vedomosti o EÚ bez bližšieho prenesenie do praktického života žiakov. Tento fakt nám potvrdil aj prieskum medzi žiakmi 8. ročníkov základných škôl z rôznych častí Slovenska. Z tohto dôvodu je konečným výsledkom príspevku návrh plagátu - postra o Európskej únii prispôsobeného veku žiakov a návrh obsahu kapitoly o Európskej únii v učebnici geografia. Oba návrhy sú koncipované tak, aby nútili žiakov kriticky premýšľať o výhodách – nevýhodách členstva v tomto spoločenstve krajín. Mali by dať odpovede na otázku: *„Prečo je nevyhnutné zahrnúť Európsku úniu do školského vzdelávania, v našom prípade do predmetu geografia a ako ju viesť do praktického života žiakov?“* Odpovede na túto otázku ako aj návrhy a aktivity „ako na to“ sme sa pokúsili zhrnúť do nasledovných bodov:

Žijeme v Európskej únii. Je všade okolo nás, každý deň, a preto je dôležité vedieť, kde žijeme, čo je okolo nás, pochopiť svet, v ktorom žijeme. Nestačí len poznať môj domov, môj región alebo môj národ ale je dôležité mať hlbšie znalosti o Európe ako celku, respektíve Európskej únii, o krajinách ktoré ju tvoria.

Sme občania Európskej únie, to nám dáva určitá práva ako občana tejto inštitúcie. Európska únia je to najrýchlejší rastúci politický systém na svete.

Európska únia – to sú rôzne typy krajín. Je nevyhnutné poznať fyzickogeografickú ale aj socioekonomickú charakteristiku, čo umožňuje vysvetlenie rôznych javov.

Európska únia a jej ekonomika. Ekonomika zohráva dôležitú úlohu v životoch ľudí, preto si vyžaduje našu pozornosť. Žiaci by preto mali mať základné vedomosti o tom, ako ekonomika funguje, čo je schengenský priestor, euro mena, kde a prečo firmy budujú svoje podniky a pobočky, prečo sa sťahujú (napr. zo západu smerom na východ) apod., čo je lacná pracovná sila či spoločný trh.

Politika Európskej únie – rozhodnutia prijaté v Bruseli majú okamžitý ale aj nepriamy vplyv na naše životy. Preto by som mal poznať kto o mne rozhoduje: Rada EÚ, Európsky parlament, Komisia EÚ, Súdny dvor apod.

Európska únia je multikultúrna. Zavádzanie európskeho rozmeru je možné len vtedy, ak sa budeme snažiť pochopiť multikulturalitu kontinentu a rešpektovanie rás, národov, národností či etník. Európska únia je viacjazyčná – každý jazyk členského štátu je oficiálnym jazykom EÚ.

Európska únia je globálnym hráčom, ochotným presadzovať svoj program nezávisle od ďalších partnerov – v záujme dosiahnutia toho najlepšieho pre svojich členov, bez toho, aby zničila vzťahy s inými krajinami, zoskupeniami či komunitami. Krajiny na celom svete sa čoraz viac orientujú na EÚ ako celok.

Zavádzanie európskej dimenzie umožňuje žiakom pochopiť vplyv Európskej únie na svet a naopak, ako svet vplýva fungovanie EÚ.

THE EVALUATION OF POTENTIAL CONTRIBUTIONS OF OUTDOOR EDUCATION – TEACHER'S VERSUS PUPIL'S POINT OF VIEW

Hana Svobodová, Darina Mísařová, Radek Durna, Eduard Hofmann

Department of Geography, Faculty of Education, Masaryk University

Poříčí 7, 603 00 Brno, Czech Republic

67632@mail.muni.cz, misarova@ped.muni.cz, 323463@mail.muni.cz, evhofmann@seznam.cz

Abstract: The outdoor education (learning) is a natural part of school educational process mostly among nature sciences. The effectiveness of outdoor education is abroad supported by professional literature (Nundy, 1999; Foskett, 1997, Rickinson et al., 2004…). There is also another important benefit while students work in the field (outdoor) – the physical activity in the fresh air. During the 16-00695S projects we analyse the contributions of outdoor education for teaching geography and advance in physical abilities of pupils on elementary school.

The aim of this paper is to introduce and to interpret teachers' and pupils' opinions on outdoor education benefits. The researches have used semi structured interviews with 19 teachers, teaching at primary and lower-secondary model schools. The pupils of 5th, 6th, 8th and 9th grade of one of these model schools were subjected to a questionnaire survey, which was conducted to compare pupils' abilities to solve the problem tasks in field (outdoor) and in class (indoor). The pupils' attitudes to outdoor education were also monitored in the survey.

Key words: outdoor education, physical activity, elementary school, teacher, pupil

INTRODUCTION

Outdoor education can be understood firstly as one of the organizing forms of education (see e. g. Průcha, Walterová, Mareš, 2013, p. 183) and secondly as strong educational strategy (e. g. Balderstone, Lambert, 2012), which helps to understand a real world in a more complex way. Terms *outdoor education/learning* or *fieldwork* are used in professional literature written in English to express summarising naming for Czech "terénní výúka" (see e. g. Balderstone, Lambert, 2012; Biddulph, Balderstone, Lambert, 2015; Kent, Gilbertson, Hunt, 1997; Lambert, Reiss, 2014; Ofsted, 2011; Oost, De Vries, Van der Schee, 2011 or Rickinson et al., 2004). Outdoor education can be considered in a "real world" as the absolutely basic part of science education, because it develops abilities which are necessary for understanding the very essence of this field of human/pupils research. Rickinson et al. (2004) say that outdoor education is not only very effective, but it is also a pleasant form of education for all participants of the educational process. However, Rickinson et al. (2004) point out that only thoughtful and meaningfully done outdoor education, classified as a follow-up to previous (respectively following) curriculum, provides pupils with new opportunities for developing knowledge and skills and adds added value to their daily learning experience.

Despite all the benefits of outdoor education already mentioned and also despite its clear inclusion in The Framework Educational Programme for Primary Education (RVP ZV), the potential of outdoor education is not fully utilized in Czech schools. However, in the Czech Republic there has not been done any complex research in the area of outdoor education, which would justify and support its inclusion into classes. A project GAČR 16-00695S Outdoor education as a strong educational strategy tries to overcome this gap. One of the partial goals of the project is to find out how outdoor education helps to develop a problem-solving competence, it means whether a pupil deals with the task better outdoor than in a classroom and at the same time whether the pupil gains deeper knowledge of the solved topic.

AIMS AND METHODS

The aim of this contribution is in agreement with the aims of GAČR project: 1) to present the opinions of teachers of primary and lower-secondary schools on development of key competences in outdoor education and 2) to analyse pupils' views on the benefits of outdoor education and their attitudes towards it.

The research methods have been chosen appropriately to the given goals. Semi structured interviews were carried out with 19 teachers, teaching at primary and lower-secondary model schools. The choice of the schools was based on previous content analysis of ŠVP and a finding that a given school realizes an outdoor education in any form (see e. g. Svobodová et al. 2016). In total the record sheet contained 5 comprehensive parts for interview, but the contribution pays attention to part E "Evaluation of the outdoor education and the feedback".

Afterwards, the questionnaire survey was done with pupils of 5th, 6th, 8th and 9th grade of the model school, which was chosen thanks to regular realization of outdoor education. The partial goal of this research was to compare pupils' ability in problem solving outdoor and indoor and also to find out pupils' attitudes to the outdoor education. The part of the survey related to the pupils' attitude to the outdoor education was the same for all mentioned grades. In this contribution there are analysed answers on 5 chosen questions.

RESULTS

Outdoor Learning by the View of Teachers

Nine teachers at the primary school and 10 teachers at lower-secondary school were asked "What do you think the biggest benefit of outdoor education is?" The teachers were interviewed on single categories and whether there is some pupils' development in the field of knowledge, skills, attitudes, interpersonal relationships or other fields. The evaluation was done on point scale from 1 to 5, where 1 is the minimum and 5 is the maximum. 9 teachers (out of nineteen) evaluated all partial goals. In other cases the teachers commented just on some of the categories or sometimes they did not answer by point but by a verbal comment. The question was evaluated (see tab. 1) by weighted arithmetic mean which was calculated to single categories from the total number of answers on given category according to following formula:

$$\overline{x} = \frac{x_1 n_1 + x_2 n_2 + \cdots + x_k n_k}{n_1 + n_2 + \cdots + n_k}$$

where there are single values marked as x_1, x_2 to x_k, k is the number of different viriants of symbols values and a frequency of appearance of single values (weights) are marked as n_1, n_2 to n_k.

Teachers at primary school see the benefits of outdoor education as follows. According to their opinion the biggest development of pupils is in the field of skills (4.60 points from maximal 5.00 points), after that field of interpersonal relationships (4.33 points), knowledge (4.00 points) and attitudes (3.67 points). Teachers at lower-secondary school again attribute the greatest importance to development of skills (3.83 points) and knowledge (3.75), development in the field of attitudes (3.67 points) and interpersonal relationships (3.66 points) follows.

As a final category teachers could add their own field of development, there occurred categories such as physical activity (3 times), then individually rising of interest, relaxation, change and health.

Tab. 1: What do you think the greatest benefit of outdoor education is?

	Weighted arithmetic mean		
	primary school	**lower-secondary school**	**TOTAL**
Pupils' development in the field of knowledge	4.00	3.75	3.89
Pupils' development in the field of skills	4.60	3.83	4.21
Pupils' development in the field of attitudes (to nature/region/subject…)	3.67	3.67	3.67
Pupils' development in the field of interpersonal relationships (pupil-pupil, pupil-teacher…)	4.33	3.66	3.99
Average value of the benefits of outdoor education	4.15	3.73	3.94

Source: interview with 19 elementary school teachers

There is quite an important difference between teachers at primary and lower-secondary school in perception of benefits of an outdoor education in single categories. Teachers at primary school perceive benefits of outdoor education in all fields much more than teachers at lower-secondary school. The reason arises from other parts of the realized interviews – at the primary school there is only one teacher who teaches his or her class so there is much bigger time possibilities for realization of outdoor education – the teacher can spend a whole day outside and combine the curriculum into one single block. A fatal barrier at lower-secondary school is a lack of time for realization of outdoor education during a school year. Rapid changing of short teaching units allows conceiving of short and medium-term forms of outdoor education just and only if a lot of difficult conditions are fulfilled (changing of classes with colleagues, exchanging of supervisions with colleagues, administration of these changes, resistance of the head, opinion conflicts with parents, etc.). The great deal is a frequent "inability to settle" of outdoor education in documenting of teachers' work. Some teachers confided that there is a problem with accepting of outdoor education as a fully-fledged form of teaching and so they have to replace the hours which they spent outside by an unpaid substitution. This attitude is strongly demotivating and it has negative impacts on development of an outdoor education. Teachers at primary school praise their freedom in teaching, where they are their "own masters". The education itself can be appropriately organized according to their ideas and the teachers can flexibly use for instance seasonal phenomena or good weather.

Outdoor Learning by the View of Pupils

Subsequently, the pupils' opinions from 5th, 6th, 8th and 9th grade of a model school on outdoor education and its benefits were examined. The choice of the years was intentional – 5th year is the final year of the primary school, where the education is done only by one teacher. Especially the difference between 5th and 6th grade is being looked into; in 6th grade the pupils start to study at lower-secondary school where the system of education is quite different, different subjects are taught by different teachers. The intentional choice of the years was also connected with realized half-day outdoor education, known as "The Expedition"; which was attended by pupils from 5th and 8th grade immediately before a questionnaire survey was carried out, however pupils of 6th and 9th grade of elementary school had a year gap between The Expedition and questionnaire survey. 9th grade was tested because it is the final year of elementary school which is characterized by realization of intensive outdoor education throughout the nine-year schooling.

The Expedition in the 5th grade was complexly focused on getting to know the pupils' neighbourhood of residence with a focus on the following aspects of the landscape: a) natural - pupils assessed different types of landscapes in which they moved and explained the differences between them (coniferous forest, broad-leaved forest, highlands, floodplain etc.); b) cultural – the pupils described the use of different types of landscape by man and solved how to behave properly in the given area; c) historical - pupils compared the settlement of the country by a human being before and today. The Expedition in the 8th grade of elementary school was focused on working with GPS, orientation in the field and observation of karst phenomena.

The first question evaluated below was trying to find out how the pupils perceive an education which takes place outside – "The Expedition". It was a semi-closed question which gave pupils 4 possibilities (answers), in the last one; the pupils had a space for a free expressing. It was possible to choose more than one answer; this possibility was used by 22 pupils out of total 61 so the total number of answers was 88. The difference in perception of outdoor education is quite significant within the grades.

40 pupils (45.5% of all the answers) stated the possibility "An opportunity to learn something new (orientation with GPS, information from educational boards etc.)" this possibility was most often chosen by pupils of 5th grade (54.5%) and the fewest times by pupils of 8th grade. (33.3%). For pupils of 8th grade The Expedition was most often "a few hours I spent outside". This answer was chosen by 42.9% of pupils. Pupils of 8th grade's replies are substantially the same as the part of teachers' statements identified in the interviews, namely that outdoor education is understood as a "non-learning day" without educational content. 22 pupils (25.0%) say that they understand outdoor education as a "Supplementing of teaching when I practice what I learned at school (working with a map etc.)". In comparison of single classes this answer was most often chosen by pupils of 6th and 9th grade. Other answer was given by 6 pupils who made the following statements: "to be with friends, feel freely", as an "entertaining form of teaching", "fun with friends", "more like a trip where we learned", "do not waste our time at school and go out".

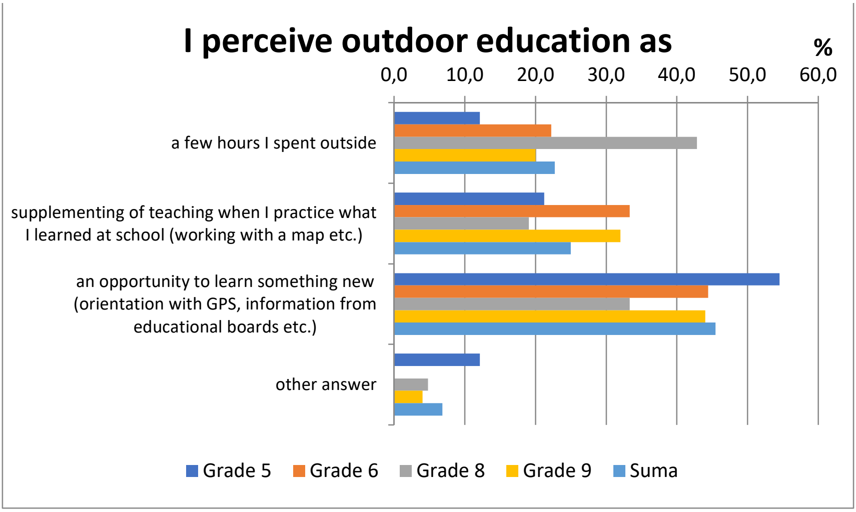


Fig. 1. I perceive outdoor education as…
Source: questionnaire survey with pupils

Pupils' attitudes to the outdoor education of model elementary school in 5th, 6th, 8th and 9th grade were recorded by a four point scale (4 yes, 3 rather yes, 2 rather no, 1 no). From single evaluations the weighted arithmetic mean was calculated, as in the teachers' case. The overview of other pupils' opinions on outdoor education is summarized in Tab. 2.

Tab. 2: Attitudes of 5th, 6th, 8th and 9th grade pupils of model elementary school to the realization of outdoor education

	I enjoy the outdoor education	An outdoor education is more interesting that education at school	During the expedition I have learnt more than in the classes	I want outdoor education more times during the school year
Grade 5	**3.8**	**3.6**	**3.3**	**3.6**
Grade 6	**3.6**	**3.8**	**3.4**	**3.8**
Grade 8	**3.5**	**3.7**	**2.6**	**3.4**
Grade 9	**3.6**	**3.6**	**2.7**	**3.4**
Total	**3.6**	**3.7**	**3.0**	**3.6**

Source: questionnaire survey with pupils

It looks that the education outside the classroom was enjoyed by all pupils of all years apart from one pupil from 9th grade. 67.2% of pupils is for the variant "yes", 31.1% of pupils is for "rather yes". Weighted arithmetic mean of all answers of pupils of all years reaches the value of 3.6 from maximal 4.0. The highest value of weighted arithmetic mean was calculated for 5th grade, it was 3.8.

The pupils stated similar numbers / shares as in the previous question in question if the outdoor education, classes outside the school, is more interesting than teaching inside the school. Only one pupil of 5th grade gave a negative answer, another two pupils of the same year stated "rather not". This answer was also chosen by one pupil of 9th grade. However, in total pupils' relationship to the outdoor education is rather positive – 72.1% of pupils proclaimed "yes" and the weighted arithmetic mean of answers of all pupils reached value of 3.7.

Pupils also feel that during outdoor education, outside the school class, they learn more than at school classes. This view prevails with pupils of the 6th grade (100% of pupils say yes or rather yes), pupils of 5th grade have a similar feeling – 73.9% of pupils is for these two possibilities already mentioned. On the contrary, for the 8th grade pupils, who participated in the outdoor education – "The Expedition" few days before testing, the positive opinion is represented less (64.3%; cold and windy weather could also play its role). The positive opinion is even less represented by pupils of 9th grade who have not participated in The Expedition before the testing (56.3%). Overall, however, in all years, there is a predominant view that pupils learn more outside than they do at school - out of 61 questioned pupils 22 (36.1%) answered "yes" and 21 (34.4%) answered "rather yes". Overall, 43 pupils out of 61 (70.5%) have a positive attitude towards teaching outside the classroom. The weighted arithmetic mean of answers of all pupils has reached only the value of 3.0.

Pupils had a positive attitude when they have been asked if they want outdoor education, education outside the classroom, to take place several times during the school year, even though some pupils answered in the previous question that they do not learn more than in the classroom. In the outdoor education they see the opportunity not to sit in the classroom as usually during classic (often frontal) form of teaching. The answer "rather no" was answered only by 6 pupils, one of the 5th and one of 6th grade, and two of the 8th and 9th grade. The answer “no” did not occur in any case. The weighted arithmetic mean of all answers reached the value of 3.6.

CONCLUSION

It is possible to ascertain two possible conclusions from the results of semistructured interviews with teachers and questionnaire survey which was filled in by pupils.

1) Even though the pupils of 8th grade most often consider outdoor education to be just a few hours, which they spent outside (pic. 1), their attitudes to outdoor education (tab. 1; they enjoy it, they want outdoor education more often) reach average value in comparison with pupils of other grades. The under-average value is for the question “During the expedition I have learnt more than in the classes” which correlates witch the answer for question “I perceive outdoor education as…”. It can therefore be said that **pupils consider outdoor education to be more fun and time spent outside the classroom than a process of education.**

The lower perceived benefit of outdoor education for pupils’ development in the field of knowledge is shown by the values which were detected from teachers’ answers. Teachers at primary school order the importance of this field to the third place out of four; teachers at lower-secondary school order the importance to the second place out of four. Teachers at both, primary and lower-secondary schools see the biggest benefit of outdoor education in pupils’ development in the field of skills. At primary schools the second place is taken by field of interpersonal relationships (pupil-pupil, pupil-teacher…) followed by development of pupils’ knowledge.

2) The second key finding is that **the attitudes of pupils to the outdoor education are more positive in 5th and 6th grade than in 8th and 9th grade. The attitudes of teachers of the model school are more positive at primary school than at lower-secondary school.** Both is probably connected with possibilities of realization of outdoor education, its connection and continuity of the curriculum. To arrange all the mentioned above from the point of organisation of an outdoor education is much easier for teachers at primary school than for teachers at lower-secondary school.

The results of pupils’ attitudes to the outdoor education found out by the questionnaire survey relate to pupils of model school where the outdoor education is quite intensive within the whole school year in comparison to other elementary schools which was proved by analysis of ŠVP and interviews with the teachers. Elementary schools where the outdoor education is not so intensive can expect that the difference in positive attitude to the outdoor education will be higher for lower grades than for the pupils of final grades.

The results show that the benefit of followed form of outdoor education is not only in the cognitive area, but can also be important for the affective aspect of education and schooling and supports mutual communication and interpersonal relationships between pupils and teachers (to each other).

Acknowledgement: This work was supported by the Czech Science Foundation grant 16-00695S Fieldwork as a Powerful Learning Strategy.

REFERENCES

BIDDULPH, Mary; LAMBERT, David; BALDERSTONE, David. *Learning to teach geography in the secondary school: A companion to school experience*. Routledge, 2015.

FOSKETT, Nick. Teaching and learning through fieldwork. *Teaching and learning geography*, 1997, 189-201.

KENT, Martin; GILBERTSON, David D.; HUNT, Chris O. Fieldwork in geography teaching: A critical review of the literature and approaches. *Journal of Geography in Higher Education*, 1997, 21.3: 313-332. http://doi.org/10.1080/03098269708725439

LAMBERT, David; BALDERSTONE, David. *Learning to teach geography in the secondary school: a companion to school experience*. Routledge, 2012.

LAMBERT, David; REISS, Michael. The place of fieldwork in geography and science qualifications. (1st ed.). London: Institute of Education, University of London, 2014.

NUNDY, Stuart. The fieldwork effect: the role and impact of fieldwork in the upper primary school. *International Research in Geographical and Environmental Education*, 1999, 8.2: 190-198.

OFSTED. Geography: Learning to make a world of difference. 2011. Available online at www.ofsted.gov.uk/resources/geography-learningmake-world-of-difference.

OOST, Katie; DE VRIES, Bregje; VAN DER SCHEE, Joop A. Enquiry-driven fieldwork as a rich and powerful teaching stratégy – school practices in secondary geography education in the Netherlands. *International Research in Geographical and Environmental Education*, 2011, 20.4: 309-325. Available online at http://www.tandfonline.com/doi/abs/10.1080/10382046.2011.619808#.VCpvhRawSEg

PRŮCHA, Jan, WALTEROVÁ, Eliška, MAREŠ, Jiří. *Pedagogický slovník* (7. vyd.). Praha: Portál, 2013.

RICKINSON, M. at al. A review of Research Outdoor Learning. National Foundantion for Educational Research and King´s College London, March 2004.

SVOBODOVÁ, Hana, MÍSAŘOVÁ, Darina, HOFMANN, Eduard. Analýza školních vzdělávacích programů ve vztahu k terénní výuce. In Aleš Nováček (ed.). *Sborník příspěvků Výroční konference České geografické společnosti Geografické myšlení jako aktuální společenská výzva*. 1. vyd. České Budějovice: Jihočeská univerzita v Českých Budějovicích, 2016. s. 292–302, 11 s.

Shrnutí

Terénní výuku můžeme považovat za silnou výukovou strategii, která je nedílnou součástí přírodovědného vzdělávání. Rozhovory s učiteli 1. a 2. stupně základních škol, kde na základě zjištění z analýzy školních vzdělávacích programů probíhá ve větší míře výuka v terénu, ukázaly, že největší přínos učitelé spatřují v rozvoji oblasti dovedností. Na prvním stupni

učitelé přisuzují větší význam také v rozvoji mezilidských vztahů (žák-žák, žák-učitel), na druhém stupni pak učitelé poukazují na vyšší přínos v rozvoji oblasti znalostí. Učitelé také zdůrazňují přínos terénní výuky v pohybové aktivitě žáků. Učitelé prvního stupně obecně přisuzují vyšší přínosy terénní výuky ve všech oblastech než učitelé druhého stupně.

Žáci shledávají největší přínos terénní výuky v možnosti naučit se něco nového (orientace s GPS, práce s mapou apod.). Postoj k terénní výuce je pozitivnější u žáků 5. a 6. třídy než u žáků 8. a 9. třídy. U starších žáků (8. třída) převažuje názor, že terénní výuka znamená „pár hodin, co strávili venku“. Výzkum realizovaný na modelové základní škole v Jihomoravském kraji dále odhaluje následující: a) obecně žáci hodnotí terénní výuku jako zajímavější než výuku ve třídě; b) tito žáci se domnívají, že se při terénní výuce mohou naučit více; z b) také plyne, že c) by si tito žáci přáli absolvovat terénní výuku v průběhu školního roku častěji.

EXPERIENCE-BASED LEARNING IN TEACHING OF THE LOCAL LANDSCAPE

Ivana Tomčíková

Dept. of Geography, Faculty of Education, Catholic University in Ružomberok
Hrabovská cesta 1, 034 01 Ružomberok, Slovak republic

ivana.tomcikova@ku.sk

Abstract: The aim of teaching at Slovak schools is to develop the knowledge, skills and competencies of pupils useful not only in school but also in everyday life. The teacher´s are challenged in how they disclose the content of the curriculum to pupils so that they are offered the opportunity to be active participants in the teaching process. One of the possibilities of such learning is experience-based learning. The experience arises in the active solving of real or model tasks.

In geography, the local landscape offers space for the development of imagination, which the teacher can foster in the teaching process of personal experiences and pupils' experiences. A deeper knowledge of the geography of the local landscape is thus not only an objective but also a means of geographic education. Specific geographic phenomena and their relationships in the local country serve as a model for understanding the generally applicable contexts and regularities. They enable pupils to better understand and consistently acquire the natural environment, as well as the peculiarities and relationships between humans and the country.

The aim of this paper is to describe the purpose and methods of experience-based learning, to give thoughts on how to implement it in the teaching process methods and supporting active pupil learning. The learner's own active approach to learning is based on activities they perform, either through direct observation of geographic walks or excursions in the local country, or mediated in the classroom by solving various problems and project tasks.

Keywords: local country, experience-based learning, walks and excursions, project teaching, problem teaching

INTRODUCTION

Learning is a necessary condition for the human existence and it requires a lot of time, systematic approach, responsibility and patience. The joy and need for learning can be brought to pupils spontaneously, but also through a planned activity, in which a pupil can enjoy from discovering the new and unknown. Pupils have to learn to think, create, consider, evaluate and be responsible for the results of their work. Therefore, teachers attempt to substitute a traditional, educational model, based on memorisation of a lot of information with one that focuses on the independent and creative work of pupils in their lessons.

The subject of Geography teaches pupils to think about the phenomena of nature and the society since these two are mutually interconnected. It is supposed to motivate pupils to yearn to discover and protect natural beauty, and help them to shape the world around them. A local country offers an environment for the development of the imagination, which a teacher can support during the teaching process through the pupils' personal experiences. Getting to know the world as a pupil and learning through their own life experiences with new information, which can be taught by the teacher and extracted from the surroundings so these experiences become a part of the pupil's mental portfolio.

The goal of this paper is to describe the core of Experiential Learning and to propose suggestions for the implementation of Experiential Learning into the teaching of Geography of the local country.

BACKGROUND OF EXPERIENCE-BASED LEARNING

According to Brestenská et al. (2010), under the term of 'Experiential Learning' we understand the way of leaning by which experiences are utilised to learn. With this type of learning it is not the teacher that passes on new knowledge, but the pupil that is capable, through their own senses, initiative, and personal activity, which helps them form their own thoughts and gather new information.

Experiential Learning arises from similar principals that D. A. Kolb in the 1970s' named the Experience Based Learning of the teaching process. It is derived from the specific experience (through ones own experience), followed by very important observation and the reflection of that experience, which brings about the need to learn from new experiences (formation of abstract concepts based upon the reflection) and its application in life (testing the new concept), which induces new experiences.

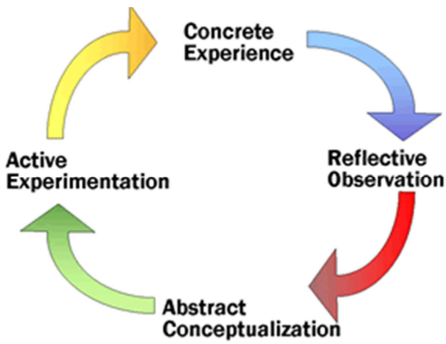


Fig. 1. A diagram of Kolb's cycle of experiential learning.
Source: https://serc.carleton.edu/introgeo/enviroprojects/what.html

We can instigate an experience, according to Gašparová (2012), in two ways:

- **Through Perception** - through observation of the certain phenomena and its influence on a pupil, by which they gather a new experience, subsequently they understand and masters the new experience arising out of this situation;

- **Through Interpretation** - through ones own active approach, which teaches a pupil in the given reality setting new skills and behaviours.
- Andresen, Boud, Cohen (2000) state that for a project to be truly experiential, the following attributes are necessary in some combination:
- The goal of experience-based learning involves something personally significant or meaningful to the students.
- Students should be personally engaged.
- Reflective thought and opportunities for students to write or discuss their experiences should be ongoing throughout the process.
- The whole person is involved, meaning not just their intellect but also their senses, their feelings and their personalities.
- Students should be recognized for prior learning they bring into the process.
- Teachers need to establish a sense of trust, respect, openness, and concern for the well-being of the students.

Pupils are getting to know natural, social and industrial environments of their surroundings, which provides new experiences, they are broadening their views relevant to the given phenomena. They are gathering new information about the country; they are gathering correct geographical ideas. It is important to realise that knowing the facts is in itself useless without being supported by a capability to synthesise, integrate and evaluate (with factual questions it only allowes one to briefly acknowledge the content). The local country is familiar to pupils because they live in it, specific geographical phenomena and their relationships in the local country serve as a model for gaining the understanding of generally applicable contexts and regularities. Particular geographical phenomena are seen by the pupils of the country in the context, they learn to understand that context, relationships and patterns of the development of the geographical terrain.

EXPERIENTIAL METHODS

Experiential Methods assume formation of an experience, emotional experiencing of the real situation intimately connects with an emotional investment (being absorbed in the situation, real experiencing of the situation) and with the conscious cognitive processing of an event. These methods come very close to reality or they are performed within real life situations. This type of learning leads to very profound experiences and to an unforced learning process. Pupil's own experiences followed by intentional reflection is transformed into the formation of general knowledge. Therefore this knowledge is stored in the pupil's long-term memory and is then quick to be retrieved in specific situations. It is intentional learning, as the actual experiences connect to the pupil's past experiences. They can make use of this knowledge in the future.

The Experiential Methods of teaching have, according to Lencz (1992), the following characteristics:

- **A positive evaluation of oneself and others** - strengthens the positive mood in the classroom,
- **Learning through participation** - pupils make an initiative in order to obtain the information. This information is then used to create new ideas,
- **Learning through cooperation** - supports communication, creative thinking, interpersonal relationships,
- Learning through a personal experience brings about **a change in behaviour, creativity and interpretation,**
- **Acknowledgement of own values, feelings and attitudes** - a change in the understanding of oneself and others connected to the change in the behaviour and attitudes,
- **Creative learning** - it relates to problem solving. It requires thinking in concepts and images, connecting the rational and emotional contemplation.

These activities belong, according to Hanuš and Chytilová (2009), amongst the Experiential Methods:

- **Physical Activities** - sports in nature, hiking and recreational activities in nature, camping, etc.,
- **Artistic Activities** - literature, fine arts, music, singing, dance, filmography, theatre, photography,
- **Socio-Psychological Activities** - communicative, self-knowledge, creative, intellectual, social,
- **Social Activities** - contemporary social games, happenings, celebrations and rituals, contemporary board games,
- **Cognitive Activities** - observation and monitoring, cognition, experiment,
- **Technical Activities** - construction, craft, technique, ones own practise,
- **IT and Media Activities** - games, programming and designing, researching, creative media.

For a successful accomplishment of the experiential lesson the teacher, according to Denková (2013), has to comply with the following criteria:

- **Age of Pupils** - activities have to be suitable for the developmental period of the pupils,
- **Group Climate** - the overall mood of the classroom cannot be tense, a teacher is open to different pupils' views and expressions and thus creates a feeling of trust and respect,
- **Teacher's Presence** - a teacher should not interfere when solution to the problem is formed within the group so the free expression of the pupils is not disturbed, in an nonintrusive way a teacher should point out the opinion that he considers to be the correct one,
- **Pupils' Discipline** - a teacher makes an effort to maintain an acceptable discipline in the classroom so it does not interfere with the overall course of teaching process,

- **Teacher's Authority** - pupils should respect the teacher, however, at the same time the teacher should act as a partner who is willing to help in every situation should a pupil ask for it,
- **Self-reflection of Pupils** - a teacher should during the lesson allow a space for pupils to express their views through their experience, when pupils observed a given challenge through their eyes, the task of a teacher is to bring the lesson to the end.

Beside the experience itself, the important aspect of Experiential Learning is the reflection of ones experiences, which is supposed to induce a need to learn new knowledge and its application in real life, by which the new experiences are instigated. An experience, as the state of a real situation which a pupil finds themself in, is an emotional intervention to the pupil that leads to joy and enthusiasm in children, however, can also have the opposite effect - a fear, rejection, sadness, feeling of failure. Therefore, for the effectiveness of positive development of the pupil's personality, it is important that the appropriate selection of activities from which they can choose or freely decide to or to not participate in.

The experiential pedagogy influences man in these areas (Holec, 1994):

- **Intellect Development** (memory, sensory awareness, attention, wit, logical thinking, tactics, strategy, abilities to combine)
- **Creativity Development** (imagination, fantasy, original, unconventional practices)
- **Social Skills Development** (communication, cooperation, team work, rhetorics, negotiation, discussion, responsibility, assertiveness)
- **Motor and Movement Skills Development** (speed, strength, endurance, dexterity)
- **Will Development** (patients, self-control, psychological endurance, courage)
- **Self-Knowledge** (self-awareness, self-mastery, abolishment of the psychological barriers, self-confidence, independence).

THE LOCAL COUNTRY IN GEOGRAPHY EDUCATION IN ELEMENTARY SCHOOLS

The local country is the country in which children grow up, attend school and perform sports. Children are introduced to the knowledge of their local country at a pre-school age. They get familiar with the basic terms and descriptive features of the country such as rivers, forests, residences, traffic communications. They intuitively distinguish between different types of landscapes and they talk about it.

In Homeland studies in the 3rd and 4th year (2 classes per week), pupils illustratively explore the main features of a municipality and its closest surroundings, they learn to understand the basic relations between nature and society in a local landscape at elementary level. Since Homeland studies represent an elementary level of geographical education, they have a very close relation to Geography. However, we cannot completely associate it with the teaching of Geography, because Homeland studies are a complex vision of the world in geographical as well as historical contexts, with a significant educational function (Tomčíková, Rakytová, 2017).

The subject Geography in Slovakia is taught in the 5th year in the range of 2 classes per week (66 classes per year) and in the 6th, 7th, 8th and 9th year in the range of 1 class per week (33 classes per year). The curriculum of a local landscape is, more or less, the interest of Geography education in each year.

Thanks to the School Educational Programme, the number of Geography classes in individual years can be increased and this increase can be used for the inclusion of the curriculum about a local landscape. However, it is necessary to objectively add, that schools are often not willing to increase the number of Geography classes in the National Educational Programme, the increase usually occurs mainly in foreign languages or other subjects, which are defined as cross-sectional themes by the National Educational Programme. Then, we cannot wonder that there is no space for creativity and lack of time for the curriculum about a local landscape, but also an absence of enthusiasm not only on the side of teachers but also on the side of pupils.

The additional space for teaching of geography of local landscape is provided by the cross-curricular topic of Regional Education and Traditional Folk Culture, it can be incorporated, through the curricular reform of The National Educational Programme, into optional subjects such as Regional Education or Regional History. The objective is to create conditions for students to grow and develop their sense of beauty in their region, nature, architecture, folk art and learning about the cultural heritage of our ancestors. The educational activity is focused on educating the pupils about the history, but also the present, of regional knowledge of their own village or town (Tomčíková, 2010).

THE EXPERIENTIAL LEARNING IN TEACHING OF GEOGRAPHY OF THE LOCAL COUNTRY

Learning through experience brings new knowledge and experiences to pupils, without the feeling of an active learning. Pupils exercise their new knowledge in real situations and gain competencies that can be used in a real life. Pupil’s own active approach in the Experiential Learning lies in the activities, which they do themselves through either a direct observation during geographical walks and excursions, or provided in the classroom by finding solutions to the different problem tasks.

The subject of Geography teaches pupils to think about the natural and social characteristics which are mutually interconnected. The subject should also motivate them to yearn to learn, discover and protect the natural beauty, furthermore to help to cultivate the world around them. The teacher’s challenge is to present the curriculum in a way that will invite pupils to become active participants of the teaching process, with different options of learning methods such as group or independent work, in order to find solutions to different problems in projects creation.

Walks, Excursions, Teaching Outdoors, poss. Virtual Excursion

The forms that carry a characteristic of the Experiential Learning, and create a new direct experience, are walks and excursions. To teach pupils Geography in the classroom environment only with the use of textbooks and maps can be uninteresting because a pupil does not get a chance to engage their senses in the learning process. The organisational form such as geographical walk or an excursion allows to perceive objects and characteristics directly in pupil's natural environment, moreover it provides an opportunity to engage passive pupils in the learning process. Experiential learning is a powerful teaching tool. While classroom lectures address primarily the cognitive domain, experiential learning involves more; cognitive, affective and physical domains of a pupil (Oxendine, Robinson and Willson, 2004). The result is that students can relate to the subject matter in a way that is meaningful to their own lives.

The main reason for the geographical walks and excursions is an application of the theoretical knowledge of pupils during the various observations and exercises in local landscape. The pupils are learning how to work with a compass, orientate maps of the local landscape and determine a morphological type of a local landscape. Furthermore they observe changes in the local landscape and acquire their relationship to the local landscape, environment and shared responsibility in environment protection.

A walk is a time-wise and short organisation structure; a direct educational activity usually takes one teaching lesson and is suitable for primary education to explore the pupils' natural and social environment of the nearest surroundings and their environment. An amount and a content of the walks is limited by the size of the place in which they are taking place and the most effective timing during transfers between points of interest. It is in the competence and invention of teachers to what they are capable of introducing to their pupils directly in the real environment, in which the given natural or social phenomena exists and is currently active.

An excursion demands a larger time and content space. Due to this fact, fewer excursions are carried out, compared to the amount of walks during the school year. More thorough preparation is required, a communication with parents is needed, and it is more financially demanding. However, on the other hand, it provides an opportunity to visit and get to know objects, thus pupils are offered with more working material for further use in curriculums of other subjects.

Hofmann et al. (2017) sees a large importance in the outdoor teaching. It has different strategies compared to traditional teachings – from the traditional excursions, through the field research, all the way to the research-orientated teaching. The authors of this write-up hold the view that teacher's and pupil's task in this type of teaching process is different to the traditional one in the classroom. The teacher is not the provider of the information anymore, but a manager, a trainer, and the pupil is not merely the one absorbing the information, but is actively learning human being.

During an excursion it is, however, not possible to visit and present to pupils all the beauty of the local country. Therefore, it is suitable to take an advantage of **a virtual excursion** as a part of the lesson in the classroom, this offers to the educator new options. Without any problems the educator can secure for the pupils a presentation of selected places in the local region. But a preparation of the virtual excursion is quite demanding on teacher's part. Suitable is a dynamic interactive excursion, the part of which are different video and audio recordings, but also a real static photographs supported by the charts that have often an explanatory and outlining function. It is necessary that the teacher visits the places and thoroughly prepares the virtual excursion. He is though freed from tasks that organising the excursion involves, i.e. the amount of administrative and organisational obligations relating to the excursion preparation.

Fig. 2. Work of the pupils on the walk.
Source: author

Challenge Based Teaching Process

Meaningful learning is a learning, in which pupils think of new knowledge, engage in discussion and seek solutions. Then their experience becomes the basis of their knowledge. Many teachers have confirmed that the ability to analyse and evaluate the information, along with the creativity and imagination are the key skills pupils can acquire. In many ways, is the way how pupils learn just as important as what they learn (Scoffham, 2011). It is requested to introduce pupils to the country in which they live and present its global development - what it looked like, what were progressive human interventions and what are the current problems in the country. It is appropriate to clarify the causes of deployment activities, their specialization in relation to the condition of the country, their impact on the landscape, the state of the environment and the aesthetic value of the landscape. Teaching of local landscape´s geography should by supplemented by the geographic assessment of the country in terms of the quality of the environment (the restoration of town / village, the location of economic activity in the country), regional planning (land use and its changes, the stability of the territory) and historical development (manufacturing tradition, culture and customs, change of the landscape during the period of time).

Activating Methods are practices that lead the education process in a way so that the educational goals are achieved mainly on the basis of the pupil's own learning work, whereby the focus is on the thinking and solving of problems. The Activating Methods should, among other things, teach pupils critical thinking. The critical thinking is an active and independent thinking process that includes understanding of information, analysis, a comparison of thoughts with the other views and opinions, seeing facts in contexts, the use of all levels of logical thinking processes, taking a stand and the responsibility for it.

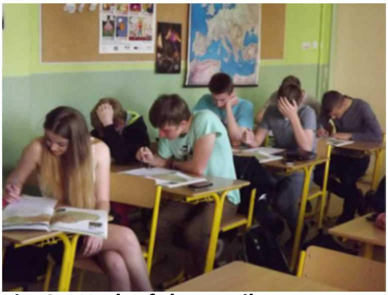


Fig. 3. Work of the pupils.

Source: autor

Project Based Teaching Process

The primary objective of the Project Based Learning is to actively involve pupils in the educational process. The main teaching method is the Project Method, whereby pupils under the supervision of a teacher, or individually, work on the project (theoretical or practical), through which the actual learning takes place. By the use of this method in lessons, the teacher guides pupils to learn independence, creativity and the responsibility. During the Project Based Learning it is possible to develop communication skills and competences, i.e. writing skills, researching and creating information. Another competence is the ability to work within a team should a group setting be also utilised. The ability to work with modern information technology tools is currently one of the basic key competencies, since to be able to use a personal computer, the internet and to utilise several information channels is a prerequisite for gathering a lot of information during a creation of suitable projects. When selecting a project topic, it is necessary to take into account the needs and interests of pupils. It is appropriate if the project relates to pupils' out-of-school exposure and is based on their own experiences. It should be a bridge between the school and life, it should not be an artificial reality for the prescribed curriculum. The appropriate prerequisite for the Project Based Learning is an internal motivation of pupils, therefore drawing up of the project should lead to the specific results, and whereby based on those results the pupils absorb the knowledge of the relevant subject. Out of many benefits of the Project Based Learning we can mention that it is a highly motivating method, creative, it teaches pupils to search for the information, to select it and to consider its relevance for the problem solving. It also develops social-emotional intelligence and strengthens the aesthetic feel. The Project Based Learning leads pupils to the 8mutual communication and respect. Finally, their work leads to the sense of responsibility as they have to justify and prove the correctness of the work created.

Fig. 4. Work of the pupils on the project.
Source: author

CONCLUSION

We believe that pupil's relationship to its school and the teaching subject is not solely based on the personal prerequisites, but also on the specific educational methods and activities. It is our assumption that if a pupil actively participates in the educational process, where they find their usefulness, the situations that spark pupil's passion for knowledge and progress are created. The Experiential Learning is more effective form of the personal development compared to the traditional one, sometimes almost dogmatic system of education. A major challenge for a teacher is to create an active environment for the pupils so that they become more active and more creative.

In today's terms, the teaching about the local country is of a large importance in forming of the attitudes and pupil's relationship towards the local region. The one can only solve problems in the local region if one is familiar enough with it. Furthermore, if one has formed a positive relationship towards the region and the whole Slovakia, which is also very important to nurture in schools in addition to the home environment. It is necessary to dedicate lessons of Geography to the local country so that the pupils comprehend and perceive the environment in which they are growing up, so they gain an overview of the functioning of the natural processes in their surroundings. It is important that they are sufficiently aware of the impact of humans on the natural environment and the need to protect nature in their region.

REFERENCES

ANDRESEN, L., BOUD, D., COHEN, R. Experience-BasedLearning , in Foley, G., Understanding Adult Education and Training, second edition, 2000,Allen&Unwin, Sydney.

BRESTENSKÁ, B. et al. Premena školy s využitím informačných a komunikačných technológií. Košice: ELFA. 2010, ISBN 978-80-8086-143-8.

DENKOVÁ, J., 2013. Zážitkové učenie v praxi učiteľa, In: Zborník z Odbornej konferencie PRIMAS: Objavné vyučovanie matematiky a prírodovedných predmetov, s. 42-50, dostupné na:http://www.primas.ukf.sk/conference/papers/OV_cvicni_ucitelia/c_Denkova.pdf

GAŠPAROVÁ, M. Osobitosti aplikácie prírodných a kultúrno-spoločenských reálií v primárnom vzdelávaní. In: Podmiotowość w edukacji wobec odmienności kulturowych oraz społecznych zróżnicowań 2. Poznań: Wydawnictwo Wyźszej Skoły Bezpieczeństwa, 2012, s. 419-439. ISBN 978-83-61304-54-8.

HANUŠ, R., CHYTILOVÁ, L. Zážitkově pedagogické učení. Praha: Grada, 2009, ISBN978-80-247-2816-2.

HOFFMAN a kol. Terénní výuka jako specifická výuková forma ve výuce na základní škole. In Miroslav Prokša, Anna Drozdíková. Inovácie a trendy v prírodovednom vzdelávaní. Bratislava: Univerzita Komenského v Bratislave, Prírodovedecká fakulta, 2016. s. 61-67, ISBN 978-80-223-4175-2.

HOLEC, O. Dramaturgie.In: Outward Bound Czech Republic: Prazdninová škola Lipnice, Instruktorský šlabikář, 1994, s. 37-50.

KARIKOVÁ, S. Štrukturovaná hra v zážitkovom učení. In: Zborník príspevkov z vedeckej konferencie „Hra-prostriedok formovania osobnosti". Banská Bystrica: PF UMB, 1999, s. 23-29.

LENCZ, L. Pedagogika etickej výchovy, 1992, Metodické centrum Bratislava

OXENDINE, C., ROBINSON, J., WILLSON, G. Experiential learning, In M. Orey (Ed.), Emerging perspectives on learning, teaching, and technology. 2004

SCOFFHAM, S. Coreknowledge in therevised curriculum. In Geography: 96 (3): 201, p. 124-129.

TOMČÍKOVÁ, I. 2010. Miestna krajina vo vyučovaní vlastivedy a geografie na základnej škole. In Geographia Cassoviensis: 4 (1): p. 159 – 163.

TOMČÍKOVÁ, I., RAKYTOVÁ. Geography of local landscape in the educational process in primary schools in Slovakia. In European Journal of Geography, 2017 (in print).

Shrnutí

Cieľom vyučovania na slovenských školách je rozvíjať vedomosti, zručnosti a kompetencie žiakov využiteľné nielen v škole, ale aj v každodennom živote. Pred učiteľom stojí výzva, ako žiakom sprístupniť obsah učiva tak, aby im ponúkol možnosť byť aktívnymi účastníkmi vyučovacieho procesu. Jednou z možností takého učenia sa je práve zážitkové vyučovanie, kde sa prostredníctvom určitej skúsenosti vyvolá zážitok. Ten vzniká pri aktívnom riešení reálnych alebo modelových úloh.

Práve miestna krajina ponúka priestor na rozvoj predstavivosti, ktorú môže učiteľ vo vyučovacom procese podporovať osobným zážitkom a skúsenosťou žiakov. Hlbšie poznanie geografie miestnej krajiny tak je nielen cieľom, ale aj prostriedkom geografického vzdelávania. Konkrétne geografické javy a ich vzťahy v miestnej krajine slúžia ako model na pochopenie všeobecne platných súvislostí a pravidelností. Umožňujú, aby žiaci ľahšie pochopili a trvale si osvojili zákonitosti prírodného prostredia, ale aj osobitosti a vzťahy medzi človekom a krajinou.

Cieľom príspevku bolo popísať podstatu a metódy zážitkového vyučovania, podať námety ako implementovať do vyučovacieho procesu metódy

podporujúce aktívne učenie sa žiakov. Vlastný aktívny prístup žiaka v zážitkovom učení spočíva v činnostiach, ktoré sám vykonáva, či už priamym pozorovaním na geografických vychádzkach, či exkurziách v miestnej krajine, alebo sprostredkovane v triede riešením rôznych problémových a projektových úloh.

ACTIVATING METHODS IN GEOGRAPHY TEACHING (GEOGRAPHY BY SENSES)

Jana Vojteková[1], Michaela Žoncová[2]

[1] *Department of Geography and Regional Development, Faculty of Natural Sciences, Constantine the Philosopher University in Nitra, Trieda A. Hlinku 1, 949 74 Nitra, Slovakia*

jvojtekova@ukf.sk

[2] *Department of Geography and Geology, Faculty of Natural Sciences, Matej Bel University in Banská Bystrica, Tajovského 40, 974 01 Banská Bystrica*

michaela.zoncova@umb.sk

Abstract: The paper deals with activating and explorational methods in teaching of regional geography. As an example, a methodology for teaching of regional geography of Slovakia, which is taught in the 8th grade of primary school, is presented. The aim of the proposed methodology is to acquire knowledge on the specifics of the regions of Slovakia using the explorational approach and activating methods. Activating methods lead the teaching process so that educational goals are achieved mainly on the basis of pupils' own activities while the emphasis is being placed on solving problems. Teaching by using exploration, research or discovery by pupils themselves and finding the truth is an important part of education in the process of adopting key concepts in the field of natural (but not only) sciences. The methodology was verified by primary school pupils at the event called Vedecký jarmok (Science fair) and geography students in the academic course of Geography Didactics.

Key words: activating methods, explorational methods, regional geography, educational process, senses

INTRODUCTION

Due to the development of science, there are gradually increasing demands on pupils cognition. This is also related to the search for new teaching methods. The learning process in its multiplicity involves many aspects that need to be respected when discovering new insights into teaching methods. In this respect, it can be stated that teaching is a process in which there is a constant quantitative and qualitative development of pupils cognition (Kalakay, 2001).

The aim of the paper is to propose methodology to acquire knowledge on the specifics of the regions of Slovakia using the explorational approach and activating methods. The methodology was verified by primary school pupils at the event called Vedecký jarmok (Science fair) and geography students in the academic course of geography didactics.

METHODS

Activating methods lead the teaching process so that educational goals are achieved mainly on the basis of pupils' own activities while the emphasis is being placed on solving problems. . Teaching by using exploration, research or discovery by pupils themselves and finding the truth is an important part of education in the process of adopting key concepts in the field of natural (but not only) sciences. Pupils' discovery allows not only to learn new knowledge, but also to understand the very essence of science and to learn about research methods. This occurs in situations intentionally created by the teacher that allow pupils to observe phenomena, manipulate with specific objects, experiment, participate in excursions, discuss each other, solve creative tasks, practical and theoretical problems, etc. (Bagalová, Siváková, 2012).

According to Kotrba, Lacina (2007), activating methods:

- Promote pupils' interest in learning,
- Support intensive experience, thinking and action,
- Use the acquired experience and knowledge of pupils,
- Significantly support and develop pupils' cognitive processes.

Clarity in modern teaching is to be understood as a process or product of sense cognition which is related to an active psychic activity of the pupil. However, knowledge must not only remain at the stage of meaningful understanding of the phenomenon, but have to focus on the essence of things, phenomena and the learning processes of geography and have to lead to abstraction. Applying the principle of clarity leads to an increase in efficiency in the pupils' learning, encourages their interest and facilitates memorization. Fundamental means which apply the principle of clarity in geography teaching include game and experiment (Kalakay, 2001).

Didactic games, tasks and experiments as part of an activating teaching method should not be missed in every modern learning process.

In geography teaching, we should look for new ways and means to enable our pupil not only to develop the ability to learn self-containedly the latest knowledge of geography, but also to foster an interest in continuous education (Dragulová, Vincejová, 2005).

Since each person is an individual and has different interests, also the pupil does not have to be interested in everything from geography. The teacher's success is if he is able to find at least one of the areas of geography that will attract the pupil. Moreover, this interest can easily be obtained through games, tasks and experiments.

In the paper, we deal with specific didactic games as a part of activating method in the teaching of regional geography. As an example, we present the methodology created for the 8th grade of primary school, applied to the topic called Regions of Slovakia with a time allowance of 45 minutes. Through this method, pupils learn about the specifics of Slovakia's regions in a playful way. The aim of this methodology was to gain insight into the specificities of Slovakia's regions by using explorational approach, activating methods and information-communication technologies.

The 7E learning cycle was used in the proposed methodology:

Phase 1: Engage and Elicit,

Phase 2: Explore,

Phase 3: Explain,

Phase 4: Elaborate/Extend,

Phase 5: Evaluate.

RESULTS

An example of methodology: Slovakia by Senses

In the preparatory phase of the previous lesson, the teacher assigns pupils a homework where each pupil has to bring some Slovak food product (Figaro chocolate, Sedita Horalka (biscuit), parenica (cheese), Miva peanuts, etc.) or drink (except for alcoholic beverages).

The teacher has to prepare aids (interactive tablet, tablets, Wi-Fi internet connection, computer, loudspeaker, plastic cups, rubber bands, thin cloth or napkin, scissors, adhesive tape, typical Slovak beverages, food, rocks or minerals (beer, wine, bryndza (cottage cheese), mineral water, wood, etc.), atlases of Slovak Republic, data projector).

The plastic cups are filled with beer, wine, bryndza (cottage cheese), pieces of wood (e.g. pine, spruce, oak, etc.), mineral water with a pronounced odor (e.g. Fatra), rubber pieces (e.g. tire), chopped potatoes or cooked corn. A thin cloth is placed on the top of the cups so that the content inside the cup is not visible and the canvas attached to the cup is fastened using a rubber or adhesive tape (fig. 1).

In addition, the teacher prepares various sounds typical for Slovakia (e.g. Slovak dialects, fujara (music instrument), various examples of folk songs, sounds of animals typical for Slovakia, etc.).

As the last, the teacher prepares the physical-geographical map of Slovakia with towns/cities and prepares the task using the software for interactive board. If the school does not have software for interactive board, the teacher will create this task in e.g. Microsoft PowerPoint software.

The proposed methodology also uses inter-subject relations where geography is merged with history, civic education or music education.

Teacher at the beginning of the lesson invites pupils to bring typical Slovak foods, beverages (other than alcoholic drinks) that they should have brought from home (such as Horalka (biscuit), Figaro chocolate, parenica (cheese), etc.). Pupils place these traditional Slovak food, drinks or meals on a pre-arranged bench near the teacher where cups with scents are already prepared.

Fig. 1. Sample of a cup with certain scent.

The teacher divides pupils into groups of 4-5. Each group receives a tablet, access to the Internet and interactive board and atlas of the Slovak Republic.

Then teacher says the hypothesis: Can we discover Slovakia other than from TV programs, textbooks, prints and the like? The teacher invites pupils to the first of their activities to go and smell the prepared glasses.

Teacher gradually calls each group (all pupils from the group) to the desk where the cups with different scents are prepared. Each group smells one cup and their role is to identify what is in the cup and sit back.

After this task, there is a sound task. Teacher gradually plays prepared sounds for each group and the task for pupils in each group is to identify the sound.

According to the atlas of the Slovak Republic and the Internet, the task for pupils is to find out where the "scent" can be found in Slovakia. Using the tablet, its occurrence is drawn by a predefined symbol and color to the map on the interactive board. For example, one of the groups will smell a cup with a piece of wood. The task for pupils is to find out where the wood-processing industry is located in Slovakia and mark it via tablets on the interactive board using a pictogram of brown color. Another group will mark e.g. wine companies, breweries, sheep breeding, mineral springs, thermal springs, rubber industry, cultivation of potatoes, corn, etc. The pictogram used will also be marked in the legend of the map (fig. 2).

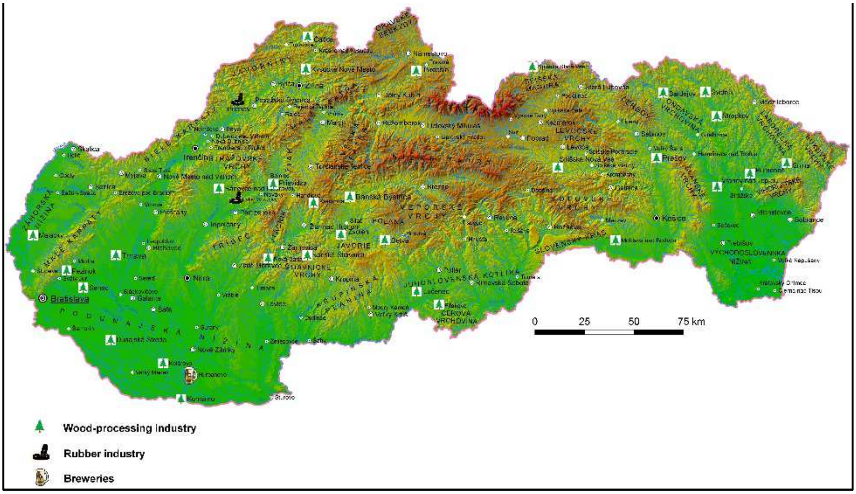


Fig. 2. Sample of semi-finished pupils' map.

After the “smelling” task, the sound task follows. Teacher gradually plays prepared sounds for each group and the task is to identify the sound. For example, the teacher uses: https://www.youtube.com/watch?v=R1_lBpN4AGw sound and the pupils' task is to find out what music instrument it is (fujara) and then using the Internet, they identify its origins, peculiarities, etc. (For example, on 25 November 2005 it was included in the List of Oral and Intangible Cultural Heritage UNESCO in a solemn proclamation in which UNESCO appreciated a total of 43 works). Moreover, teacher can play a sample of the conversation from https://www.youtube.com/watch?v=-LzaxnhThtc and the pupils' task is to find out what dialect (záhoráčtina) it is and where it can be found in Slovakia, its origins, etc. The dialect can also be replaced by songs specific for certain regions. Furthermore, it can be the animal sound: https://www.youtube.com/watch?v=dGagp49q7uA and the pupils' task is to find out what animal (marmot) it is and then find out endemic and relict animals in Slovakia and their occurrence.

During the lesson, the teacher talks about regions of Slovakia as well as cities, cultural and natural monuments, etc., explains the link between the industry or agriculture and regions. The examples used by the teacher include regions that are not mentioned in the tasks for pupils. For example, the automotive industry is not mentioned in the tasks for pupils and the teacher explains that it is located mainly in western Slovakia due to a good transport network, workforce (universities focused on engineering ...), etc.

When all groups mark their findings on a map on the interactive board, the teacher will show the correct solutions. If the pupils missed something, they can supplement it or correct the wrong findings. During the revelation of the resulting map, the teacher discusses with pupils and gives them explorational questions such as: Why are there winery companies located there? Why are potatoes grown mainly in those localities? What determines the occurrence of mineral springs?, etc. If pupils do not know the answer, they have to find out in each group why it is so. If they do not find out it until the end of the lesson, it will be their homework which will be presented on the next lesson.

When they identify all the sounds and find out all the necessary information, they indicate their occurrence in the interactive board. The teacher correct their findings and discusses with pupils using explorational questions. For example: Why did the dialects emerge? How can we help preserve the natural heritage? Why the specific dialect is located in those localities? If pupils cannot answer, they have to find out in each group why it is so. If they do not find out it until the end of the lesson, it will be their homework which will be presented on the next lesson.

At the end of the lesson, the teacher invites pupils in each group to evaluate their results and compare with other groups. After the pupils' evaluation, the teacher assesses each group and as a reward for all groups, teacher encourages pupils to go and taste all the foods they brought which adds another sense of taste. When tasting the food, the teacher tells pupils to look at the packaging and find out where the product was made.

Pupils thus used all the senses in this methodology:

- Hearing - listening to sound samples,
- Smell - smelling the cups with various “aromas of Slovakia”,
- Taste - tasting traditional Slovak food,
- Sight - searching for information in atlases, on the Internet, etc.,
- Touch - marking information on the map in a tablet or interactive board.

APPLICATION

The methodology Slovakia by Senses was applied in the educational process at university, in particular, in the subject Geography Didactics where it was verified by the future geography teachers. The future geography teachers also used information-communication technologies in the educational process. They were divided into groups and in the groups they developed the methodology Slovakia by Senses. After verification, a discussion on advantages and disadvantages of the methodology was conducted. The further task for the students was to prepare new methodologies using the activating methods in geography teaching and present them in the next seminar. Among the benefits of the methodology, students emphasized mainly a playful approach, searching for knowledge from various sources (not just print), using information-communication technologies (interactive board, tablets, internet connection ...), rewarding pupils in the form of Slovak food tasting, involvement of senses, etc. As the shortcomings of the methodology, they stated mainly demanding teacher's preparation (time, skills) for the lesson and knowing how to use information-communication technologies (Chvojka, Vojtek, 2016).

The methodology Slovakia by Senses was also adapted to the World by Senses which was oriented on the regional geography of the world and was used in the events called Vedecký jarmok (Science fair) (fig. 3) and during University Days where it was verified mainly by primary school pupils and other visitors of these events. The aim of these events was to popularize natural sciences through interesting demonstrations and experiments from individual natural sciences, to stimulate the interest of young people and their parents in the study of natural science subjects and to show the importance of natural science knowledge for ordinary life. The interactive table or tablets were not used in these events and pupils marked their findings in the printed world map. The correct answers were marked on the second printed similar map (fig. 4). The pupils were most interested in sound samples of the different languages of the world where it was more difficult to determine which language is correct and where in the world it is used. This activity was also solved by pupils of lower grades based on their own experience of from holidays, trips or television programs. The smelling samples of various spices from the world were easily identifiable, but the localization of their occurrence on the map (production, cultivation) was challenging for pupils because they could not search for the correct answers on the Internet, in the atlases or in another print resource, but they had to rely on their own knowledge.

Fig. 3. World by Senses in the Vedecký jarmok (Science fair) event – sense of sound.

Fig. 4. Sample of maps used for the methodology World by Senses in the Vedecký jarmok (Science fair event – sense of smell).

CONCLUSION

Activating methods are often applied in geography teaching mainly through didactic games, tasks or experiments. These methods were used in many studies which deal with geography teaching such as Vilínová, Repaská, Herda (2014) who used these method in project teaching or Kramáreková, Dubcová, Vojtek (2012) who deal with cartography teaching in Slovakia or Dubcová et al. (2013) who apply these methods in field teaching of geography and many others.

Based not only on the above mentioned results, it can be claimed that a competent teacher has to know a lot of ways to not only teach pupils as much as possible, but also to engage them, motivate and develop the relation to education process. The development of pupils' creative abilities requires intentional creation of creative situations in the teaching process.

REFERENCES

BAGÁLOVÁ, Ľ., SIVÁKOVÁ, M. Aktivizujúce metódy a prístupy v prírodovednom vzdelávaní. Uplatnenie bádateľskych postupov vo vyučovaní prírodovedy na 1. stupni ZŠ. [online]. 2012. [cit. 2017-08-20]. Dostupné na internete: <http://www.statpedu.sk/files/articles/dokumenty/vzdelavacie-aktivity/aktiv izujuce-metody-v-prirodovede_fin.pdf >.

DRAGULOVÁ, A., VINCEJOVÁ, E. Didaktické hry na hodinách zemepisu. Prešov: Metodicko-pedagogické centrum, 2005. 54 s.

DUBCOVÁ, A., KRAMÁREKOVÁ, H., NEMČÍKOVÁ, M., NÉMETHOVÁ, J., OREMUSOVÁ, D., RAMPAŠEKOVÁ, Z., REPASKÁ, G., ŠOLCOVÁ, L., TREMBOŠOVÁ, M., VILINOVÁ, K. Didaktika geografie v teréne. 1. vyd. Nitra: UKF, 2013. 395 s. ISBN 978-80-558-0297-8.

CHVOJKA, L., VOJTEK, M. Aktuálny stav využívania geoinformačných technológií vo výučbe geografie na stredných školách v Nitrianskom samosprávnom kraji = Current State of Using Geoinformation Technologies For Teaching Geography at Secondary Schools in the Nitra Self-governing Region. In: Geografické informácie: 22nd International Geographical Conference on Central Europe After 25 Years of Transformation, Oct 09-10, 2014, Nitra, Slovakia. ISSN 1337-9453, roč. 20, č. 2, 2016, s. 161-174.

KALAKAY, R. Demonštračný experiment vo vyučovaní fyziky. [online]. 2001. [cit. 2017-08-20]. Dostupné na internete: <http://physedu.science.upjs.sk/sis/fyzika/experimenty/demonstracne/index.htm>.

KORTBA, T., LACINA, L. Pracovný list. Aktivizujúce metódy. [online]. 2007. [cit. 2017-08-20]. Dostupné na internete: <http://www.pdf.umb.sk/~lrovnanova/PL_aktivizujuce_metody_text.pdf>.

KRAMÁREKOVÁ, H., DUBCOVÁ, A., VOJTEK, M. School Cartography in the Slovak Republic After 1993. In: 4th International Conference on Cartography & GIS: Proceedings Vol. 1, 18-22 June, 2012, Albena, Bulgaria. Sofia: Bulgarian Cartographic Association, 2012. ISSN 1314-0604, pp. 175-185.

VILINOVÁ, K. REPASKÁ, G., HERDA, M. Projektové vyučovanie prírodných zložiek aplikovaných na miestnu krajinu = Project Teaching of Natural Components Applied To the Local Landscape. In: Geografické informácie:

22nd International Geographical Conference on Central Europe After 25 Years of Transformation, 09-10 Oct, 2014, Nitra, Slovakia. ISSN 1337-9453, roč. 18, č. 2, 2014, s. 214-222.

Zhrnutie

Príspevok sa zaoberá aktivizujúcimi metódami vo výučbe regionálnej geografie, pričom v príspevku uvádzame konkrétne metodiku venovanú výučbe regionálnej geografie Slovenska pre 8. ročník ZŠ pomocou tejto metódy a bádateľského prístupu a aj jej aplikáciu.

Metodika Slovensko zmyslami sa zaoberá výučbou regionálnej geografie Slovenska zmyslami. Žiaci pomocou zmyslov spoznávajú špecifiká jednotlivých regiónov Slovenska. Táto metodika bola verifikovaná v edukačnom procese so študentmi učiteľstva geografie pri výučbe didaktiky geografie, pričom študenti ako plusy tejto metodiky uviedli najmä hravý prístup, vyhľadávanie vedomostí z rôznych zdrojov, nie len printových, využitie IKT (interaktívna tabuľa, tablety, internetové pripojenie ...), odmenu žiakov formou ochutnávky slovenských potravín, zapojenie zmyslov a podobne. Ako nedostatky metodiky uviedli najmä náročnú prípravu učiteľa (čas, zručnosti) na vyučovaciu hodinu, krátku časovú dotáciu, manipuláciu s IKT.

Metodiku Slovensko zmyslami sme pretransformovali na Svet zmyslami orientovanú na regionálnu geografiu sveta a tú sme aplikovali na podujatiach Vedecký jarmok a Univerzitných dňoch, kde ju overili najmä žiaci ZŠ, ale aj ostatní návštevníci týchto podujatí. Žiakov najviac zaujali zvukové ukážky jednotlivých jazykov sveta, kde bolo pre nich náročnejšie určiť, ktorý jazyk je správny a v ktorej časti sveta sa s nim hovorí, avšak túto aktivitu vedeli vyriešiť aj žiaci nižších ročníkov na základe vlastných skúsenosti z dovoleniek, výletov, či televíznych programov. Čuchové ukážky korení sveta boli síce ľahko identifikovateľné, ale lokalizácia ich výskytu na mape (produkcia, pestovanie) bola pre žiakov náročná, nakoľko nemohli vyhľadávať správne riešenia na internete, v atlase, či inom printovom zdroji, ale museli sa spoliehať len na vlastné vedomosti.

Na základe nielen týchto výsledkov môžeme konštatovať, že schopný učiteľ musí poznať veľa spôsobov, ako žiakov nielen čo najviac naučiť, ale aj zaujať ich, motivovať a vypestovať v nich vzťah k vzdelávaniu.

GEOGRAPHY AND ITS APPLICATION IN EDUCATION WITHIN THE CROSS BORDER COOPERATION PROJECT "SPRINGS CONNECTING" (CASE STUDY)

Kamil Zágoršek[1], Emil Drápela[1], Tomáš Vitvar[2], Matthias Kändler[3], Jiří Šmída[1], Hynek Böhm[1]

[1] Technical University of Liberec, Faculty of Science, Humanities and Education

Studentská 2, CZ-461 17 Liberec, Czech Republic

kamil.zagorsek@tul.cz, emil.drapela@tul.cz, jiri.smida@tul.cz, hynek.bohm@tul.cz

[2] Escuela Superior Politécnica del Litoral, Facultad de Ingeniería en Ciencias de la Tierra, Campus Gustavo Galindo - km. 30.5 vía perimetral, Guayaqui, Ecuador

Czech University of Life Sciences Prague, Faculty of Environmental Sciences, Kamýcká 129, 165 21 Praha, Czech Republic

vitvartom@gmail.com

[3] Technische Universität Dresden, International Institute Zittau, Environmental Biotechnology, Markt 23, 02763 Zittau, Germany

matthias.kaendler@tu-dresden.de

Abstract: Technical University of Liberec, Technical University of Dresden-International Graduate School Zittau and Czech University of Life Sciences Prague within the framework of the cross-border co-operation project "Prameny spojují/Quellen verbinden" (Springs connecting landscapes and countries) applied mostly physical geographical studies in education. The project is providing resources and capacities to develop, implement and maintain practical education of students from all three institutions in the field of Earth, natural sciences as well as human sciences. Altogether 85 students have participated in the project activities and have been practically trained; moreover 6 Bachelor and 5 Maser theses were carried out up to now.

Key words: Education, cross-border cooperation, springs

INTRODUCTION

Practical education in Earth and natural sciences has been increasingly supported over the past decades and centuries. The proper ratio between theoretical and practical education remains a challenge not only in basic and secondary schools, but also in universities. Practical education is typically a resource- and time-consuming activity during both preparatory and implementation phases. International projects with student participation and educational components have increasingly proven to meet these challenges and promote innovative tools in the practical education. These projects can on one hand supply the financial resources needed for the practical and field education and, on the other hand, involve the students in various practical scientific tasks included in implementing project work plans.

This approach has been recently employed by three institutions - Technical University of Liberec (TUL), Technical University of Dresden- International Graduate School Zittau (IHI) and Czech University of Life Sciences Prague (CZU) within the framework of the cross-border co-operation project “Prameny spojují/Quellen verbinden” (Springs connecting landscapes and countries), supported by the joint Czech-Saxonian EU programme Interreg 5A SN-CZ 2020 “Hallo Nachbar.Ahoj sousede”. This project providing resources and capacities to develop, implement and maintain practical education of students from all three institutions in the field of Earth, natural sciences as well as human sciences. The springs were chosen as objects of multidisciplinary scientific and educational interest and valuable cross-border historical and cultural heritage.

The essential target group of this project are students, prevailingly those studying bachelor degrees in geography at TUL, master degree students from CZU and bachelor to postgraduate students from IHI. The principal aim of the project is to educate the participating students in a wide spectrum of geographical, geological, biological, hydrochemical and ecological disciplines related to the research of spring and water ecosytems. As of today, the project is launching its second half after having provided three workshops, one summer school and various research tasks supporting the theoretical background of the practical education. Hence, this paper describes experience made with educational applications of geographical and other research in the frame of this project (Vitvar et al. 2017).

The project: Springs connecting landscapes and countries

The project “Prameny spojují/Quellen verbinden” (http://quellen.tul.cz) was created by researchers from the Technical University of Liberec, Czech University of Life Sciences and Technical University of Dresden and started in 2016. This three-year project aims at improving the skills of students of participating universities to promote research across the borders and implement various types of educational activities, supported by complementary research of about 40 selected spring ecosystems in the cross-border Liberec-Zittau area. This research and educational topics include geography, geology, hydrology, hydrochemistry, hydrobiology as well as human geographical approaches to assess the historical and cultural development of the spring ecosystems and its current vulnerability and role in the landuse management. These 40 springs were selected upon relevant available information and field pre-screening of about 100 springs, which represent the variety of geological, hydrochemical, hydrological, hydrobiological and human geographical aspects of the studied area.

The educational part of the project has been implemented via workshops and summer schools. Each workshop focused on different field of study of the spring, typically related to the dominant competence of the host university. The Liberec workshops are therefore aimed to the geological, geomorphological and also human geographical aspects of springs (Fig. 1). The applications of GIS methods were demonstrated for collecting, storing and analysing spatial data, as well as using of cartography methods for visualization of the results. The Zittau workshops are aimed to field measurements of basic physico-chemical parameters (such as temperature, pH-value, electrical conductivity and dissolved oxygen content), of water, water sampling and hydrochemical laboratory analyses. Finally, the Prague workshops address the hydrological, hydrobiological, botanical and ecotoxicological aspects of the spring ecosystems.

The methods learned during workshops have been thoroughly employed by students in their own spring studies. The topics of the student work include searching, mapping, pre-screening of more than 100 springs and pre-selection of the 40 springs for detailed studies, fieldwork and water sampling, hydrochemical and hydrobiological laboratory work on analyses of water, biota and sediment, elaboration of historical and land-use aspects of spring ecosystems, and innovative visualization approaches in field and desktop GIS applications.

Educational events

The main activities of the “Prameny spojují/Quellen verbinden” project include workshops and summer schools, where their participants elaborate various theoretical and practical topics of their theses or study exercises. These workshops differ from summer schools in duration (3 days versus 6 in summer schools) and focus. Whereas the workshops address more thoroughly a selected set of topics upon the prevailing competence of the host institution, the summer school aims to provide a comprehensive summary of the research approaches applied in the spring research. Both types of events strongly emphasize practicing, fieldwork, learning by own experience and inter-institutional cross-collaboration in student teams.

Until now, three workshops and one summer school were implemented. Other three workshops and one summer school are planned until the end of the project in January 2019.

The first workshop was called “Surveys of Springs” and took place in Zittau from 12 to 14 June 2016. It was focused on methods of collecting field data about springs, training with various types of measurement devices and performing simple chemical analyses of water in the IHI laboratory. In addition to the hydrochemical laboratory facilities, the meteorological station and monitoring devices of meteorological, soilwater and groundwater data were presented. The workshop was attended by a total of 14 participants.

The second workshop was called “Springs are alive” and took place in Prague from 20 to 22 October 2016. The workshop was focused on the methods of studying living organisms in springs and their ecosystems and the research of relationships between living organisms and chemical parameters of water (such as water quality and pollution). Participants have practiced distinguishing between different types of plants, algae and cyanide bacteria as well as monitoring and capturing of benthic organisms living in the spring ecosystems and their identification in microscopic laboratories. Part of the workshop was also devoted to laboratory determination of potentially toxic metals in the selected organisms and in sediment. The workshop ended with a final team competition, attended by 29 participants.

The third workshop was called “Land of Springs” and took place from 6 to 8 April 2017 in Liberec. The central theme of the workshop was the influence of geography on springs, in particular the influence of geology and relief on the one hand and the influence of human use on spring landscape and ecosystems on the other hands. Students learned to recognize the relationships between the geological subsoil, the relief forms and the localities where the springs are located. They also practiced how to describe the human influence on the spring area sites, explore the human attitudes to water resources by the means of mental mapping, and visualized their results using ArcGIS Online. The workshop was again wrapped-up by a final team competition, with a total of 27 participants.

Fig. 1. Practical education in geology in framework of the summer school.
Source: Martin Mašek

The first summer school was named “Summer school with springs” and took place from 17 to 22 September 2017 in Heřmanice (Jablonné v Podještědí municipality), Zittau and Prague. The aim of the summer school was to present in an overall manner all the above-mentioned activities, with emphasis on attractive educational approaches, fieldwork and mini-project-cooperation in student teams. The student mini-projects included first mapping of selected sources, measurement of their parameters, and sampling of water and biota. In the improvised laboratories in the accommodation in Heřmanice, biota samples were analysed, water and sediment samples were analysed in laboratories in Zittau and Prague, where students learned basic methods. All obtained data were stored in the GIS, and the results were finally presented in the form of team mini-projects. A total of 15 students attended the summer school.

Cross-border educational aspects

The project “Prameny spojují/Quellen verbinden” has established a sustainable cross-border cooperation of two neighbouring regional institutions (IHI and TUL-Geography Department) that both have been developing educational programmes that focus on regional environmental aspects. Although both departments have been facing changes and adjustments of competences and programmatic structures in the very recent past, this project and its outcomes have created a sustainable platform for cooperation of both educational units and their students on topics related to environmental and geographical aspects of the transboundary region Liberec-Zittau. The platform has been supported by a variety of projects funded through the transboundary research and networking programmes such as Ziel 3 and Interreg.

Up to date, 6 Bachelor and 5 Master theses were carried out in the framework of these programmes at TUD-IHI, TUL and the respective project partners in Prague (Czech Technical University in Prague, Czech University of Life Sciences). All these have elaborated transboundary field data from both countries and provided a solid knowledge and cooperation base for further transboundary practical education in this region.

The importance of experiencing practical science for the training of university students is shown on example of this cross-border cooperation project. Higher education in various European countries, including the Czech Republic, records the decreasing of practical skills to conduct research of the individual scientific fields (Whittle et al. 2010). If students are involved in a project with a team of scientists, they can easily gain practical experiences from researchers directly and learn research habits in practical situations rather than just theoretical ones. This can be one of their motivations to further education and to better preparation for both further education and the post-graduate practice. The interdisciplinary focus of water spring research strengthens the students' awareness of the need for team communication and the nature of the involvement of scientific disciplines in solving practical tasks.

Case study

The final evaluation of the springs is not finished jet. To demonstrate methodology and results from field work we selected the Ploučnice spring (Vitvar et al. 2017).

The Ploučnice spring is situated in the Podještědí (Lower Ještěd region) and has already been marked on old maps (eg. Turnov 1951). Its original name in German language was “Polzenquelle”; the Czech name “Pramen Ploučnice” is referred as literal translation (Vitvar et al. 2017).

We provided geological and geomorphological field study of the surround area. The Ploučnice spring is situated in the Bohemian Cretaceous Basin, in the valley between Osečná and Janův Důl. The major sediment of surrounding is marine sand to fine grained conglomerate Turonian in age belonging to Jizera Formation. The valley itself is filled by Upper Pleistocene loess, right next to the spring are fluvial clay, sand and gravel. The whole area is fragile, deformed from northeast to southwest direction, which is indicated by short tectonic faults (Uličný, 2001).

Vegetation characteristics of the spring surroundings were studied using two methods: biotope description and fytocenological relevés, which were described in details in Vitvar et al. (2017). Ploučnice spring is characterized by a seminatural mixed montane sycamore-beech forest with dominant *Acer pseudoplatanus, Fagus sylvatica* and sporadically mixed with *Alnus incana* (Vitvar et al. 2017).

Macroinvertebrate samples were collected twice a year by a quantitative method. According to Vitvar et al. (2017), the most abundant macroinvertebrate species at the Ploučnice spring was freshwater shrimp (*Gammarus fossarum*).

Water samples were analysed in the TUD-IHI laboratory in Zittau, the complete and more precise results, see Vitvar et al. (2017). Physical parameters of water were measured in spot by Multimeter WTW Multi 3430. The water of Ploučnice spring is moderately mineralized (average conductivity is 242 µS/cm), with average pH is 7.21 and the average dissolved oxygen concentration is 8.6 mg/l. The major ions (NO_3^-, SO_4^{2-}, Cl^- and PO_4^{3-}) were analysed by Ion Chromatograph Dionex ICS-1100. The dominant ions in Ploučnice spring water is Ca^{2+} and HCO_3^-, the less abundant anion is SO_4^{2-} and Mg^{2+}.

The human geography analysis of springs was carrying out by semi-structured interviewing, studying archives and local fairy tales. Probably the best-known of story is about the peasant who drove up to the spring with horses harnessed to a fully loaded carriage; and since the spring was very deep he got drown in it (Interview with the mayor of Osečná, Jiří Hauzer, 26. 7. 2016; Interview with the mayor of Janův Důl, Jan Mašek, 26. 7. 2016). One of the local fairy tale is about a wicked waterman who drowned everybody who tried to poach in his water (Řeháček, 1997).

CONCLUSIONS

The project "Prameny spojují/Quellen verbinden" has high educational potential; altogether 85 students have participated in the project activities and have been practically trained. Most of the students continued in project activities during the whole year and experience and knowledge, gained by the project, have certainly complemented knowledge obtained during their regular studies. The students have also been working on their bachelor and master thesis, which are connected with project activities or with their field of study and experiences gained in scope of the project. Major added value should also be seen in cross-border and international scope of the project and its participants.

Acknowledgements: The described project is funded by the programme Interreg VA 5A SN-CZ 2014-2020, Nr. 101.002.497.391. "reg. č. 100249739 Prameny spojují krajiny a státy – environmentální vzdělávání a kooperace v regionu Liberec-Zittau" The authors thank all the Bachelor, Master and Ph.D. students and technicians of the partner universities for their support as well as the representatives of local authorities for collaboration on the interviews. Our thanks go also to Martin Mašek for providing the photography.

REFERENCES

ŘEHÁČEK, M. Vyprávění o strašidlech, přízracích a podivných úkazech nejsevernějších Čech. *Kalendář Liberecka*, Liberec, 1997. ISBN 80-238-3847-4

ULIČNÝ, D. Depositional systems and sequence stratigraphy of coarse-grained deltas in a shallow-marine, strike-slip setting: the Bohemian Cretaceous Basin, Czech Republic. *Sedimentology 2001*, DOI: 10.1046/j.1365-3091.2001.00381.x

VITVAR, T., KÄNDLER, M., ŠMÍDA J., KOMÍNKOVÁ, D., ŽENKOVÁ RUDINCOVÁ, K., DRÁPELA, E., ZÁGORŠEK, K., SOUČKOVÁ, L., BERCHOVÁ, K., BÍLÝ, M. & BÖHM, H. Springs connect people and landscapes – environmental education and cooperation in the region Liberec-Zittau. *ACC JOURNAL 2017, Volume 23, Issue 1.* 15-26. Technická univerzita v Liberci 2017 (ISSN 1803-9782)

WHITTLE Sue R.; PELL Godfrey & MURDOCH-EATON Deborah G. Recent changes to students' perceptions of their key skills on entry to higher education. *Journal of Further and Higher Education Volume 34, 2010 - Issue 4.* 557-570. Taylor and Francis Online, 27 Oct 2010. (ISSN 1469-9486)

http://quellen.tul.cz/ [30.10.2017]. © 2016 Technická univerzita v Liberci

Shrnutí

Technická univerzita v Liberci, Technická univerzita v Drážďanech - Mezinárodní postgraduální škola Zittau a Česká zemědělská univerzita v Praze v rámci projektu přeshraniční spolupráce “Prameny spojují/Quellen verbinden” aplikují do vzdělávání poznatky z geografického výzkumu. Projekt poskytuje zdroje a kapacity pro rozvoj, implementaci a udržování praktického vzdělávání studentů ze všech tří institucí v oblasti přírodních i humanitních věd.

Výzkum pramenů je zaměřen na geografické, geologické, hydrologické, chemické a biogeografické studium vody a okolí pramenů. Komplexní studium je prováděno společně se studenty bakalářského a magisterského stupně ze všech zapojených institucí. Celkem 85 studentů se doposud účastnilo projektových aktivit a bylo prakticky vyškoleno; navíc bylo vytvořeno 6 bakalářských a 5 magisterských prací.

Studenti zapojení do projektu jsou v kontaktu s týmem vědců a mohou od nich získávat praktickou zkušenost i návyky bádat a vědecky uvažovat, přímo v konkrétních praktických situacích, nikoliv jen těch teoretických. To vede jedna k jejich motivaci dále se vzdělávat, a také k lepší přípravě jak na další vzdělávací stupně, tak na praxi v období po absolvování univerzitního studia. Přidanou hodnotou pak je přeshraniční a mezinárodní dimenze projektu.

Na příkladu pramenu Ploučnice představujeme metodiku a předběžné výsledky našeho studia. Pramen Ploučnice se nachází v České křídové pánvi, čemu odpovídá i vápenato-hydrogenuhličitanová voda. Kolem pramenu převládají javory a buky, v prameni samotném žije nejčastěji blešivec potoční ze skupiny sladkovodních různonožců. Mimořádné postavení pramene Ploučnice, jako jednoho z nejvydatnějších pramenů ve střední Evropě, se projevuje mimo jiné i v množství legend a příběhů spojených s ním.

POSSIBILITIES OF AIR TEMPERATURE DATA PROCESSING FROM THE METEOROLOGICAL STATIONS IN BRNO AND SURROUNDING AREA

Karel Dejmal, Petr Kolář, Josef Novotný, Alena Roubalová

Department of Military Geography and Meteorology, University of Defence, Kounicova 65, Brno, Czech Republic

alena.roubalova@unob.cz

Abstract: Statistical analysis of air temperature variability in the Brno urban area is the aim of the work. Datasets from professional, institutional and amateur meteorological stations were utilized for the 2015–2016 period. Preliminary results include the evaluation of availability, reliability, and usability of amateur stations´ data. Air temperatures of selected meteorological stations were used in order to complete individual time series. Different approaches were compared and evaluated.

There are qualitative differences between stations due to the diversity of conditions of measurement and station parameters, mainly sensor placement, type of surface and spatial exposition. Five distinctive groups of stations were singled out following the evaluation of those parameters via cluster analysis. It was demonstrated that sensor placement and microclimatic conditions play a more significant role in air temperature measurement than basic physical-geographical factors (altitude, longitude).

Key words: air temperature, amateur meteorological stations, quality control, time and spatial interpolation, cluster analysis

1 INTRODUCTION

Data from meteorological stations serve for evaluation of climatic situation, but also to give information about current weather and predict its future course. In order to ensure maximum precision of the meteorological analysis, it is desirable to use a homogenous network of stations that is at the same time as dense as possible. Czech Hydrometeorological Institute (CHMI) operates over 800 meteorological and climatological stations that should meet the standards established by World Meteorological Organization (WMO). [1] [2].

In the Czech Republic there are numerous meteorological stations operated on amateur or semiprofessional level by either individuals or institutions (expert offices of universities, city organizations, etc.), that are interested to collect and make available their own station data. Weather information could be also obtained from Amateur meteorological society (AMS) that is in a long-term cooperation with CHMI, or directly from the owners of amateur meteorological stations. Their stations however often do not conform to the WMO standard and are typically differing in measuring conditions as well as quality of measuring instruments. The most influencing elements for air temperature measurement are among others sensor type and its placement (height, exposition, open/closed space), color, type and form of radiation cover, type of surface in the proximity of the sensor (natural/artificial) and the surroundings of the station in general (obstacles, surface diversity).

Besides meteorology and climatology, the air temperature records are used in other domains, such as transport and agriculture or integrated rescue system. The wide scope of climatological analyses gave base for a plurality of scientific studies, that not only deal with statistical evaluation of air temperature, but also describe different methods and drawbacks of data processing and point to the issue of non-standard meteorological stations [4] [5] [6] [7]. Many researches nowadays focus on the topical phenomena of heat island formation inside the city. Hand in hand with population growth, population density in cities and world urbanization rises the impact of urban environment on air temperature and other meteorological elements [8] [9] [10] [11]. An important stage in data processing is the control of their quality, consisting among others from definition of missing data periods, identification of errors in measurements and records. This phase is in longer-time series followed by series harmonization, which could be carried out through diverse statistical tests and instruments, described in several professional publications [12] [13]. While aiming to procure complete records, it is necessary to supplement those values that are either missing, or cancelled due to detected errors.

A dominant majority of publications, that for different objectives examine regional variability of air temperature, implements preferably data from professional meteorological stations or from special-purpose stations [5]. This work aims to appraise the usability of amateur stations as well, which might in ideal cases supplement the network of professional stations and thus contribute to a spatial refinement of status and course of weather, help characterize the microclimate of specific localities or analyze temperature extremes. Amateur meteorological stations have already been used for some studies abroad e.g. estimation of existence of heat island inside a city in the Netherlands, or in the USA, where they provided a more complex information of the current weather conditions for tourists via Internet [14] [15]. In the Czech Republic this is a first attempt to evaluate the potential and possible pitfalls of this kind of meteorological data.

2 DATA AND METHODS

For air temperature variability analysis in Brno and surrounding area in the period 2015–2016 were employed 18 meteorological stations, using maximum air distance of 25 km from the city center as a criterion of selection. Spatial distribution is demonstrated in Figure 1. It illustrates a non-homogenous group of stations within which could be spotted amateur stations (operated by individuals), as well as those operated by institutions of university or other character or the Czech Hydrometeorological Institute in professional mode (station Brno-Tuřany). A more detailed resume of the stations is contained in Tab. 1. Stations recorded data in various time steps that were converted into 1h step for consequent analysis.

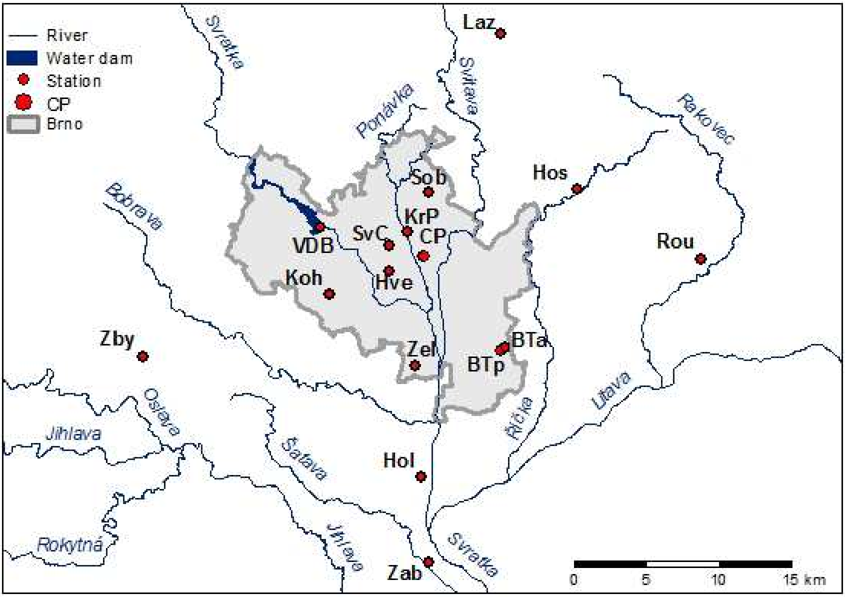


Fig. 1. Spatial localization of employed meteorological stations in Brno and surrounding area; abbreviations of station names are explained in Tab. 1 (CP – locality Černá Pole, containing a total of three stations – Met, Dav, Arb).

Quality control of the data was the first step of their processing. The air temperature course for every station was drawn in a monthly step. Consequently, this was supplemented by the air temperature course of the reference station BTp, which had been selected as the only professional station of the group. If accessible, interval minima and maxima of air temperature were then visualized. This subjective method was applied to identify the most frequent types of errors and most problematic stations. The resulting detection of suspicious values was based on the following objective parameters: (1) air temperature values fall outside the interval <-50;50> ^{o}C; (2) interpolated value (bilinear interpolation) from the 2 neighboring values differs from the real value by more than 15 °C (only counted if the time difference of the near observation times does not exceed 31 minutes); (3) occurrence of constant values – if there are at least 5 consecutive identical values within a 2h time window; (4) if the values of the controlled series differ from the reference series by more than 10 °C (only counted if the available time in the reference series does not exceed 20 minutes from the time of observation); (5) air temperature is lower that the dew point temperature (in case the dew point temperature is available); (6) air temperature is lower than minimum or higher than maximum air temperature (if those are available for the interval).

Tab. 1: List of used stations and their characteristics (station type: A – amateur, I – institutional, P - professional)

Station name	Abbr.	Station type	Altitude [m]	Measurement interval [min]
AMS Brno-Tuřany	BTa	A	242	60
ČHMÚ Brno-Tuřany	BTp	P	241	30
ČP Arboretum	Arb	I	247	15
ČP DAVIS	Dav	I	248	5
ČP METEOS6	Met	I	248	10
Holasice	Hol	A	199	5
Hostěnice	Hos	A	351	1
Kohoutovice	Koh	A	406	1
Královo Pole	KrP	A	256	5
Kraví hora	Hve	I	299	4
Lažánky	Laz	A	339	60
Rousínov	Rou	A	244	1
Soběšice	Sob	A	383	5
Svatopluka Čecha	SvC	A	253	10
VD Brněnská	VDB	I	236	60
Zbýšov	Zby	A	345	1
Žabčice	Zab	I	180	10
Želešice	Zel	I	220	60

Group of suspicious values was then finally evaluated and verifiable errors were removed from the series. The algorithm did not succeed in detecting all data, which were removed in the end. On the contrary, it pointed to many values that were probably correct. Problems occurred for example due to the atypical placement of sensors, where there was a big difference with regard to the reference series. Therefore, the data were not representative for a larger vicinity of the station, but only for the given atypical placement of the sensor (e.g. on the facade of the building). This led us to carry out a thorough field exploration of all stations, metadata collection, photographic documentation and geodetic measurement. A confrontation with valid meteorological standards [1, 19] brought about following findings:

1. occurrence of obstacles (such as buildings, trees) modifying the radiation and wind conditions within a distance of 4 times the height of the obstacle from the station,
2. the height of the temperature sensor over the ground surface
3. type of the radiative shield (w. shelter – wooden shelter, ? – parameter had not been found),
4. sensor location (such as open space, roof of a building, wall of a building – the sensor is positionned directly on the wall or at a maximum distance 50 cm),

5. type of ground surface (P – paved, G – grassy, M – paved + mixed in a distance < 5 m),
6. spatial exposure (no obstacles occur in the given direction).

The observed parameters are illustrated in tab. 2. No technical parameters were considered (sensor manufacturer, measurement accuracy, calibration frequency, etc.).

Tab. 2: Summary of parameters influencing the recorded air temperature data according to [1] and [19]

Station	Obstacles	Sensor height [m]	Radiative shield	Placement	Surface	Exposition [°]
BTa	YES	3,5	PVC box	wall	P	280–100
BTp	NO	2	standard	space	G	0–360
Arb	YES	2	standard	space	G	0–360
Dav	YES	1,7	standard	space	M	330–30
Met	YES	2	standard	space	M	330–30
Hol	YES	2	standard	space	M	360–180
Hos	YES	2	standard	space	G	260–80
Koh	YES	8,5	PVC box	wall	P	90–270
KrP	YES	2	PVC box	space	G	330–360
Hve	YES	10	PVC box	wall	M	315–45
Laz	YES	1,5	w. shelter	space	G	240–10
Rou	YES	2	standard	space	M	235–145
Sob	YES	2,3	standard	wall	P	210–240
SvC	YES	12	PVC box	wall	M	260–80
VDB	YES	1	?	space	G	0–180
Zby	YES	2,7	standard	wall	M	360–90
Zab	NO	2	standard	space	G	0–360
Zel	YES	4	?	space	M	300–120

Frequency of failures (Figure 2) is another indicator of data usage. It has been evaluated after the interpolation to whole hours was finished (see below), since some stations either recorded the data in such fixed observation times that never or rarely corresponded with whole hours (Laz), or were recorded in an irregular time step (Hve).

One of the possible ways to supplement the missing data is to apply a temporal interpolation from the existing data of the given series. The accuracy of interpolation depends not only on the interpolation method, but also on the period to which data are interpolated. For our case the selected interpolation method is bilinear interpolation from neighboring values. A main disadvantage of such method is its incapability to interpolate extremes. On the other hand, the fact that it does not generate unrealistic values is a clear benefit. Another method was considered to compare the accuracy – to take the last available value (value of the beginning of the given interval) and simply copy it to the place of the missing data. In order to estimate the expected accuracy of interpolation, a test of accuracy of above stated methods has been executed on stations with 1-minute data (Hos, Koh, Rou and Zby). The tests worked with different time intervals in between the given data up until a duration time of one hour. Interpolation was realized for all possible cases inside this interval. E.g. for a 5-minute interval we tested the interpolation accuracy of 1, 2, 3 and 4 minutes after the beginning of interval. All possible intervals of this length that could have been derived from the data, which offered a comparison between interpolated and real value, had been considered. The standardly applied characteristics were counted for the accuracy appraisal: RMSE (root mean square error) and values of 95% and 99% quantile of error (absolute value of difference). Consequently, a dependence of those characteristics on the time of day has been surveyed.

As there were several time outages longer than one hour that could not have been filled by interpolation, the values had to be estimated with the use of data from neighboring stations. An optimal number of most suitable stations had to be chosen for this calculation. A set of most similar stations was defined for each station. Appropriateness of stations for the calculation was assessed through: (1) coefficient of correlation, (2) standard deviation of value differences on the stations, (3) Euclidean distances from the cluster analysis and (4) geographic distance. Five stations were always selected on the base of those criteria [12]. We determined five air temperature estimates by adding the average difference between the calculated station and the given station for each of the five stations. The resulting air temperature estimate was done and presented on the average of these five estimates (no weights were considered). Similarly, other combinations of selection from these stations were tested - from four stations, omitting one of them, three and two most similar stations, and each of five stations individually.

This procedure has been applied on all data without distinction of time, but also individually for every hour of the day. The role of selection of stations individually for every hour in contrast to the selection based on all data and their use for whole day has also been subjected to a test. After the appraisal of interpolation accuracy (RMSE) for observation times with available observations, the best method as well as the optimal set of stations for every station was selected and missing values were calculated. In case the best combinations of stations could not have been used due to failures on one of them, the next best available combination was applied respecting the order of successfulness.

A cluster analysis was carried out on the common data of all stations in order to express the rate of relative similarity of air temperature time series from individual stations. The analysis figures among explorative multidimensional statistical techniques that are often used in climatology to define the climatic zones [e.g. 16]. In case of smaller territorial range the results of cluster analysis may serve for clustering of stations with similar standpoint or exposition conditions [17]. The aim is to reduce the total number of stations into several clusters, where the stations are as similar as possible and stations outside of a given cluster are as different as possible. The cluster analysis offers a larger number of possible ways to arrange the stations into clusters. Two methods were selected based on the recommendations provided by climatological studies [18] – non-hierarchical clustering via k-means and hierarchical clustering using Ward method. A quantified rate of difference is Euclidean distance that can be calculated between either individual clusters or among all stations. To ensure the representativeness of results from given methods only those hourly observation times were selected in the period 2016–2016, which disposed of available data from all stations (2 731 cases from possible 17 544). Software STATISTICA 12.0 was employed for data processing.

3 RESULTS

At least one piece of information was removed on 10 from 18 stations. This concerned stations Arb (0,38% values removed), BTa (1,68%), Hv (< 0,01%), Koh (2,87%), KrP (5,25%), Met (< 0,01%), Sob (0,19%), SvC (6,07%), VD (0,66%) and Zab (< 0,01%). Considering the stations with more than 1% of removed values (BTa, Koh, KrP, SvC), the most frequent cause of removal was the occurrence of constant values or continuous significantly varying data ended with an outage or abrupt change. In other stations it was mostly individual notably differing values. For some stations, in the case of measurement failure (or record failure), a defined value falling outside of the range of real values appears. Such value, e.g. in Arb station, was not identified until this control, which means it is not a result of faulty measurement but measurement failure.

The most missing data appears in station Zel, as this station started measuring in 2016 (Fig. 2). More than 10% of data is also missing in stations BTa, KrP, Koh, Laz and Dav. Only station BTp and thanks to the temporal interpolation Zby as well, show all data from the period 2015–2016 (17 544 values).

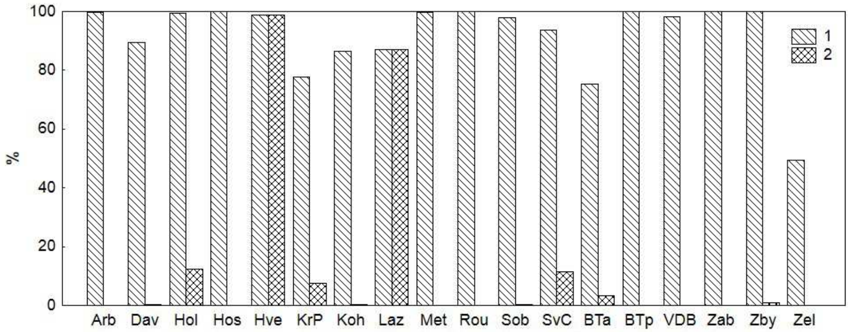


Fig. 2. Percentage of data completeness in time series (1) and ratio of temporally-interpolated values (2) from all theoretically possible hourly records in the employed meteorological stations in 2015–2016.

As far as the estimated accuracy of temporal interpolation, the results for individual stations are comparable with the exception of Koh, which demonstrated a significantly lower accuracy. This is evidenced in Figure 3, depicting maximum value of RMSE for interpolation within selected length of interval. Similarly, depending on the length of interval, maximum quantile (Q95, Q99) values rise as well. The worst results inside one time interval appear close to the middle of interval. The more the values approach to one of the limit values, the more rises the accuracy. Bilinear interpolation returns better results in comparison to the method of last available value, even for a point in time just a few minutes after this last available value has been recorded. If compared the dependence of characteristics (RMSE, Q95, Q99) on the time of day, the Koh stands out from the other stations again. The disparity appears not only in size, but also in time of occurrence of extreme values. For Koh the accuracy of interpolation augments from minimum values at night to its maximum between 6–8 PM, while rest of the stations encounter worst quality results around midday and then the characteristics gradually decline.

Temporal interpolation was applied to supplement missing values on full hours for all stations on such event, where the window between the available values around this hour was maximum 60 minutes and one of those values had been recorded maximum 10 minutes from the given observation time. On the base of above described tests on 4 stations the resulting estimated value of RMSE in the worst case is 0,2–0,3 °C, Q95 around 0,5 °C and Q99 0,8–1,0 °C. No value was filled with this technique on 7 stations from 18 (Figure 2). Apart from Hve and Laz stations that have not returned any recorded value exactly on the hour, more than 10% of possible data were calculated this way for Hol and SvC and more than 1% for KrP and BTa.

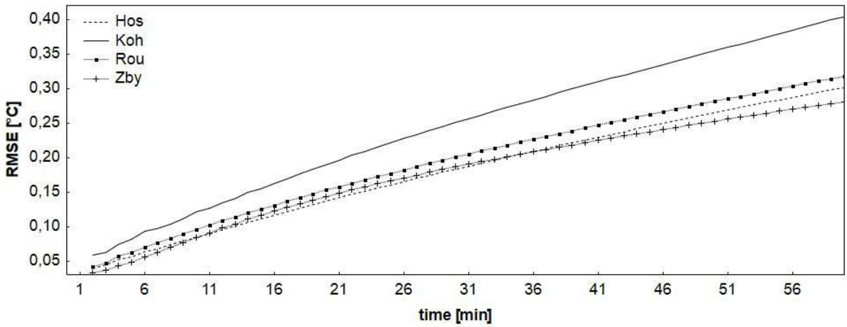


Fig. 3. Maximum values of RMSE time-interpolation of 2–60 minutes intervals for stations Hos, Koh, Rou and Zby based on data from 2015–2016 period.

Spatial interpolation helped to supplement all data. Calculation via mean difference of air temperatures without distinction to the time of a day turned out to be substantially worse than calculation with a link to every hour separately. The best criterion for the selection of stations proved to be the standard deviation (in 12 cases). Coefficient of correlation was more appropriate in 5 cases and in 1 case it was the Euclidean distance from the cluster analysis. The difference between using the same station for a whole day and individual selection of stations for every hour was not distinct (but individual selection was better in 15 cases). The optimal number of stations in two cases (closely placed stations Arb and Dav) was only one selected station. The rest of the possibilities (selection of 2, 3, 4 and 5 stations) appear to be the best 4 times each. RMSE would decline with the rising number of selected stations during elimination of cases of neighboring stations (Met, Dav, Arb).

Mean RMSE value amounts to 0,9 °C and ranges from 0,3 °C (Met) to 1,7 °C (KrP), mean value of Q95 is 1,9 °C (0,6–3,0 °C) and Q99 3,1 °C (1,3–7,2 °C). Results for the examined stations are therefore considerably worse than would correspond to the range of temporal interpolation. For example the result of spatial interpolation in the best station Met is comparable with temporal interpolation from the hourly interval on 30 minutes in the worst station Koh.

The results of cluster analysis prove that geographic distance of stations is not a crucial factor of shared variability in the air temperature data. A more notable impact could be attributed to the sensor placement (open space/wall, city/landscape) or microclimatic conditions. The group of 18 stations can be divided into five clusters through the application of k-mean method (1 – Laz; 2 – KrP, Rou, SvC, BTa, Zab; 3 – Zel; 4 – Hos; 5 – rest of the stations), while cluster no. 2 typologically corresponds to the stations with higher rate of data variability caused by placement on the walls of buildings (SvC, BTa), in the landscape (Zab) or at the periphery of a smaller city (Rou). The cluster no. 5 represents an inhomogeneous group of city stations with the exception of Zby that is however situated inside a former industrial area. Stations constituting autonomous clusters are located in places characteristic with specific microclimatic slope and valley conditions (Laz, Hos). Almost identical distribution of stations results from Ward method that additionally brings also the genesis of clustering. Analysis of clustering recommended such Euclidean distance, that divides the stations into 7 clusters (Figure 4).

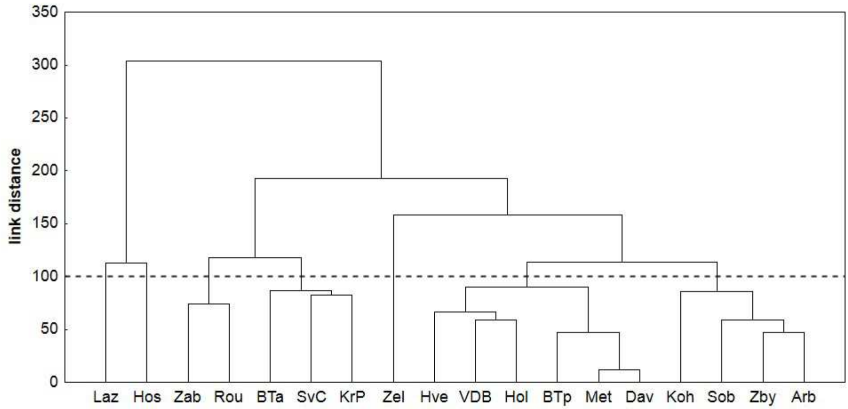


Fig. 4. Cluster analysis dendrogram for the set of meteorological stations in the period 2015–2016 from common hourly data of air temperature (dashed line illustrates the Euclidean distance for definition of individual clusters).

4 DISCUSSION AND CONCLUSIONS

The results of field survey confirm that the stations are typologically very diverse. The differences are induced by their different parameters resumed in tab. 2. Some of those parameters in the given urban setting influence the meteorological data more significantly than basic physical-geographical parameters (altitude, longitude, topography). This mostly concerns sensor location, type of surface and exposition. That is why it is very difficult to interpret data in sum and in context of other works [5, 9] to discuss, e.g. the issue of the city thermal island. A short period of time prevents the use of data for climatological purposes. Nevertheless, it is possible to present the basic statistical characteristics of the period 2015–2016 on the basis of complete time series, supplemented by temporal or spatial interpolation data (Figure 5). No significant discrepancies were found. Stations located at higher altitudes north of Brno (Laz, Hos) are cooler and the data are also affected by valley location of the stations compared to other stations. As far as urban stations, SvC could be labelled the hottest station, which is most likely due to the combination of sensor position on the wall of the building and the black radiant shield. Comparison of three nearby stations in Cerna Pole (Ard, Dav, Met) confirms that the physical distance or altitude is not the most important parameter within the analyzed stations' set. For a more detailed interpretation, it is necessary to analyze the data under specific meteorological situations (radiation x advection days, etc.) at different times of the day, which would be the aim of the following research issues.

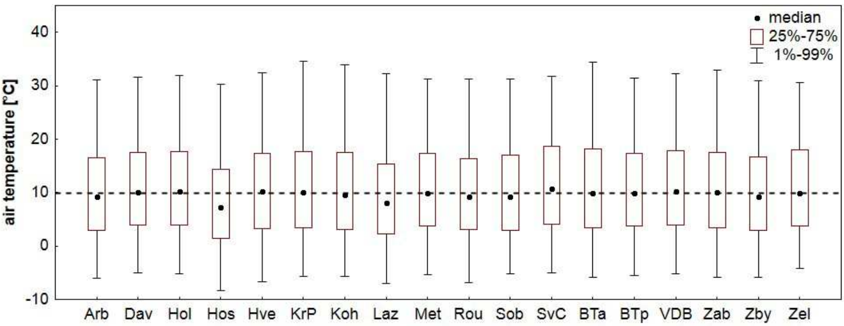


Fig. 5. Basic statistical characteristics of air temperature for individual stations in the period 2015–2016 (the dashed line corresponds to the average air temperature of the BTp reference station).

Temporal interpolation is a more appropriate method of adding missing values than spatial interpolation even for a set of nearest stations. It would be preferable to verify the suitability of both methods even in longer time intervals than one hour. The accuracy of time interpolation can be expected to deteriorate with increasing time intervals. At the same time, it is possible to test other temporal interpolation approaches (e.g. regression models). It was demonstrated that in the spatial interpolation from the given stations the key role plays a degree of stations' similarity which is given by the size of the standard deviation of the difference of values or the correlation dependence, and not geographical or Euclidean distance between stations. A different spatial interpolation provides better results for each daytime separately. It is also desirable to test the season's dependency. In most cases, it turned out to be better to limit the selection for less than five stations, which is a generally recommended number when working with professional station data.

The data from most stations located in open space could be used for further processing. Stations Zel, VDB and Laz, which are influenced by the type and placement of temperature sensor, are an exception. Data from amateur stations fixed on building walls are less usable than those from other stations, especially during radiation weather conditions and during winter season. As far as the number of outages, the number of corrected values and the location of the sensors, the following stations provide less usable data: Zel, KrP, SvC, Koh and BTa. This assumption was also confirmed by cluster analysis. On the other hand, different microclimatic conditions of the Laz and Hos stations are projected to the data, revealing the influence of the valley slope, or basin position of the stations.

Acknowledgement: This research runs in the collaboration with the project of specific research SV16-210/2. We would also like to thank all the individuals/institutions that participate in the project by providing meteorological data.

REFERENCES

[1] WORLD METEOROLOGICAL ORGANIZATION. Guide to meteorological instruments and methods of observation. 7th ed. Geneva, Switzerland, World Meteorological Organization, 2008, 716 p.

[2] AMS o. s. Amatérská meteorologická společnost [online]. AMS o. s., 2012 [cit. 2017-10-21]. Available from: http://www.amsos.cz/index.php?page=main

[3] ČHMÚ. Český hydrometeorologický ústav [online]. ČHMÚ, 2011 [cit. 2017-10-10]. Available from: http://portal.chmi.cz/

[4] BRÁZDIL, R., ŠTĚPÁNEK, P.: Kolísání teploty vzduchu v Brně v období 1891–1995. Geografie - Sborník ČGS, Praha, ČGS, 1998, 103, 1, p. 13–30. (in Czech)

[5] DOBROVOLNÝ, P. et al.: Klima Brna: víceúrovňová analýza městského klimatu. Brno, Masarykova univerzita, 2012, 202 p. (in Czech)

[6] NOSEK, M.: Teplotní poměry v Brně v období 1851-1950. Meteorologické zprávy, 1954, 7, 4, p. 101–107. (in Czech)

[7] QUITT, E.: Klima města Brna (rukopis). Diplomová práce. Přírodovědecká fakulta, Masarykova univerzita, Brno, 1957, 253 p. (in Czech)

[8] ELSAYED, I. S. M.: Effects of Population Density and Land Management on the Intensity of Urban Heat Islands: A Case Study on the City of Kuala Lumpur, Malaysia, Application of Geographic Information Systems, Bhuiyan M. A. (Ed.), InTech, 2012, 17 p.

[9] DOBROVOLNÝ, P.: The surface urban heat island in the city of Brno (Czech Republic) derived from land surface temperatures and selected reasons for its spatial variability. Theoretical and Applied Climatology, 2013, 112, 1–2, p. 89–98.

[10] OKE, T. R.: City size and the urban heat island. Atmospheric Environment, 1973, 7, 8, p. 769–779.

[11] VAN HOVE, L. W. A. et al.: Exploring the urban heat island intensity of Dutch cities. Assessement based on a literature review, recent meteorological observations and datasets provided by hobby meteorologists. Alterra report 2170, Wageningen, 2011, 60 p.

[12] ŠTĚPÁNEK, P.: Metodologie kontroly a homogenizace časových řad v klimatologii. Praha, Český hydrometeorologický ústav, 2012, 118 p. (in Czech)

[13] ŠTĚPÁNEK, P. et al.: Homogenization of daily air pressure and temperature series for Brno (Czech Republic) in the period 1848-2005. In Proceedings of the Fifth Seminar for Homogenization and Quality Control in Climatological Databases. Geneva, Switzerland, WCDMP-No. 71, WMO, 2009, p. 107–121.

[14] BRISTOW, R. S. et al.: Emergency Preparedness and Tourism: Both Win with Help of the Amateur Meteorologist. In: Peden, Schuster, J. G., Rudy, M. (eds.) Proceedings of the 2005 northeastern recreation research symposium; 2005 April 10–12; Bolton Landing, NY, 2006, General Technical Report, p. 135–139.

[15] WOLTERS, D., BRANDSMA, T.: Estimating the Urban Heat Island in Residential Areas in the Netherlands Using Observations by Weather Amateurs. Journal of Applied Meteorology and Climatology. 2012, 51, 4, p. 711–721.

[16] UNAL, Y. et al.: Redefining the climate zones of Turkey using cluster analysis. International Journal of Climatology, 2003, 23, 9, p. 1045–1055.

[17] PRAX, P. et al.: Měření, validace a analýza dlouhodobých dešťových řad v městském odvodnění. VUTIUM, Brno, 2010, 108 p. (in Czech)

[18] KALKSTEIN, L. S. et al.: An evaluation of 3 clustering procedures for use in synoptic climatological classification. Journal of Climate and Applied Meteorology, 1987, 26, 6, p. 717–730. https://doi.org/10.1175/1520-0450(1987)026<0717:AEOTCP>2.0.CO;2

[19] LIPINA, P., ŽÍDEK, D.: Návod pro pozorovatele meteorologických stanic: Metodický předpis č. 13, verze č. 2. Český hydrometeorologický ústav, Praha, 2014, 96 p. (in Czech)

Shrnutí

Data z meteorologických stanic představují důležitý podklad k vyhodnocování klimatických poměrů, podávání informací o aktuálním počasí, a také pro jeho predikci. V České republice je velký počet meteorologických stanic provozován nejen oficiálně Českým hydrometeorologickým ústavem, ale i na amatérské či poloprofesionální bázi buď jednotlivci, nebo institucemi (odborná pracoviště vysokých škol, městské organizace, apod.) se zájmem o sběr a dostupnost vlastních staničních dat. Jejich stanice se však často vymykají platným standardům a je pro ně typická různorodost podmínek měření a kvality měřících přístrojů. Na měření teploty vzduchu má mj. značný vliv typ čidla a jeho umístění (výška, expozice, otevřený/ uzavřený prostor), barva, typ a podoba radiačního krytu, dále druh povrchu v blízkosti čidla (přírodní/ umělý) a celkové okolí stanice (překážky, různorodý povrch).

Analyzovaná data 18 meteorologických stanic byla podrobena subjektivní i objektivní kontrole naměřených údajů. V rámci terénního šetření byla každá stanice zdokumentována s důrazem na sběr relevantních metadat. Teplota vzduchu byla zpracována v hodinovém kroku s tím, že chybějící údaje byly doplněny algoritmy časové či prostorové interpolace. Standardními nástroji (RMSE) byla zhodnocena vhodnost jednotlivých metod. Prostřednictvím shlukové analýzy a z ní plynoucích euklidovských vzdáleností se kvantifikovala míra podobnosti dat všech stanic.

Časová interpolace se jeví jako vhodnější metoda doplnění chybějících hodnot než interpolace prostorová. Bylo by vhodné ověřit vhodnost obou metod i v delších časových intervalech. Zároveň se nabízí testování jiných přístupů časové interpolace (např. regresní modely). Bylo prokázáno, že při prostorové interpolaci z daných stanic hraje primární roli míra podobnosti stanic daná velikostí směrodatné odchylky rozdílů hodnot teploty vzduchu či těsností korelační závislosti, nikoliv vzájemná vzdálenost stanic. Lepší výsledky poskytuje odlišná prostorová interpolace pro každou denní dobu zvlášť. Je žádoucí otestovat i závislost na sezóně. Ve většině případů se ukázalo jako lepší omezení výběru na méně než pět stanic, což je obecně doporučený počet při práci s daty profesionálních stanic.

Údaje z amatérských stanic umístěných na stěnách budov jsou hůře využitelné než ze stanic ostatních, zejména pak při radiačním typu počasí a během zimního období. Z hlediska množství výpadků, počtu opravených hodnot a umístění čidel lze za hůře využitelné označit tyto stanice: Zel, KrP, SvC, Koh a BTa. Toto vymezení se potvrdilo i na základě výsledků shlukové analýzy. Na druhou stranu se v datech promítají odlišné mikroklimatické podmínky stanic Laz a Hos, kde je patrný silný vliv údolní svahové, resp. kotlinové polohy stanic.

WATER REGIME AND PREDICTION OF ITS IMPACT ON RIVER CROSSING IN DIFFERENT TYPES OF ZONAL LANDSCAPE

Filip Dohnal, Marian Rybanský, Kateřina Šimková

Department of Military Geography and Meteorology, Faculty of Military Technology, University of Defence in Brno, Kounicova 65, 662 10 Brno

filip.dohnal@unob.cz

Abstract: The main goal of the army is defence of the state, the fulfilment of which requires state-of-the-art technologies. Terrain analyses are one of the basics. The landscape affects almost everything and the water is its important element. From the military point of view, watercourses are considered as significant operational obstacles. The characteristics of watercourses, especially the water regime, are dependent on latitude and altitude, but also on the climatic conditions of the areas through which the rivers flow. On the basis of a publicly available database with hydrological data, an analysis was made of the river characteristics in different types of zonal landscapes. The water regime should develop very similarly over the course of the year. This hypothesis was partially verified using the statistical methods. The main goal is approximate prediction of the water regime in different seasons of the given type of zonal landscape.

Key words: water regime, zonal landscape, trafficability, river.

1 INTRODUCTION

The landscape sphere represents a complex unite that includes a sphere of physical-geographical (natural) and human-geographic sphere [3]. Both of these spheres include several components that bind to one another, intertwine with each other, and interfere with each other. The physical-geographic sphere includes lithosphere, atmosphere, hydrosphere, cryosphere, pedosphere, and biosphere [3], [15]. Lauermann and Rybanský (2002) describe the landscape as a complex unite, which is created by interaction, intertwining and influencing the lithosphere, the hydrosphere, the pedosphere, the lower part of the atmosphere, the biosphere and the socio-economic sphere. This fact agree with creating the various landscape classifications around the world, e.g. Köppen climate classification [18], Holdridge life zone system [9], Trewartha climate classification [4], Köppen-Geiger climate classification [11], Whittaker biomes classification [18], Lvovič river types [3], Guilcher or Demek river classification [3] (see chapter 3).

From the previous definitions we can clearly state that one of the basic and the most important components of the landscape is the hydrosphere (water). In the nature, the water can be find in all three states and it is in constant cyclical circulation – the hydrological cycle, which is represented as a system. Based on this system, we can, according to Chow et al. (1988) or according to Brutsaert (2005), divide the water into atmospheric water, surface water, and sub-surface water. Landscape development is directly dependent on the intensity of river processes and the development of the river network where flowing water is the main contributor [3].

The landscape has always had a significant influence on the work of the military troops, and therefore it has become the subject of exploring military geography, which ranks among military science disciplines. Effective military tasks require a variety of analyses, including landscape analysis (terrain analysis). One of the field analyses, which deals with the influence of geographic factors on the movement of military technologies, is terrain analysis [12].

2 THE IMPACT OF LANDSCAPE ON THE VEHICLE MOVEMENT

Terrain trafficability, the ability to overcome objects and terrain obstacles, always belonged to the interests of the world armies. Knowledge of the behaviour of the landscape, knowledge of landscape features and their interrelationships certainly had and still has an effect on the outcome of military operations, so the issue of terrain trafficability was primarily solved in the framework of military unites.

Cross-country movement can be defined as the degree of technical competence of specific vehicles to move around obstacles and overcome various geographic objects and phenomena [14].

When evaluating geographic objects and phenomena affecting terrain trafficability, we focus on [6] [7] [12] [14] [16]:

- relief,
- vegetation,
- soils,
- climatic condition,
- waters,
- settlements,
- communications.

The factors are closely related and interact with each other to a certain extent. The resulting ability of the vehicle to move on the terrain surface is a function of all factors including the maximum vehicle speed [12].

Another definition states [5] that cross-country movement is driving through terrain, where the terrain is not adapted to automobile traffic. When evaluating terrain trafficability, this publication focuses on:

- relief (slope),
- soils,
- vegetation,
- climatic conditions,
- surface roughness.

Focusing on the land water, the analysis of terrain trafficability assesses the possibility of overcoming water barriers, including watercourses, waterways and water areas. Water obstacles can be overcome by barking, cruising or using special technical equipment (pontoon bridges). Factors that enter evaluation of drainage overcome are: depth, width, flow rate, flow, and climatic influences [13]. If we only deal with watercourses and their influence on the assessment and forecasting of trafficability in a global concept, it is not necessary to evaluate the factors mentioned in the previous sentence individually but generally as the effect of water regime to overcome watercourses.

3 TYPES OF WATER REGIME OF THE RIVERS IN CONNECTION WITH THE REGIONALIZATION OF LANDSCAPE TYPES

The water regime generally reflects changes in hydrological characteristics during the period of time (daily, monthly, yearly water regime) and depends on the effects of many factors, including climatic conditions, source of water (atmospheric precipitation, melting snow or melting glacier) or altitudinal zonation.

The regionalization method has resulted in a number of climatic classifications that divide the area by selected factors. By geographers, meteorologists and climatologists the most widely used climate classification is the Köppen climate classification [18]. This classification system is a combination of latitude, average annual temperature and average annual rainfall, and is made up of 5 major climatic types and several other subtypes that reflect seasonal changes in temperature and precipitation. Just rainfall and temperature in a certain period of time predetermine the water regime of rivers. Another classification was made by eg Strahler, who proceeded to compile the classification similarly to Köppen [15].

The water regime of rivers depends not only on climatic conditions, but also on vegetation distribution. Whittaker (1975) classified 21 so-called biomes (biome types) that correspond to climatic zones (i.e. annual rainfall and annual temperature) and vegetation structure [18].

For example, in 1964, M. I. Lvovič distinguished 38 types of water regime of rivers [3]. In 1965, Guilcher created the classification of river types according to their regimes. In this classification, we find 13 types of rivers [3]. Demek (1975) identified the main types of rivers according to the water regime resulting from the law of the zonal climatic belts as follows:

1. Polar type – melting of polar icebergs and snow water are involved in the supply of rivers during a short summer; most of the year the rivers has frozen surface or are frozen down to the bottom.
2. Subarctic type – mainly snow melting water is involved in the supply of rivers, the underground spring causes the largest flows in the summer; in wetlands, summer precipitation together with the snow water cause summer floods; subsurface waters contribute very little, in the winter there are frozen down to the bottom even great rivers.
3. Temperate type in which we distinguish the following subtypes:
    a) with the predominance of spring water supply caused by melting of the snow cover,
    b) with the predominance of water supply caused by rainfall with the biggest flow in the spring, both due to the numerous rains in this season, and the melting of the snow cover,

c) with the predominance of water supply caused by rainfall in the winter, with a more or less even distribution of rainfall during the year,

d) with the predominance of water supply caused by rainfall in the summer due to monsoons.

4. Subtropical (Mediterranean) type with the predominance of water supply caused by winter rainfall.
5. Tropical type with the predominance of water supply caused by rainfall in summer; summer abundant rainfall prevails over evaporation, and floods combine and cause a high flood wave; in the rest of the year the flow is small.
6. Equatorial type, in which rainfall is abundant throughout the year and supplies water flows evenly, although the largest flow is in each hemisphere in the autumn.

The water regime of the rivers is a reflection of several factors, of which the nature of the climate in the region has a very significant impact. As well as various climatic classifications or classification of terrestrial biomes, the classification of river water regimes has also emerged. In all these classifications, the effect of latitude, rainfall, or air temperature is projected. Arms (1990) expressed the relationship between climatic characteristics (temperature and humidity-precipitation) and terrestrial biomes [18].

4 PREDICTION OF THE IMPACT OF THE RIVER WATER REGIME ON OVERCOMING THE WATERCOURSES

4.1 Input assumptions

An analysis of the prediction of the impact of the river water regime on overcoming the watercourses has been done using hydrological database managed by the Global Runoff Data Center (GRDC) in Germany. GRDC collects and archives flow data from over 9300 profiles from around the world. Part of the database data can be obtained from the UNH / GRDC Composite Runoff Fields v1.0 international project (http://www.grdc.sr.unh.edu/index.html). For analysis, data from this database (1340 profiles) were used because they have a more user-friendly form of writing. Long-term average monthly flow Q_{am} [$m^3 \cdot s^{-1}$] and long-term average annual flow Q_a [$m^3 \cdot s^{-1}$] (taken as normal) at measuring stations spread over watercourses in different climatic areas became the key hydrological information. The purpose of the whole analysis is to verify the hypothesis that in the given climatic area the water regime should show similar development on individual river measuring profiles during the year. The analysis is focused only on the influence of the climate factor on the water regime of the rivers (in this case the regime of discharge) and on the influence of the discharge regime on the prediction of the possibilities of a watercourse overcoming in the different climatic areas.

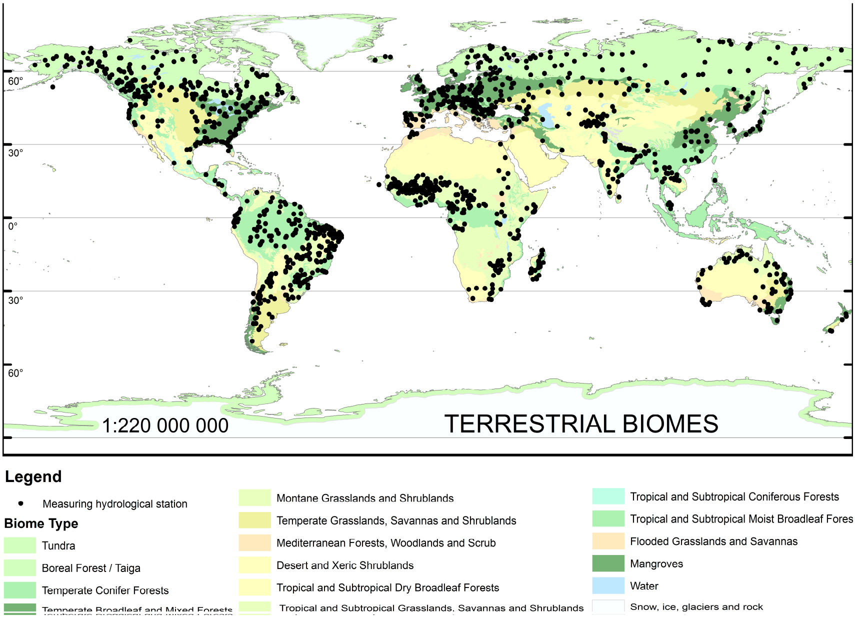


Fig. 1. Terrestrial Biomes.
Source: http://www.grdc.sr.unh.edu/index.html

4.2 Verification of the hypothesis

To verify the hypothesis, raw data had to be edited firstly and redundant information removed. The geographic coordinates of the positioning of the measuring profile on the river are determined to the nearest thousandth of a degree [17]. For each measured profile, the long-term average monthly flow values Q_{am} and the long-term average annual flow values Q_a are known. Measured profiles were divided into two groups according to the position (in the northern or southern hemisphere) and further into 14 terrestrial biome classes (Figure 1) [17].

It is inappropriate to use the absolute values of long-term monthly flows to compare drainage regimes of individual rivers in a given biomes. For this purpose, it is more appropriate to divide the individual long-term average monthly flows Q_{am} and the long-term average annual flow Q_a expressed in the decimal number d_{Qm} (Formula 1):

$$d_{Qm} = \frac{Q_{am}}{Q_a} \tag{1}$$

where $m = 1, 2, \dots, 12$ represents the month (from January to December).
For each biome, the average values of individual monthly dividing d_{TBm} were also calculated as the arithmetic mean of all d_{Qm} measured profiles in a given biome (Formula 2). The river regime of discharge expressed this way then has

become representative for each biome (separately for the northern and southern hemispheres).

$$d_{TBm} = \frac{1}{n} \cdot \sum_{i=1}^{n} d_{Qim} \tag{2}$$

In formula (2), *m* represents, as in the previous formula, the month and *n* the number of stations in the given biome.

Correlation coefficients *R* determining the degree of linear dependence between the regime of discharge of individual measuring profiles (expressed by d_{Qm}) and the representative regime of discharge of the given biome (expressed by d_{TBm}) were calculated using the correlation analysis. Using the interpolation of the point value of the coefficient *R* by the Inverse Distance Weighting (IDW) method, the correlation coefficient is distributed to the plane.

Interpolation have revealed it is possible to observe the areas that contain the measured profiles which are characterized by a regime of discharge non-linearly dependent or almost without any dependence on the representative regime of discharge of the given biome (South and West coast of North America, Northwest and Northeast coasts of South America, southern part of South America, Western Europe, South and Central Africa, Eastern China, Southeast Asia, Southeast coast of Australia or New Zealand). On the contrary, areas that are well correlated can be found.

To determine the validity of the hypothesis, a test with test criteria (Formula 3) was used to assess the degree of linear dependence:

$$t = \frac{R_{TB}}{\sqrt{1 - {R_{TB}}^2}} \cdot \sqrt{n-2} \tag{3}$$

where R_{TB} expresses the correlation coefficient of the given biome (calculated as the arithmetic mean of the correlation coefficients *R* in the given biome) and *n* the extent of the base dataset (in this case 12 months). Testing took place at a significance level of 0.05 with *n* -2 degree of Student Distribution Frequency (Formula 4) and the result of 2,2281 became the critical value in the test.

$$t_{0,05}(12-2) = 2{,}2281 \tag{4}$$

If

$$|t| > t_{0,05} \tag{5}$$

the hypothesis can be rejected due to the low linear correlation between d_{Qm} and d_{TBm}. This statement is valid for: Tropical and Subtropical Moist Broadleaf Forest, Temperate Broadleaf and Mixed Forests, Temperate Conifer Forests in Northern hemisphere, Temperate Grasslands, Savannas and Shrublands in Southern hemisphere and Desert and Xeric Shrublands in Northern hemisphere.

4.3 Predicting the impact of the river’s water regime on overcoming the watercourses

As already mentioned above, the overcoming of watercourses and other water barriers by vehicles always belonged to the activities of armies. Assessing the possibilities of overcoming the watercourses is itself a very complex issue. It depends on the knowledge of the individual factors and their interrelationships that affect the manoeuvre itself [13]. High-quality analysis of individual factors depends primarily on the availability of data sources and information.

To predict the impact of the river's water regime on overcoming the watercourses in a shorter period (in days), it is possible to use a variety of meteorological and hydrological outputs. In such an interval, the meteorological conditions in the area have the greatest influence on the regime of discharge. If it is a long-term prediction (weeks to months), it is necessary to use statistically processed data (climatic and hydrological).

The annual discharge is characterized by one characteristic that can predict the possibility of overcoming the watercourses in different climatic areas. This is the volatility or the degree of variability in long-term monthly flows during the year. One indicator that determines the rate of variation of the series of long-term monthly flows is the index K_r (Formula 6) [10].

$$K_r = \frac{\sum(|p_i - 8{,}3|)}{8{,}3} \tag{6}$$

In formula 6, the percentage of each of the months in the long-run average annual discharge is 8.3 and represents the average part of each month in the yearly discharge ($\frac{100}{12} = 8{,}3$). Assuming an ideally balanced discharge during the year, $K_r = 0$; assuming a maximum unbalanced discharge, when the yearly quantity of water discharges in a single month and for the rest 11 months the river will dry, $K_r = 22$. The increasing numerical value of K_r represents also the increase in the degree of river imbalance. Figure 2 shows the interpolation of index K_r by the IDW method.

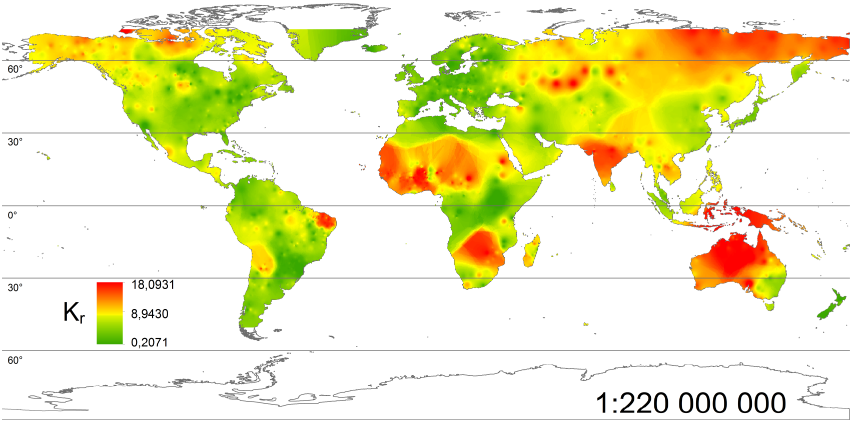


Fig. 2. Spatial distribution of index K_r.
Source: Filip Dohnal

From the point of view of the possibility of overcoming the watercourses, the high rate of water flow imbalance during the year appears to be a negative factor. The big change in discharge characteristics from normal state has a significant effect on the prediction of overcoming the watercourses in the area. On the other hand, the low level of imbalances and the slight monthly changes in discharge characteristics are not considered negative. Watercourses show stability and balance over the year, so the prediction of the ways to overcome them is more successful. Based on the distribution of the frequency of occurrence of the coefficients d_{TBm}, 5 classification grades were developed. They express the degree of influence of the regime of discharge on the prediction of the possibilities of overcoming the watercourses (Table 1).

Tab. 1: The degree of influence of the regime of discharge on the prediction of the possibilities of overcoming the watercourses

Category	d_{TBm}	Degree of impact	Recommendation
A	$d_{TBm} \leq 0{,}42$	significant	The period is more appropriate for overcoming the watercourses – possible freezing of water or drying of river.
B	$0{,}42 < d_{TBm} \leq 0{,}66$	considerable	The period rather unsuitable for overcoming the watercourses – knowledge of more detailed information is necessary.
C	$0{,}66 < d_{TBm} \leq 1{,}54$	no impact	The period suitable for overcoming the watercourses.
D	$1{,}54 < d_{TBm} \leq 2{,}34$	considerable	The period rather unsuitable for overcoming the watercourses – knowledge of more detailed information is necessary.
E	$d_{TBm} > 2{,}34$	significant	The period rather unsuitable for overcoming the watercourses.

Source: Filip Dohnal

In Table 2, the effect of the regime of discharge of watercourses on the ability to overcome water flows in a given month is shown for all biomes (separately for the Northern hemisphere and Southern hemisphere).

Tab. 2: The effect of the regime of discharge on the prediction of the possibilities of overcoming the watercourses for all biomes in Northern and Southern hemisphere (R^2 expresses coefficient of determination of prediction; *x* express "no available data")

Landscape type	R^2	Northern hemisphere Southern hemisphere											
		month											
		J	***F***	***M***	***A***	***M***	***J***	***J***	***A***	***S***	***O***	***N***	***D***
Tropical and Subtropical Moist Broadleaf Forest	0.3038 0.3223	B C	B C	B D	B D	C C	C C	C C	D B	D B	C B	C B	C C
Tropical and Subtropical Dry Broadleaf Forests	0.5963 0.5914	A D	A E	A D	A C	A C	B B	D B	E B	E A	D A	C B	B C
Tropical and Subtropical Coniferous Forests	0.8290 *X*	A *x*	A *x*	A *x*	A *x*	B *x*	C *x*	D *x*	E *x*	E *x*	C *x*	B *x*	A *x*
Temperate Broadleaf and Mixed Forests	0.2042 0.2937	C C	C C	C C	C D	C C	C C	C C	C B	C B	C C	C C	C C
Temperate Conifer Forests	0.2653 *x*	C *x*	C *x*	C *x*	C *x*	D *x*	D *x*	C *x*	C *x*	C *x*	C *x*	B *x*	B *x*
Taiga	0.5971 *x*	A *x*	A *x*	A *x*	C *x*	D *x*	D *x*	C *x*	C *x*	C *x*	C *x*	C *x*	B *x*
Tropical and Subtropical Grasslands, Savannas, Shrublands	0.6989 0.5523	A D	A E	A D	A C	A C	A B	C A	E A	E A	D A	C B	B C
Temperate Grasslands, Savannas and Shrublands	0.4885 0.0551	B C	B C	C C	D C	D C	D C	C C	C C	C C	B C	B C	B C
Flooded Grasslands and Savannas	0.7346 0.7205	B C	A D	A D	A D	B C	C C	C C	D B	D B	D B	C B	C C
Montane Grasslands and Shrublands	0.8499 0.4315	A D	A D	A C	B C	C C	C B	E B	E B	C B	C C	B C	A C
Tundra	0.8178 *x*	A *x*	A *x*	A *x*	A *x*	C *x*	E *x*	E *x*	D *x*	C *x*	C *x*	A *x*	A *x*
Mediterranean Forests, Woodlands and Scrub	0.7974 0.5473	C B	D A	D A	C A	C B	C C	B E	A E	A D	B C	C C	C A
Desert and Xeric Shrublands	0.2580 0.4460	B C	B D	C E	C E	C C	C C	C B	D A	C A	C A	B A	B C
Mangroves	0.8077 *x*	A *x*	A *x*	A *x*	A *x*	A *x*	A *x*	B *x*	D *x*	E *x*	E *x*	E *x*	C *x*

Source: Filip Dohnal

5 CONCLUSION

In the analysis of watercourses trafficability, we focus on assessing the impact of different watercourse characteristics (depth, width, stream velocity, character of the bottom, etc.). To predict the possibilities of overcoming the watercourses in the global concept, it is possible to use statistically processed data, which express the development of hydrological characteristics during the year. One of them is regime of discharge. Monthly changes in discharge characteristics can greatly affect the possibility of overcoming the watercourses.

The results of the analysis show that in the areas where climatic conditions are characterized by less annual variability, the rivers are characterized by a high degree of imbalance (high K_r coefficient). These are mainly the areas of Tundra, Taiga, Coniferous Forests, Subtropical Savanna and Temperate Savanna. Although the rivers are characterized by a high level of imbalance, reliability is rising in the prediction of the possibilities to overcome the watercourses. In areas where rivers have higher level of balance, however, reliability in predicting the possibility of overcoming the watercourses is declining. In these biomes, it is necessary to focus on assessing the possibility of overcoming the watercourses to other factors that affect the water flow regime (e.g. source of water).

Acknowledgement: The work presented in this paper was supported within the projects: "Development of the methods of evaluation of environment in relation to defense and protection of the Czech Republic territory" (Project code NATURENVIR) and "Analysis of impact of terrain surface, soils, hydrology and vegetation on the Cross-Country Movement – the support of the project "NATO Reference Mobility Model (NRMM)" and the geographical support of the Armed Forces of the Czech Republic" (Project code SV17-210).

REFERENCES

[1] BRUTSAERT, W., 2005. Hydrology: an introduction. 1st. New York: Cambridge University Press. ISBN 9780521824798.

[2] CHOW, V., MAIDMENT, D. and MAYS, L. 1988. Applied hydrology. 4th. New York: McGraw-Hill Book Co. ISBN 0-07-010810-2.

[3] DEMEK, J., QUITT, E. and RAUŠER, J., 1975. Úvod do obecné fyzické geografie. 1. vyd. Praha: ACADEMIA.

[4] FENG, S., HO, CH., HU, Q., OGLESBY, R. J., JEONG, S. and KIM, B., 2012. Evaluating observed and projected future climate changes for the Arctic using the Köppen-Trewartha climate classification. *Climate Dynamics*. **38**(7-8), 1359-1373. DOI: 10.1007/s00382-011-1020-6. ISSN 0930-7575. https://doi.org/10.1007/s00382-011-1020-6

[5] FM 5-33: Terrain Analysis, 1990. Washington, DC.: Headquarters, Depeartment of the Army.

[6] HOFMANN, A., HOŠKOVÁ-MAYEROVÁ, Š., TALHOFER, V. and KOVAŘÍK, V. Creation of models for calculation of coefficients of terrain passability. Quality & Quantity, 2015, vol. 49, no. 4, p. 1679-1691. ISSN 0033-5177. https://doi.org/10.1007/s11135-014-0072-1

[7] HUBÁČEK, M., KOVAŘÍK, V., TALHOFER, V., RYBANSKÝ, M., BŘEŇOVÁ, M. and ČEPLOVÁ, L., 2016. Modelling of geographic and meteorological effects on vehicle movement in the open terrain. In: Central Europe Area in View of Current Geography. 1st. Brno: Masaryk University, s. 149-159. DOI: 10.5817/CZ.MUNI.P210-8314-2016. ISBN 978-80-210-8313-4.

[8] LAUERMANN, L. and RYBANSKY, M., 2002. Vojenská geografie. Praha: Ministerstvo obrany ČR. ISBN 8023892746.

[9] LUGO, A. E., S. L. BROWN, R. DODSON, T. S. SMITH and H. H. SHUGART, 1999. The Holdridge life zones of the conterminous United States in

relation to ecosystem mapping. *Journal of Biogeography* [online]. 26(5), 1025-1038 [cit. 2018-01-18]. DOI: 10.1046/j.1365-2699.1999.00329.x. ISSN 03050270. Available http://doi.wiley.com/10.1046/j.1365-2699.1999.00329.x.

[10] NETOPIL, R., 1981. FYZICKÁ GEOGRAFIE - I.: Hydrologie – Limnologie – Oceánografie. První vydání. Praha: Státní pedagogické nakladatelství, n. p.

[11] PEEL, M. C., B. L. FINLAYSON and T. A. MCMAHON. Updated world map of the Köppen-Geiger climate classification. Hydrology and Earth System Sciences Discussions, European Geosciences Union, 2007, 11(5), pp. 1633-1644. https://doi.org/10.5194/hess-11-1633-2007

[12] RYBANSKY, M., 2009. Cross-country movement: the impact and evaluation of geographic factors. Brno: Akademické nakladatelství CERM. ISBN 9788072046614.

[13] RYBANSKY, M., The Impact of Drainage on Cross-Country Movement. In: Proceedings from International Conference on Military Technologies. Brno: University of Defence, Brno, 2011, p. 1371-1380. ISBN 978-80-7231-787-5.

[14] RYBANSKY, M., HUBÁČEK, M., HOFMANN, A., KOVAŘÍK, V. and TALHOFER, V., The Impact of Terrain on Cross-Country Mobility – Geographic Factors and their Characteristics. In: Proceedings of the 18th International Conference of the ISTVS, Seoul, Korea, 2014. Seoul, Korea: Seoul National University, Seoul, Korea, 2014, p. 1-6. ISBN 978-1-942112-45-7.

[15] STRAHLER, A., 2011. Introducing physical geography. 5th ed. Chichester: John Wiley. ISBN 978-0470-13486-3.

[16] TALHOFER, V., HOFMANN, A., KRATOCHVÍL, V., HUBÁČEK, M. and ZERZÁN, P. Verification of Digital Analytical Models: Case Study of the Cross-Country Movement. In: 2015 International Conference on Military Technologies (ICMT). Brno: University of Defence, 2015, p. 203-209. ISBN 978-80-7231-976-3.

[17] UNH/GRDC: Composite Runoff Fields V 1.0 [online database], 2000. [2016-07-13]. Available http://www.grdc.sr.unh.edu/index.html.

[18] WARD, A. and TRIMBLE, S., 2004. Environmental hydrology. 2nd ed. Boca Raton, FL: Lewis Publishers. ISBN 1-56670-616-5.

THE SIGNIFICANCE OF HISTORICAL LANDSCAPE STRUCTURE IN SOUTH MORAVIA FOR THE PROTECTION OF THE LANDSCAPE, LANDSCAPE FUNCTION AND THE PROTECTION OF AGRICULTURAL LAND RESOURCES

Marek Havlíček[1], Hana Skokanová[1], Bořivoj Šarapatka[2], Renata Pavelková[2], Patrik Netopil[2]

[1] The Silva Tarouca Research Institute for Landscape and Ornamental Gardening, Lidická 25/27, 602 00 Brno, Czech Republic
[2] Faculty of Science, Palacký University in Olomouc, 17. listopadu 1192/12, 771 46, Olomouc, Czech Republic
marek.havlicek@vukoz.cz

Abstract: The paper focuses on identification of rare landscape structures in model areas of South Moravia with traces of traditional and regionally conditioned ways of farming, assessment of their significance in the protection of agricultural land resources, environmental protection, and provision of eco-system services. The potential of future use of these areas, the possible sustenance of traditional ways of farming, or the possible renewal of extinct landscape structures are other key topics of the paper.

The aim of the paper is to find the answers to the following research questions: What are the surviving rare historical landscape structures in the model areas with respect to the categories of land use, how are they being currently managed? How are the surviving historical landscape structures in the model areas protected in the view of the environmental and landscape protection? What are the options of renewal of historical landscape structures?

Key words: historical landscape structure, landscape function, environmental protection, protection of agricultural land resources

INTRODUCTION

Historical landscape structures are a significant phenomenon of cultural landscape in which the historical way of land use is recorded; they also make the landscape features specific (Muchová, Petrovič, 2014; Atik, Işıklı, Ortaçeşme, 2016). Many historical landscape structures have survived in Central Europe, which are currently being mapped using old map resources, remote land survey, detail terrain models, terrain research and research of archive materials (Šantrůčková et al., 2016). In the view of maintaining biodiversity in agricultural landscape (Skokanová et al., 2016) and sustainable land farming (Stejskalová et al., 2012; Pašakarnis et al., 2013; Dumbrovský, Larišová, 2016), it is necessary to maintain or to restore rare landscape structures with the traditional ways of farming (Hreško et al., 2015; Petrovič et al., 2017). While assessing the historical structures of South Moravia (Czech Republic), the focus was placed mainly on traces of traditional and regionally conditioned ways of farming – the structure of arable land, meadows, orchards, pastures, gardens, hop gardens, vineyards, and baulks (Amici et al., 2017, Špulerová et al., 2015; Súľovský et al., 2017). The issue of historical water management – fishponds, pond systems, drives, dykes, reservoirs - was also dealt with in this dry area (Fairchild et al., 2013; Havlíček et al., 2014; Pavelková et al., 2016).

It is possible to map historical landscape structures in Europe using old topographic maps which can be used in the GIS if they date from the 1850s (Skokanová et al., 2012; Kanianska et al., 2013), using detailed cadastre maps (Skaloš, Engstová, 2010; Hanušin, Štefunková, 2015) or using aerial shots which have been available for Central Europe since the 1930s (Mojses, Petrovič, 2013; Šebo, Kopecká, 2014; Skokanová et al., 2016).

The paper aims at identifying the rare landscape structures in the typical hilly areas of Central Europe which bear traces of traditional and regionally conditioned ways of farming, assessing their significance in the view of agricultural land resources protection, environmental protection, and provision of eco-system services. The potential of future use of these areas, the possible sustenance of traditional ways of farming, or the possible restoration of extinct landscape structures are other key topics of the paper.

The aim of the paper is to find the answers to the following research questions:
What are the surviving rare historical landscape structures in the Kyjovská pahorkatina Hilly Land with respect to the categories of land use, how are they currently being managed?
How are the surviving historical landscape structures of the Kyjovská pahorkatina Hilly Land protected with respect to the environmental and landscape protection?
What are the options of restoration of historical landscape structures in the Kyjovská pahorkatina Hilly Land?

METHODS

Materials and methods

The historical development of the landscape structures of larger territories can be assessed on the basis of old topographic maps of the medium scale (Skokanová et al., 2012). The authors used the maps from the following surveys to assess the model area of South Moravia represented by the Kyjovská pahorkatina Hilly Land: the 2nd Austrian Military Survey 1 : 28 800 (1836-1841), the 3rd Austrian Military Survey 1 : 25 000 (1876), the Czechoslovak topographic maps 1 : 25 000 (1953-1955), the Czechoslovak topographic maps 1 : 25 000 (1991), the Base maps of the Czech Republic 1 : 10 000 (2002-2006) and orthophotomaps from 2016. The land use was divided into nine categories in the assessment of important historical changes of the landscape development of the Kyjovská pahorkatina Hilly Land: arable land, permanent grassland, garden and orchard, vineyard, forest, water area, built-up area, recreational area, other areas (Skokanová et al., 2012). The procedure of creating maps of landscape use applies the unified method valid for the whole Czech Republic in which the smallest map unit is of 0.8 ha and the minimum width of individual polygons is 40 m. A more detailed landscape structure was studied using the maps of the stable cadastre in the scale 1:2880 from 1827, the sets of archive aerial shots from 1953 to the present day, using field survey and available photographs of particular areas of interest picked on the basis of an assessment of landscape macrostructure in maps of the medium scale.

Study area

The Kyjovská pahorkatina Hilly Land belong among the typical farming areas of South Moravia with a large scale of areas of arable land in large land blocks, with large areas of large-scale vineyards and orchards and small scale of forested areas, permanent grasslands and water areas. The Kyjovská pahorkatina Hilly Land cover the whole of 487 km^2. This geomorphological unit is located in South Moravia and extends into four districts (Hodonín, Uherské Hradiště, Břeclav and Zlín). It is an indented hilly area with an average height of 235 m and a medium slope of 3 ° 30 ', with hollow and trough-shaped valleys and the distinctive Čejč basin (Demek, Mackovčin, et al., 2006). The Kyjovská pahorkatina Hilly Land peak called Babí lom is at 417,2 m.a.s.l. The lowest point is 169,5 m.a.s.l. The rugged surface of the Kyjovská pahorkatina Hilly Land is also evidenced in the distribution of individual slope categories: the most common are medium slopes of 5° to 10° (31.7% of the area) with optimum uses as vineyards, orchards, forests or pastures; slight slopes of 2° to 5° (32.5%) with optimum uses as arable land, built-up areas, orchards, recreational areas; flat areas in river and stream meadows, planes, planar parts of terraces of 0° to 2° slope (29.3%) with optimum uses as arable land, floodplain forests, water-meadows, water areas, orchards and vineyards on terraces, larger slopes of 10° to 15° cover only 5.5% of the area and its optimum use is a forest.

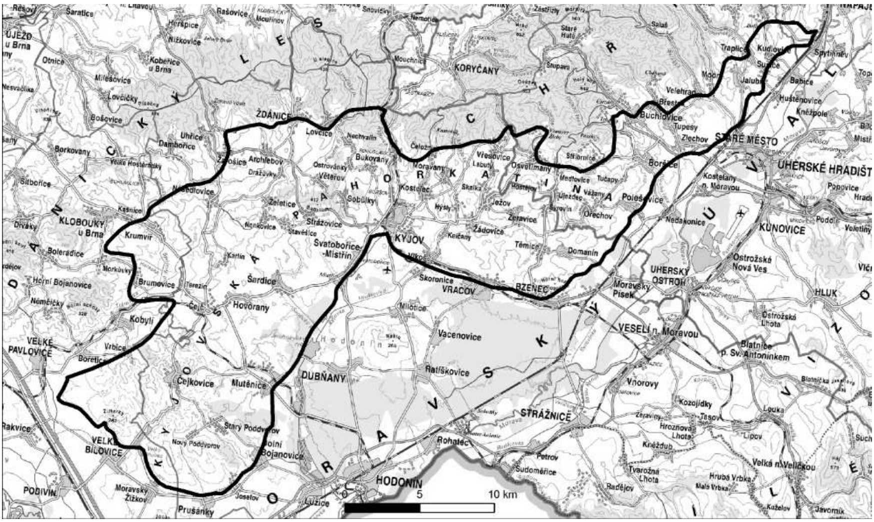


Fig. 1. Kyjovská pahorkatina Hilly Land. Source: Base Map of the Czech Republic at 1 : 200 000 (ZM 200), Copyright © 2010 ČÚZK.

RESULTS AND DISCUSSION

Changes of the landscape use based on old topographic maps of medium scale

Arable land prevailed in all the observed periods in the Kyjovská pahorkatina Hilly Land. Its ration greatly increased at the end of the 19th century and reached its peak in 1953-1954 (Tab. 1). The increase of arable land in this period caused the extinction of permanent grasslands and water areas. In the subsequent periods, the scale of arable land decreased, mainly due to their transfer to large-scale vineyards, gardens and orchards, built-up areas. In 1836-1841 and 1876, the other largest area of land use of the Kyjovská pahorkatina Hilly Land was the permanent grassland (Table 1). Extensive ploughing of meadows and pastures for arable land gain at the end of the 19th century and unfavourable effects of the socialist farming method led to a decline in the area of permanent grassland from 16.7% to only 1.4% (in 1991). The ratio of grasslands in the Kyjovská pahorkatina Hilly Land has been on a slight increase in the last 20 years, however, it is still very low compared to the original data. Permanent grasslands are mainly formed on slopes of arable land, extinct vineyards and orchards. The surviving permanent grassland in this region can thus be considered very rare with respect to sustaining the biodiversity of the given region.

Tab. 1: Development of land use in the Kyjovská pahorkatina Hilly Land from 1836 to 2015 (area in%)

Land use	**1836-1841**	**1876**	**1953-1954**	**1991**	**2002-2006**	**2014-2015**
Arable land	66.5	77.3	79.6	68.3	68.3	66.0
Permanent grassland	16.7	8.3	2.9	1.4	2.5	3.1
Orchard	0.2	0.1	1.7	4.1	4.2	3.4
Vineyard	6.6	5.4	4.6	10.4	8.5	9.7
Forest	6.2	5.7	6.2	7.2	7.6	7.9
Water area	1.0	0.0	0.0	0.2	0.2	0.3
Built-up area	2.8	3.1	5.0	8.1	8.5	9.3
Recreational Area	0.0	0.0	0.0	0.2	0.2	0.3
Other Area	0.0	0.0	0.0	0.1	0.1	0.1
Total	100.0	100.0	100.0	100.0	100.0	100.0

In the long term, the number of vineyards is also significant in this region, which is currently about 10% (Table 1). While the vineyards, together with orchards and small fields in the mosaic-like landscape of ecologically attractive agricultural landscapes, existed until 1953-1954, today they are predominantly made up of large-scale areas which were mass-produced in the second half of the 20th century. The preserved mosaic-like structures of the farmland have a significant impact on the landscape functions, eco-system services of the landscape, the landscape biodiversity and the protection of agricultural land resources, mainly the protection against water and wind erosion. The number of garden areas and orchards increased mainly thanks to the establishment of large orchards in the second half of the 20th century. Fruit trees were grown in the region in the second half of the 19th century, but they were usually part of small fields and vineyards, thus their representation is not always clear on the topographic maps. Forests are rather sporadic in the Kyjovská pahorkatina Hilly Land, their number did not exceed the 8% limit (Tab. 1). They are mostly localised in higher levels above the sea. The built-in aeras grew three times during the observed period, thus their scale is currently 9.3%, which makes them the third largest category in the land use in the studied area. There are no larger towns in the Kyjovská pahorkatina Hilly Land apart from Kyjov (11.5 thousand inhabitants). On the other hand, there are a high number of smaller towns and large villages inhabited by 2,000 to 5,000 inhabitants. Water areas developed specifically in the Kyjovská pahorkatina Hilly Land; their number plummeted in the beginning period between 1836-1841 and 1876, when not only two largest natural lakes in the region ceased to exist (Kobylí and Čejč lakes), but also the pond systems on the rivers Kyjovka and Trkmanka and other water courses. No restoration of ponds to their original form has taken place yet. Smaller water areas were created sporadically, with the exception of the Velký Bílovec water reservoir on the river Prušánka.

Rare historical landscape structures in the Kyjovská pahorkatina Hilly Land

A very rare historical structure in the agricultural landscape of South Moravia is considered to be a small agricultural tenure with alternating vineyards, fields, orchards. A similar finding was presented in other studies as well (Amici et al., 2017, Špulerová et al., 2015; Súľovský et al., 2017). Their historical continuity is shown in the example in Fig. 2 in the village of Čejkovice on the basis of a map of the Stable cadastre from 1827 and a photograph from 2012. The significance of these rare historical landscape structures is known to all representatives in spatial planning and in tourism; however, the practical agricultural landscape use abandons the traditional management in a part of the area and replaces it with larger vineyard complexes with a higher scale of mechanisation and minimum of solitary trees.

When assessing mosaic-like landscape structures in the Kyjovská pahorkatina Hilly Land, it was found that approximately 15% of these rare areas have been preserved or partially preserved since the mid-19th century. Fragments of these areas were predominantly preserved in the immediate background of the settlements or in the background of wine cellars. The significance of a historical mosaic landscape structure lies in the enhancement of landscape functionality, the support of the higher biodiversity of the area, the support of the protection of the agricultural land resources as well as the preservation of the typical landscape features of South Moravian hilly land. These locations are significant for example for the protection of populations of certain bird species (Skokanová et al., 2016). Maintenance of these areas is an issue due to abandoning the traditional farming in the region. However, based on negotiations with the local planning authorities, there is a demand for maintenance and protection of the so-called settlement or suburban zone, where the transfer of the seat to the open landscape would be gradual, through a mosaic of smaller fields, meadows, pastures, orchards or accompanying greenery.

Fig. 2. Mosaic landscape structure in Čejkovice with vineyards, small fields and orchards on the Stable Cadastre map from 1827 (left) and the photograph from 2012 (right).

Permanent grasslands are a very rare element in the landscape structure of the Kyjovská pahorkatina Hilly Land, currently their scale comprises only 3%, while it was 17% in 1836-1841. The continually used areas of permanent grassland are very rare in this country and are often included in the protected areas (Fig. 3). Two thirds of the specially protected small-scale areas in the Kyjovská pahorkatina Hilly Land are declared to protect steppe vegetation - NP Hovoranské louky (left) and NNP Na Adamcích (right). Permanent grasslands are also represented (e.g. at former mining areas of brickworks and sandpits) in other specially protected small-scale areas. Permanent grasslands are also represented in a significant scale at Europe´s important locations, bird areas, and significant landscape elements in this area. They play a very important role in the protection of agricultural land resources at the same time; they are crucial locations of high biodiversity of the area. The restoration of permanent grasslands in the Kyjovská pahorkatina Hilly Land is one of the key activities that can help protect soil from erosion, increase biodiversity and improve other landscape features.

Fig. 3. Protected areas with rare steppe species – Nature preserve Hovoranské louky (left), National nature preserve Na Adamcích (right).

Extinct historical structures of the Kyjovská pahorkatina Hilly Land landscape and their possible restoration.

The location called Babí hora is in the vicinity of the villages Vrbice and Čejkovice (see Fig. 4). The aerial photograph from 1953 and the attached black-and-white photograph from the early 1970's still show the slopes of Babí hora with an interesting landscape structure.

Fig. 4. Babí hora location in a 1970's photograph and in an aerial photograph from 1953 (above) and in a photograph and an aerial photograph from 2012 (below).
Source: http://kontaminace.cenia.cz/, http://botany.cz/cs/babi-hora/

Under the socialist method of farming, this dimension was levelled with its surrounding terrain by the use of bulldozers and planted with vineyards which are currently exposed to the effects of frost in the frost basin (see Fig. 4). In addition to this very negative impact on the historical landscape, typical for the Kyjovská pahorkatina Hilly Land are also agricultural terraces with areas of up to 100 ha, which were created in very indented areas similar to those of Babí hora. The restoration of the original structure of the landscape in these locations is not possible, only the adjacent slopes near the terraces can be managed in an appropriate manner.

Fig. 5. Šatrapský pond in a map from 1827 (left) and today's wetland on the same site in a photo from 2013 (right).

Šatrapský pond was on the southern edge of the cadastral territory of the village Čejkovice; it was depicted in the map of the 1st Austrian Military survey from 1763, on the map of the Stable Cadastre from 1827 (see picture on the left), on the map of the 2nd Austrian Military survey from 1841. However, it was drained in the second half of the 19th century and it has not been restored up to the present day, despite its partly preserved dyke. After the 2005 winter, which was rich in snow showers, wetland started developing arbitrarily in the location of the pond with the branching Prušánka covering an area corresponding to the the area of the original pond (16 ha). This shows that partial restoration of some landscape elements is possible without human interference; the wetland restoration in this location is a typical example of the influence of landscape memory. The area of South Moravia and especially the Kyjovská pahorkatina Hilly Land is an area where a number of pond systems disappeared in the middle of the 19th century and their restoration is partly due to the preservation of some remnants of old pond dykes (Havlíček et al., 2014; Pavelková et al., 2016).

Fig. 6. Implementation of measures to increase the biodiversity of agricultural landscape in the vicinity of the villages of Šardice and Hovorany.

In the vicinity of the villages of Šardice and Hovorany, several implementations of measures in the landscape have occurred in recent years in order to increase the biodiversity of the area and the protection of the agricultural land resources. It is fully consistent with the attempts at sustainable agricultural management (Stejskalová et al., 2012; Pašakarnis et al., 2013; Dumbrovský, Larišová, 2016). Fig. 6 (left) shows the implementation of a biocorridor along the local communication, Fig. 6 (right) shows the implementation of the wetland Mokroňovsko, which has become a sanctuary to a number of rare amphibian species (e.g. the smooth newt) and water birds. The monitoring of animal distribution has confirmed that the implementations of measurements in agricultural landscape and their regular management have a crucial influence on the biodiversity of agricultural landscape of South Moravia.

CONCLUSION

A specific small agricultural tenure with a combination of vineyards, orchards and small fields, or preserved areas of permanent grassland, water areas can be considered rare historical landscape structures in the model territories in South Moravia. The traditional farming of small areas is being gradually abandoned. The continuity of the preserved historical landscape structures in the studied area of the Kyjovská pahorkatina Hilly Land can be documented starting in the first half of the 19th century. The extinction of rare landscape structures took place in several waves starting in the second half of the 19th century (e.g. in favour of the production of sugar beet) until the 1970s or 1980s (creation of terraces, elimination of sloping sites). Some historical preserved landscape structures in the model areas are protected as small-scale specially protected areas or locations of the NATURA 2000 system. Currently, there are opportunities for restoration of historical landscape structures, especially with the use of grant titles, or while planning complex land improvements. It is advisable to use knowledge of the historical landscape structure when rebuilding wetlands, water areas, building bio-corridors, green infrastructure, local roads and other landscape elements in the landscape.

Acknowledgement: The paper is part of the project QJ1630422 – Soil protection through optimization of spatial and functional parameters of the elements of landscape structure in the process of Land Consolidation which was subsidised by the programme KUS of the National agricultural agency for science and research.

REFERENCES

AMICI, V., MACCHERINI, S., SANTI, E., TORRI, D., VERGARI, F., DEL MONTE, M. Long-term patterns of change in a vanishing cultural landscape: A GIS-based assessment, 2017. *Ecological Informatics*, 37, pp. 38-51, DOI: 10.1016/j.ecoinf.2016.11.00. DOI:10.1016/j.ecoinf.2016.11.008

ATIK, M., Işıklı, R.C., Ortaçeşme, V. Clusters of landscape characters as a way of communication in characterisation: A study from side, Turkey, 2016. *Journal of Environmental Management*, 182, pp. 385-396. DOI: 10.1016/j.jenvman.2016.07.076

DUMBROVSKÝ, M., LARIŠOVÁ, L. The influence of different technologies of soil processing on infiltration properties of soil in the cambisols area of the opava district, 2016. *Acta Universitatis Agriculturae et Silviculturae Mendelianae Brunensis*, 64 (5), pp. 1495-1505. DOI: 10.11118/actaun201664051495

FAIRCHILD, G.W., ROBINSON, C., BRAINARD, A.S., COUTU, G.W. Historical Changes in the Distribution and Abundance of Constructed Ponds in Response to Changing Population Density and Land Use, 2013. *Landscape Research*, 38 (5), pp. 593-606. DOI: 10.1080/01426397.2012.672640

HAVLÍČEK, M., PAVELKOVÁ, R., FRAJER, J., SKOKANOVÁ, H., 2014. The long-term development of water bodies in the context of land use: The case of the Kyjovka and Trkmanka River Basins (Czech Republic). *Moravian Geographical Reports*, 22 (4): 39–50. DOI: 10.1515/mgr-2014-0022.

HREŠKO, J., PETROVIČ, F., MIŠOVIČOVÁ, R., 2015. Mountain landscape archetypes of the Western Carpathians (Slovakia). *Biodiversity and Conservation*, 24 (13), pp. 3269-3283. DOI: 10.1007/s10531-015-0969-6.

KANIANSKA, R., KIZEKOVÁ, M., NOVÁČEK, J., ZEMAN, M., 2014. Land-use and land-cover changes in rural areas during different political systems: A case study of Slovakia from 1782 to 2006. *Land Use Policy*, 36, pp. 554–566. DOI:10.1016/j.landusepol.2013.09.018

MOJSES, M., PETROVIČ, F., 2013. Land use changes of historical structures in the agricultural landscape at the local level – Hriňová case study. *Ekologia*, 32, 1–12. DOI:10.2478/eko-2013-0001

MUCHOVÁ, Z., PETROVIČ, F. Impact of land consolidation on the visual characteristics (scenery) of a landscape, 2014. *Journal of Central European Agriculture*, 15 (1), pp. 76-85. DOI: 10.5513/JCEA01/15.1.1414

PAŠAKARNIS, G., MORLEY, D., MALIENE, V. Rural development and challenges establishing sustainable land use in Eastern European countries, 2013. *Land Use Policy*, 30 (1), pp. 703-710. DOI: 10.1016/j.landusepol.2012.05.011

PAVELKOVÁ, R., FRAJER, J., HAVLÍČEK, M., NETOPIL, P., ROZKOŠNÝ, M., DAVID, V., DZURÁKOVÁ, M., ŠARAPATKA, B., 2016. Historical ponds of the Czech Republic: an example of the interpretation of historic maps, Journal of Maps 12 (Sup 1), pp. 551-559. DOI: 10.1080/17445647.2016

PETROVIČ, F., STRÁNOVSKÝ, P., MUCHOVÁ, Z., FALŤAN, V., SKOKANOVÁ, H., HAVLÍČEK, M., GÁBOR, M., ŠPULEROVÁ, J. Landscape-ecological optimization of hydric potential in foothills region with dispersed settlements – a case study of Nová Bošáca, Slovakia, 2017. *Applied Ecology and Environmental Research*, 15 (1), pp. 379-400. DOI:10.15666/aeer/1501_379400

SKALOŠ, J., ENGSTOVÁ, B. Methodology for mapping non-forest wood elements using historic cadastral maps and aerial photographs as a basis for management, 2010. *Journal of Environmental Management*, 91 (4), pp. 831-843. DOI: 10.1016/j.jenvman.2009.10.013

SKOKANOVÁ, H., HAVLÍČEK, M., UNAR, P., JANÍK, D., ŠIMEČEK, K., 2016. Changes of Ortolan Bunting (Emberiza hortulana L.) habitats and implications for the species presence in SE Moravia, Czech Republic. *Polish Journal of Ecology*, 64 (1), pp. 98-112. DOI:10.3161/15052249PJE2016.64.1.009

SKOKANOVÁ, H., HAVLÍČEK, M., BOROVEC, R., DEMEK, J., EREMIÁŠOVÁ, R., CHRUDINA, Z., MACKOVČIN, P., RYSKOVÁ, R., SLAVÍK, P., STRÁNSKÁ, T., SVOBODA, J., 2012. Development of land use and main land use change processes in the period 1836-2006: Case study in the Czech Republic. *Journal of Maps*, 8 (1), pp. 88-96. DOI: 10.1080/17445647.2012.668768

STEJSKALOVÁ, D., KARÁSEK, P., PODHRÁDSKÁ, J., TLAPÁKOVÁ, L., 2012. Methods of determining landscape functions and their evaluation: A case study of Hustopeče, Czech Republic. *Moravian Geographical Reports*, 20 (2), pp. 17-24. ISSN: 12108812

SÚĽOVSKÝ, M., FALŤAN, V., SKOKANOVÁ, H., HAVLÍČEK, M., PETROVIČ, F., 2017. Spatial analysis of long-term land-use development in regard to physiotopes: case studies from the Carpathians. *Physical geography*, 38 (5), pp. 470-488, DOI: 10.1080/02723646.2017.1318652

ŠANTRŮČKOVÁ, M., WEBER, M., SOJKOVÁ, E., BENDÍKOVÁ, L., 2016. Map Analysis of Cultural Heritage Values in Designed Landscapes: A Case Study on Červený Hrádek, Czech Republic. *Acta Universitatis Agriculturae et Silviculturae Mendelianae Brunensis*, 64 (2), pp. 663–675. DOI: 10.11118/actaun201664020663

ŠPULEROVÁ, J., PISCOVÁ, V., GERHÁTOVÁ, K., BAČA, A., KALIVODA, H., KANKA, R., 2015. Orchards as traces of traditional agricultural landscape in Slovakia. *Agriculture, Ecosystems and Environment*, 199, pp. e67-e76. DOI: 10.1016/j.agee.2014.08.021

Shrnutí

Článek je zaměřen na identifikaci cenných krajinných struktur v modelových územích jižní Moravy se stopami tradičních a regionálně podmíněných způsobů hospodaření, posouzení jejich významu z hlediska ochrany zemědělského půdního fondu, ochrany přírody, poskytování ekosystémových služeb. Klíčovým tématem tohoto článku je také potenciál budoucího využití těchto území, možnosti udržení tradičního způsobu hospodaření, případně možnosti obnovy zaniklých krajinných struktur.

Cílem příspěvku je najít odpovědi na tyto výzkumné otázky: Jaké jsou dochované cenné historické krajinné struktury v modelových územích z hlediska kategorií využití krajiny, jak jsou v současnosti obhospodařovány? Jak jsou chráněny historické dochované krajinné struktury v modelových územích z hlediska ochrany přírody a krajiny? Jaké jsou možnosti obnovy historických krajinných struktur v modelových územích?

Za cenné historické krajinné struktury v modelových územích na jižní Moravě lze považovat zejména specifickou drobnou zemědělskou držbu s kombinací vinic, sadů a malých polí, případně dochované plochy trvalých travních porostů. Tradiční hospodaření na drobných plochách je zde postupně opouštěno. Kontinuitu výskytu dochovaných historických krajinných struktur ve studovaném území Kyjovské pahorkatiny je možné doložit již od první poloviny 19. století. Některé historické dochované krajinné struktury v modelových územích jsou chráněny jako maloplošná zvláště chráněná území, případně lokality soustavy NATURA 2000. Aktuálně existují možnosti obnovy historických krajinných struktur, zejména s využitím dotačních titulů, případně při plánování komplexních pozemkových úprav. Při obnově mokřadů, budování biokoridorů, zelené infrastruktury, místních cest a dalších prvků v krajině je vodné využívat znalosti o historické struktuře krajiny.

INVEST SOFTWARE AS A MODELLING TOOL FOR ECOSYSTEM SERVICES ASSESSMENT (EXAMPLE OF POLLINATOR ABUNDANCE MODEL FOR NITRA AND SURROUNDING AREA)

Martin Jančovič

Constantine the Philosopher University in Nitra, Department of ecology and environmental studies, Tr. A. Hlinku 1, 949 74, Nitra

martin.jancovic01@gmail.com

Abstract: The main aim of this paper is to use the InVEST software (model *Pollinator Abudance: Crop Pollination*) for the ecosystem services assessment in the territory of Nitra town and adjacent municipalities (Slovakia). At the beginning, we clarify the concept of ecosystem services and the basics of InVEST software. Then, on the basis of the landscape structure map (for year 2016) we demonstrate how InVEST works – we use the pollination model for detecting the preconditions for occurrence of wild bees and bumble bees in the landscape. We analyse occurrence of wild pollinators in the research area in regards to possibilities of their nesting and accessibility to flower sources. The analyses are based on GIS raster layer of landscape structure and related data - information about basic features of secondary landscape structure (which are important for behaviour of wild bees and bumble bees) and information about pollinator species occurring in the research area. The outcomes of conducted analysis are spatial and narrative assessment of relative potential of wild pollinators' occurrence in the research area. This information could be useful e.g. for agriculture optimizing and landscape management.

Key words: Ecosystem services, InVEST, pollinators, wild bees, bumble bees, Nitra.

1 INTRODUCTION

Ecosystem services became a key concept in the current ecology, nature protection and sustainable development. Ecosystem services are considered to be an innovative approach to the assessment of importance that environment bears considering mainly its effects on human prosperity and wellbeing (Eliáš, 2010). The term "nature's services" appeared for the first time in the academic literature in 1997 in a paper in Science by Walter Westman called "How much are Nature´s services Worth?" (Costanza, 2017).

Ecosystem services are dependent on natural resources such as soil, air, water, biodiversity and fauna – the term "natural capital" is often used. It is important to assess ecosystem services in relation to their functions, processes and the structure of ecosystems (Costanza, 1997).

Absolute and relative value of the nature could be recognized and assessed by various methods, such as in monetary expression through economic analysis and the concept of total economic value, in biophysical and geochemical point of view, it is possible to assess nature either by means of natural sciences or different - qualitative viewpoints - sociology, cultural geography, art, social studies etc. (Badura et al., 2016). According to Gómez-Baggethum et al. (2016) the main aim of the ecosystem services assessment is to accomplish environmental sustainability, social justice and a long term economic viability.

Modern methods of assessing and quantification of ecosystem services are often based on computer modelling and geographical information systems. They could be used in various scales, complexity and also for various purposes – there are plenty of local and regional studies using the previously mentioned modelling tools (for Slovakia see e.g. Mederly et al. 2017), at European scale, models such as ESTIMAP and QuickScan (www.ec.europa.eu) are used.

The ecosystem services issue would deserve more attention and more complex elaboration than it has received so far when taking in consideration the whole country of Slovakia due to its obvious benefits to the environmental policy and landscape management. Our work could bring a new contribution to the recent approaches based on comprehensive review of legislation and decision making process (Bezák et al. 2017), land use changes assessment (Izakovičová et al. 2017), involvement of stakeholders to the valuation process (Bezák, Bezáková 2014), assessments of ecosystem services in national parks (Považan et al. 2014) and so on.

One of common and widely used models is a software tool InVEST developed at Stanford University in California (www.naturalcapitalproject.org). This tool contains several models for ecosystem services' assessment. Each model has developed a special assessment method for specific ecosystem service assessment. Therefore, InVEST could be considered as a comprehensive tool for analysing and visualizing various ecosystem services, and it is currently worldwide used (Gretchen et. al., 2009, Burkhard, Maes eds., 2017).

Pollination is a very important regulating ecosystem service, for which a diverse landscape with occurrence of appropriate crops and flowers is inevitable. In many cases, such landscape is composed of mixed agricultural and natural biotopes (Gordon Allen-Wardell et al., 1998). Pollinators fulfil important tasks in the most of the terrestrial ecosystems and fulfil the key ecosystem service for sustaining flower associations and promoting agricultural production (Simon et al., 2010). Nowadays, pollinators' abundance and diversity is decreasing in many ecosystems in the world because of intensification of agriculture which results in loss of natural and semi-natural biotopes and abnormal use of chemicals that have negative influence on nesting and migration of pollinators (Benelli, 2017). This fact could be the reason for developing a wide range of tools and approaches to the assessment of the current pollination service in various landscape types. Similarly, one of the InVEST models – *Pollinator Abundance: Crop Pollination* belongs among the mentioned tools. The model is focused on the assessment of wild bees and bumble bees occurence.

The InVEST model *Pollinator Abundance: Crop Pollination* classifies pollination according to wild bees as supporting ecosystem service. As CICES (2017) states, we can include this service in the regulating and supporting ecosystem services. Outcomes of this model could be helpful e.g. for agriculture optimization and they could contribute to better landscape management. In our study, we have used this model to assess the pollination ecosystem service in the model area of Nitra town and surrounding municipalities (Slovakia).

2 AIM AND METHODOLOGY OF THE WORK

The main aim of this paper is an assessment of pollination ecosystem service using InVEST software (model *Pollinator Abundance: Crop Pollination*), on the example of the city Nitra and adjacent municipalities (Lužianky, Zbehy, Čakajovce, Jelšovce, Podhorany, Žirany, Štitáre, Nitrianske Hrnčiarovce). The model area is located in western Slovakia, in the Nitra region and Nitra district. The extent of area is 187.62 km², of which 100.48 km² belongs to the Nitra town cadastre area and the rest of 87.14 km² belongs to the adjacent municipalities (Čakajovce 5.78 km², Jelšovce 10.44 km², Podhorany 17.71 km², part of the cadastral area Žirany 3.78 km², Nitrianske Hrnčiarovce 9.95 km², Štitáre 7.49 km², Zbehy 19.56 km², Lužianky 12.43 km²) (www.datacube.statistics.sk). According to the Statistical Office, the number of inhabitants in the area in 2016 was 88 834 (Nitra town - 77 374 inhabitans, adjacent municipalities 11 460 inhabitants). Case study area is quite heterogeneous, it includes the densely populated Nitra town, the surrounding agriculturally used lowland landscape and a part of the forested landscape of Tribeč mountains (Zoborské vrchy).

As a first step, the map of secondary landscape structure (SLS) of the research area in 2016 was created, by identifying individual features in the landscape, vectorising them and storing in a QGis format. In a spatial form, we have identified the land use in a model area mainly on the basis of open-source aerial photos (orthophotomaps from Google maps, 2016) – this applies to the municipalities of Zbehy, Čakajovce, Jelšovce, Podhorany, Žirany, Nitrianske Hrnčiarovce and Štitáre. For the Nitra and Lužianky municipalities, the maps from the study Haladová (2016) were used and actualised. For the SLS classes determination, the legend by Petrovič et al. (2009) was used. We have identified totally 56 land use classes in 6 main categories – according to the classification of Petrovič et al. 2009. Digitized map of SLS was a spatial base for selected ecosystem service assessment and for demonstration results of our work.

The next research step was based on the determination of the input values for the computational model *Pollinator Abundance: Crop Pollination.* For this model, the tabular data expressing the properties of individual SLS features affecting behaviour of wild bees and bumblebees are required. Such data include the type of SLS feature (buildings, agriculturally used landscape, water elements, differently cultivated landscape and unclassified landscape type), nesting sites' accessibility in given type of element (above-ground cavity N_Cavity and under-ground N_Ground) and accessibility of flower sources in spring (F_Spring) and in summer (F_Summer).

The next important information for the model operation is a table with data about pollinator species relevant for the research area. These data include pollinator species (SPECIES), index of nesting in cavities (NS-Cavity) or in the ground (NS_Ground), activity ratio in spring (FS_Spring) and in summer (FS_Summer), and also the flight radius of the species to flower sources

(Alpha). For our purposes, we have used the basic values from a pattern table of the project's homepage (www.naturalcapitalproject.org).

After gathering spatial data and entering required tabular data into the model environment, the map of pollinator occurrence was produced expressed as an index of occurrence abundance (0 – without pollinators, 1 – high occurrence of pollinators) for considered pollinator species (genus *Apis* and *Bombus*). These values represent probable occurrence of pollinators in the model area, with consideration of nesting places and flower sources accessibility from surrounding areas. Therefore, the model reflects two aspects of pollination ecosystem service - "pollinators' demand" – their occurrence in particular landscape feature and "pollination supply" i.e. occurrence and placement of flower sources in surrounding areas (www.naturalcapitalproject.org).

3 RESULTS

3.1. Secondary landscape structure in 2016

Currently (2016), most of the research area consists of agricultural land - landscape feature "arable land" is dominant with an area of 90.52 km^2 that represents 48.26% of the model area. The "broad-leaved forests" cover the second largest part of the landscape with an area of 30.41 km^2 that represent 16.21% of the model area. The third largest landscape feature are "gardens" – their extent 7.21 km^2 represents 3.84% of the model area. Landscape features "individual housing" cover 7.11 km^2 that represents 3.79% of the total area.

To the landscape features with negligible extent in the model area (share less than 0.10%) belong bushes, pastures, greenhouses, agricultural cultivation patterns with dominance of grasslands, formation of rocks, natural and semi-natural surface waters and wetlands, city central area, vegetation of cemeteries and other technical sites, sport facilities, landfill sites, railway stations, airports, intersections. In total, 56 types of landscape features are identified in the area - because of broad extent of the map and its legend we present only a part of it (fig. 1).

Presented map section documents the basic shape of the model area – it could be characterized as mixed agricultural-residential landscape complemented by broad-leaved forests of the Tríbeč mountains, with the occurrence of other diversified landscape features.

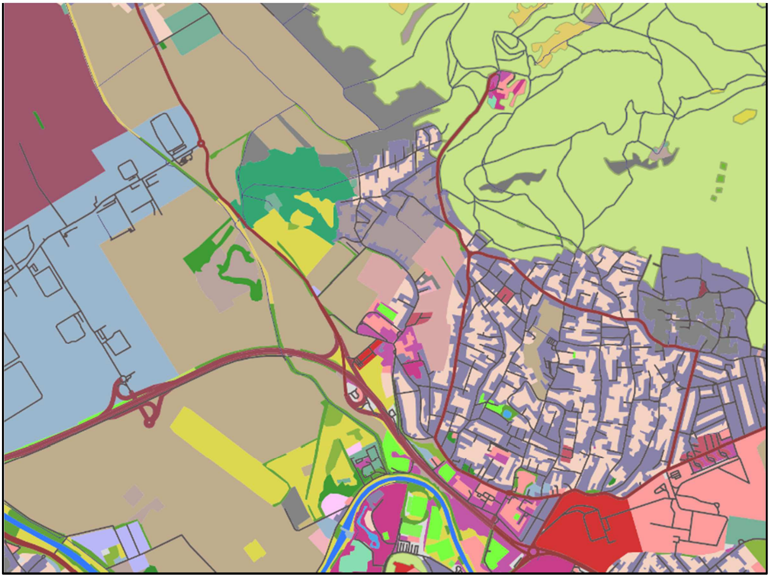


Fig. 1. The secondary landscape structure in the city of Nitra and surrounding municipalities, 2016 (Section of the map).
Source: own research 2017, Haladová 2016, www.google.maps.com

3.2 Pollinator Abudance: Crop Pollination

The basic objective of the model *Pollinator Abundance: Crop Pollination* is an identification of wild bees and bumble bees nesting sites in the investigated area by the use of raster layer with specification of the landscape features. Model's outcome shows values of probable occurrence of pollinators in the landscape (fig. 2). The lowest value 0 represents features with no potential for nesting and occurrence of wild bees, while the highest value 0.216 represents relatively adequate potential for pollinators’ occurrence.

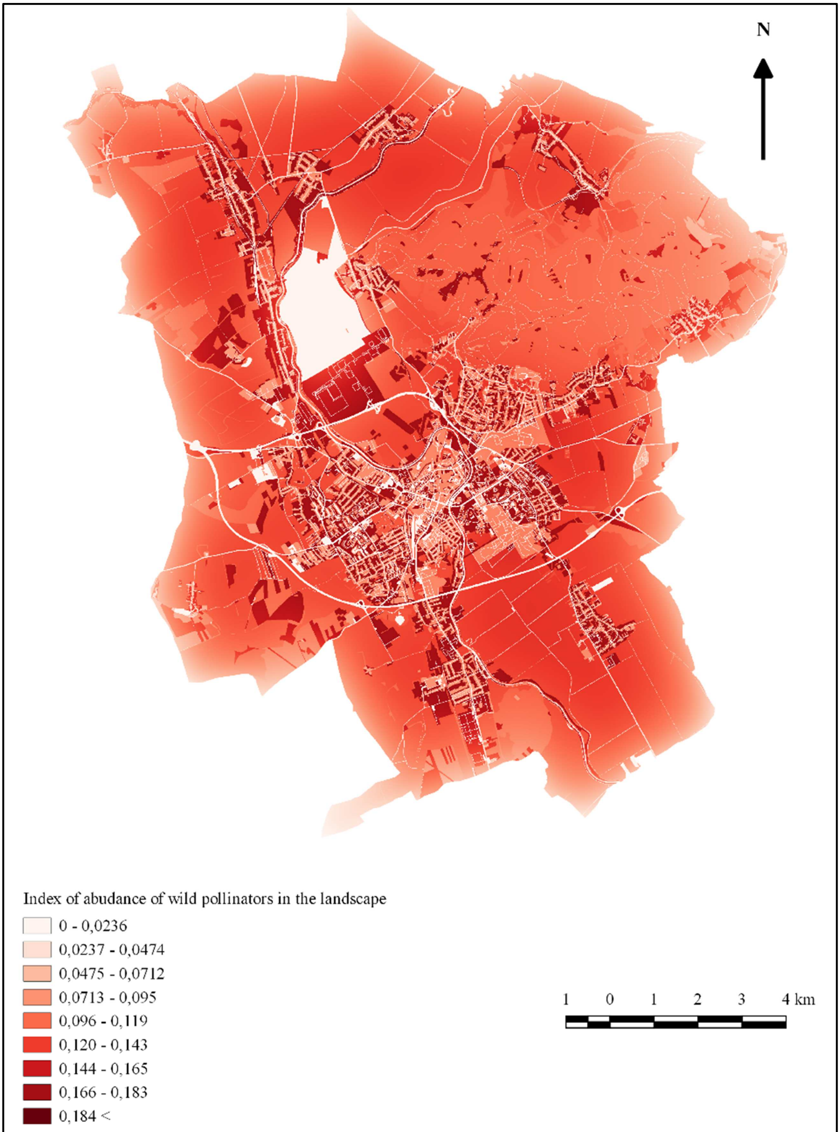


Fig. 2. The relative potential of wild bees and bumlebees occurence in the city of Nitra and surrounding municipalities (2016).
Source: InVEST - Pollinator Abundance: Crop Pollination, processed in QGIS

The model outcomes (Fig. 2) were subsequently reclassified and expressed by index of occurrence of wild pollinators in these five categories according to potential occurrence of pollinators (fig. 3) in the landscape:

1 **Very low occurrence** – index value 0 - 0.051 – landscape area 8.9% - 16.71 km^2

2 **Low occurrence** – index value 0.051 – 0.103 – landscape area 20.96% - 39.30 km^2

3 **Medium occurrence** – index value 0.104 – 0.154 – landscape area 58.22% - 109.16 km^2

4 **High occurrence** – index value 0.155 – 0.206 – landscape area 11.43% - 21.43 km^2

5 **Very high occurrence** – index value – 0.206 and more– landscape area 0.48% - 0.89 km^2

The medium occurrence category (3rd) is the largest extent, with percentage of 58.22% and area of 109.16 km^2. The second largest extent represents a low occurrence category (2nd) with percentage of 20.96% and area of 39.30 km^2, the third is a high occurrence (4th category) with percentage of 11.43% and area of 21.43 km^2, category 1 (very low occurrence) covers only percentage of 8.9% and area of 16.71 km^2. The least represented is a category 5 (very high occurrence) with percentage of 0.48% and area of 0.86 km^2 - this category means the highest probability of wild bees' occurrence.

Basically, the occurrence of wild pollinators is at a very low level in the model area. The highest achieved value of pollinators occurrence (abundance) index is 0.216, while the theoretically highest potential value is 1,0. This is probably caused by the fact that exemplary data from InVEST model were not verified for local conditions – this is still a challenge for further research.

In the category of "very low pollinators' occurrence" the highest abundance has been assigned to a landscape feature "roads" with percentage of 25% (this is caused mainly by a construction of the Jaguar Land Rover factory in the area). In the category of "low pollinators' occurrence" "fields" are dominant with the percentage of 45%, the next are "broad-leaved forest" with percentage of 20% and "individual housing" with percentage of 16%. In the category of "medium pollinators' occurrence" also the "fields" with percentage of 66% are dominant, followed by "broad-lived forests" with percentage of 21%. In the category of "high pollinators' occurrence" are prevailing "gardens" with percentage of 28% and "industrial and technical areas" with percentage of 19%. "Other vegetation in the city" with percentage of 15% and "ruderal vegetation" with percentage of 11% that holds relatively high occurence as well. In the last category of "very high pollinators' occurrence" the landscape feature "gardens" with percentage of 78% dominates, followed by "other vegetation in the city" with percentage of 11%.

After reclassification of continual data in 5 categories (1-5) it is obvious, that the most favourable wild bees' biotope is located at the part of Nitra town Zobor, covered by a large complex of "gardens" and occurrence of vineyards. This area borders with the broad-leaved forest, agricultural landscape and other residential areas. On the other hand, "roads", "construction sites" and "objects of static traffic" are among the landscape features with the lowest importance for wild bees' occurrence. Finally, in some marginal parts of the research area the lowest category of the index is occurring – this could be caused by landscape isolation, i.e. not covering neighbouring villages during calculation.

Except of the described basic use of the model for calculation of the index of pollinators abundance, the model could be utilized (after gaining required data) for creating the scenarios of future development, as well as for counting the value of ecosystem services for every landscape feature.

Fig. 3. Categorization of the potential of wild bees and bumlebees occurence in the city of Nitra and surrounding municipalities (2016).
Source: InVEST - Pollinator Abundance: Crop Pollination, processed in QGIS and GRASS GIS

4 DISCUSSION AND CONCLUSION

The main aim of this paper is to use the InVEST software (model *Pollinator Abudance: Crop Pollination*) for the ecosystem services assessment in the model area of Nitra town and adjacent municipalities. This area is typical by current dynamic economic development, resulting in the land use changes and significant pressures on the environment.

In our study, the pollination model was used to determine probable occurrence of wild pollinators in the study area, considering possibilities of their nesting and accessibility of flower sources on the basis of current landscape structure and transformed model input data.

Our outcomes shows, that the best biotopes for wild pollinators in the reseach area are "gardens", that are near the flower sources and also near human dwellings. Categories such as "other vegetation in the city", "ruderal vegetation" and "industrial and technical areas" (mainly those that are abandoned), represent good habitats for pollinator occurrence in research area as well. To the certain point, agricultural areas and forests (both large complex of Tríbeč forests and small woods dispersed within the agricultural landscape), facilitate the occurrence of pollinators too. After data reclassification, the area with the highest probability for occurrence of pollinators was identified as area Zobor in the town of Nitra.

Finally, it is obvious that landscape diversity, not only natural diversity but also diversity in land use, is very important for bees and other pollinators. They can find shelter in gardens, buildings (mainly those that are old and uninhabited), forests and in many other landscape features with adequate accessibility of flower sources such as ruderal vegetation, gardens, city greenery, fields etc.

Regarding our research, the assessment of other InVEST models, their efficiency and testing different ecosystem services assessment in the model area is a great challenge to the future.

Acknowledgement: This work was supported by the Scientific Grant Agency of the Ministry of Education of the Slovak Republic – VEGA No. 1/0496/16 "Assessment of natural capital, biodiversity and ecosystem services in Slovakia" and KEGA No. 032/UKF-4/2018 0158/14 "Overview of methods and proposal for the application of the ecosystem services concept in the Environmental studies study program".

REFERENCES

BADURA, T. et al. 2016. Valuing preferences for ecosystem-related goods and services. In: *Routlege Handbook of Ecosystem Service*, Abington a New York: Taylor and Francis Group, 2016, p. 228-242. ISBN 978-1-13802508-0

BENELLI, G. 2017. Food for honeybess? Pollinators and seed set of Anthyllisis barba-jovis L. (Fabaceae) in arid coastal areas of the Mediterranean basin. In: *Saudi Journal of Biological Sciences,* vol. 24, 2017, no. 5, p. 1056-1060. ISSN 1319-562X. https://doi.org/10.1016/j.sjbs.2017.01.018

BEZÁK, P., BEZÁKOVÁ, M., 2014. Landscape Capacity for Ecosystem Services Provision Based on Expert Knowledge and Public Perception (case Study from the North West Slovakia). In: *Ekologia (Bratislava)*, vol. 3, p. 344–353. ISSN 1335-342X.

BEZÁK, P. et al. 2017. Divergence and conflicts in landscape planning across spatial scales in Slovakia: opportunity for an ecosystem services-based approach? In: *International Journal of Biodiversity Science, Ecosystem Services & Management*. vol. 13, 2017, no. 2, p. 119-135. ISSN 2151-3732. https://doi.org/10.1080/21513732.2017.1305992

BURKHARD, B., MAES, J. (eds.), 2017. Mapping ecosystem services. Pensoft Publishers, Sofia, 374 pp.

COSTANZA, R. et al. 1997. The value of the world´s ecosystem services and natural capital. In: *Nature*, vol. 387, 1997, p. 253-260. ISSN 1476-4687. https://doi.org/10.1038/387253a0

COSTANZA, R. et al. 2017. Twenty years of ecosystem services: How far have we come and how far do we still need to go? In: *Ecosystem services*, vol. 28. 2017, p. 1-16. ISSN 2212-0416

ELIÁŠ, P. 2010. Ekosystémové služby. In: *Životné prostredie*, vol. 44, 2010, no. 2. ISSN 0044-4863

GRETCHEN, D. et. al. 2009. Ecosystem services in decision making: time to deliver. In: *Frontiers in Ecology and the Environment,* Washington DC, vol. 7, 2009, p. 21-28. ISSN 1540-9295. https://doi.org/10.1890/080025

GÓMEZ-BAGGETHUM, E. et al. 2016. Concepts and methods in ecosystem service valuation. In: *Routlege Handbook of Ecosystem Service*, Abington a New York: Taylor and Francis Group, 2016, p. 99-111. ISBN 978-1-13802508-0

GORDON ALLEN-WARDELL, G. et al. 1998. The potential consequences of pollinator declines on the conservation of biodiversity and stability of food crop yields. In: *Conservation Biology,* vol. 12, 1998, no. 1, p. 8-17. ISSN 1523-1739 https://doi.org/10.1111/j.1523-1739.1998.97154.x

HALADOVÁ, I. 2016. *Vývoj druhotnej krajinnej štruktúry mesta Nitra v kontexte socioekonomických zmien.* Dizertačná práca. Nitra: FPV UKF, Katedra ekológie a environmentalistiky, 2016. 96 p.

IZAKOVIČOVÁ, Z. et al. 2017. Long-Term Land Use Changes Driven by Urbanisation and Their Environmental Effects (Example of Trnava City, Slovakia). In: *Sustainability*. vol. 9, is. 9, no. 1553. ISSN 2071-1050,

MEDERLY, P. et al. 2017. Selected methods of evaluation of ecosystem services – OpenNESS project and Trnava case study. In: *Životné prostredie*, vol. 51, no. 4, p. 205-212. ISSN 0044-4863 (in Slovak).

POVAŽAN, R. et. al. 2014. Valuation of ecosystem services in carpathian protected areas with focus on slovakia – guidelines for rapid assessment. In: Quaestiones rerum naturalium, vol. 1, 2014, no. 2, p. 7 – 44. ISSN 1339-7907

PETROVIČ, F. et al. 2009. Zoznam krajinných prvkov mapovateľných na území Slovenska. In: *GEO Information*, p. 112 – 124. ISSN 1336-7234

SIMON et. al., 2010. Global pollinator declines: trends, impactsm and drivers. In: *Science direct*, vol. 25, 2010, no. 6, p. 345-353. ISSN 0140-6736 https://cices.eu/revision-highlights/ [cited 19.7.2017]

http://datacube.statistics.sk/TM1WebSK/TM1WebLogin.aspx [cited 19.7.2017]

http://ec.europa.eu/environment/pubs/pdf/factsheets/biodiversity_2020/2020%20Biodiversity%20Factsheet_SK.pdf [cited 14.12.2016]

http://www.naturalcapitalproject.org/nightly-build/invest-users-guide/html/index.html [cited 26.2.2017]

http://www.naturalcapitalproject.org/software/ [cited 20.2.2017]

http://www.naturalcapitalproject.org/invest/#invest-models [cited 27.2.2017]

Zhrnutie

Práca stručne definuje problematiku ekosystémových služieb ako jedného zo základných konceptov ochrany prírody v súčasnosti. Na príklade vybraných obcí z okresu Nitra hodnotíme súčasný stav vybranej ekosystémovej služby pomocou softvéru InVEST, ktorý sa zaoberá hodnotením ekosystémových služieb na základe rôznych výpočtov a preddefinovaných algoritmov. Vybraný bol model *Hojnosť opeľovačov: opeľovanie plodín*, ktorý hodnotí predpoklady pre výskyt divých opeľovačov v krajine (včiel a čmeľov) na základe vstupných ukazovateľov ako typ a využitie krajiny, výskyt druhov divokých včieľ, ich letový rozptyl, dostupnosť potravy, vhodnosť pre hniezdenie a i.

Východiskom pre použitie modelu bola analýza súčasného stavu využívania skúmaného územia (druhotná krajinná štruktúra). Výsledkom z modelu sú dva mapové výstupy – prvým je základný neupravený výstup z modelu, kde je možné interpretovať rôzne hodnoty indexu výskytu opeľovačov v krajine. Druhým výstupom je reklasifikovaná mapa, ktorá upravuje indexy do 5 základných kategórií podľa výskytu divokých včieľ a čmeľov v krajine, a na základe ktorého je možné určiť územia s najvyšším a najnižším výskytom opeľovačov.

Z dosiahnutých výsledkov vyplýva, že pre divé opeľovače je dôležitá krajinná diverzita - a to nielen prírodná, ale aj diverzita využívania krajiny. Včely a čmele môžu nachádzať svoje útočiská najmä v prídomových záhradkách, v budovách (najmä starších a neobývaných), lesoch a mnohých iných krajinných prvkoch s dostatočnou dostupnosťou kvetinových zdrojov, ktoré môžu byť obsiahnuté v ruderálnych porastoch, v záhradách, v mestskej zeleni, poliach a pod. Výsledky tohto modelu môžu byť využité napr. pri optimalizovaní poľnohospodárskej činnosti a môžu byť zohľadnené pri celkovom manažmente krajiny.

CULTURAL HERITAGE AND GEODIVERSITY OF LANDFORMS IN THE LANDSCAPE OF THE ARCHDIOCESE OF OLOMOUC

Karel Kirchner [1], František Kuda [1], Lucie Kubalíková [1], Marek Havlíček [2], Ivo Machar [3], Vilém Pechanec [4]

[1] *Institute of Geonics of the Czech Academy of Sciences, Department of Environmental Geography, Drobného 28, 602 00 Brno, Czech Republic*

kirchner@geonika.cz, kuda@geonika.cz, kubalikova@geonika.cz

[2] *The Silva Tarouca Research Institute for Landscape and Ornamental Gardening, Research Centre Brno, Lidická 25/27 602 00 Brno, Czech Republic*

marek.havlicek@vukoz.cz

[3] *Faculty of Science, Palacký University in Olomouc, Department of Development and Environmental Studies, 17. listopadu 12, 771 46 Olomouc, Czech Republic*

ivo.machar@upol.cz

[4] *Faculty of Science, Palacký University in Olomouc, Department of Geoinfomatics, 17. listopadu 50, 771 46 Olomouc, Czech Republic*

vilem.pechanec@upol.cz

Abstract: Within the framework of the NAKI II project – Cultural heritage of landscape of the Archdiocese of Olomouc - research, presentation and management (DGB 16P02B014), we focus on the results that will contribute to the sustainable development of regional cultural identity through applied cultural heritage research in the cultural landscape of the area of interest. As part of the material cultural heritage, we include the landforms that originated from the conscious activity of man - the anthropogenic relief forms. These landforms complement the geodiversity of the landscape and are referred to as secondary geodiversity. Therefore, their identification and interpretation will make it possible to complement and enhance the diversity of cultural heritage and to specify the development of the cultural landscape. The first results from the area of Central Moravia will be presented with the using of the historical maps, the digital model of the relief DMR5G and the field research.

Key words: cultural heritage, secondary geodiversity, Archdiocese of Olomouc

INTRODUCTION

European cultural landscape with its historical values is a mirror of the cultural identity development both on national and regional level. At the same time, cultural landscape represents the space for conservation and sustainable development of numerous key elements of the cultural identity. NAKI II project – Cultural heritage of landscape of the Archdiocese of Olomouc - research, presentation and management (DGB 16P02B014) should contribute to the issues of the cultural identity and to the knowledge of the sustainable development of the cultural identity using the applied research of the cultural heritage within the landscape of the historical area of the Archdiocese of Olomouc (ADO) - (Fig. 1).

In the study area, a historic role of the man as the decisive element of changes within the European cultural landscape is accepted (Antrop 1997). The aim of the research is to recognize the role of man in all the time, social and spatial consequences and to interpret the diversity and uniqueness of natural and cultural-historical values of the landscape and their contribution to the cultural heritage formation (Machar et al. 2016). A specific objective of the physical-geographical and geomorphological research is the identification and interpretation of anthropogenic landforms in order to complement and increase the diversity of cultural heritage and the specification of the development of the cultural landscape of ADO.

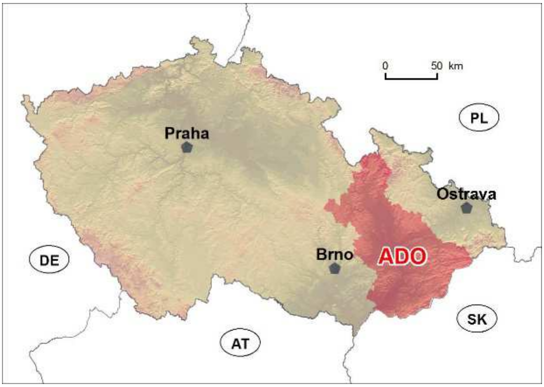


Fig. 1. Localization of the Archdiocese of Olomouc within the Czech Republic.
Source: authors

In the first part of the research, we focused on the identification of the basic land use changes within the central part of ADO (Fig. 2) and on the formulation of the basic approach to the anthropogenic landforms assessment in relation to the cultural heritage. These results are presented in this paper.

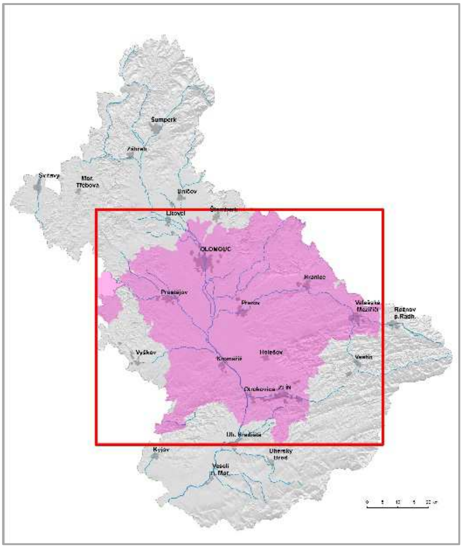


Fig. 2. Study area in the Central Moravia within the Archdiocese of Olomouc.
Source: authors

METHODOLOGICAL APPROACH, TERMINOLOGY

Formulating the methodological approach, we come out from the fact that anthropogenic (technogenic) landforms represent the significant part of tangible cultural heritage. The origin and formation of the anthropogenic landforms is often related to the driving forces of particular cultural periods, war events and technical and scientific development.

Therefore, these historical anthropogenic landforms (e.g. ramparts, agrarian terraces, hollow ways) form an important part of the historical landscape elements (Buček, Černušáková 2016). Concerning the landscape assessment, Dohnalová et al. (2015) includes these landforms to the cultural landscape artifacts, i.e. objects that materialize the uniqueness of the specific culture of the given region, municipality or locality, that reflect their traits and point on the cultural-historical values. The cultural is all that is associated with human existence, activity, thinking, attitudes and oppinions as manifestations of the diversity and uniqueness of a particular community or society related to the specific place. For the assessment purposes, Dohnalová et al. (2015) defines e.g. funeral and celebrational historical landforms and presents also the topographic landforms (Hájek, Bukačová 2001).

Analyzing and dealing with the historical anthropogenic landforms is linked to the geodiversity concept. Geodiversity is defined as “the natural range (diversity) of geological (rocks, minerals, fossils), geomorphological (landforms, topography, physical processes), soil and hydrological features. It includes their assemblages, structures, systems and contribution to landscapes” (Gray 2013). Panizza (2009) uses a term “geomorphodiversity” that is linked to the morphological diversity and the diversity of the processes.

Geodiversity can be seen in two ways:

- geodiversity as a value-free entity (analogical to definition of Gray 2013) that include all the abiotic features. Those elements of natural geodiversity that are of significant value to humans for non-depleting purposes which do not decrease their intrinsic or ecological values are called “geoheritage” (Sharples, 2002). The concept of geoheritage is based on the definition of natural heritage (UNESCO, 1972). The term geoheritage was defined as those components of natural geodiversity of significant value to humans, including scientific research, education, aesthetics and inspiration, cultural development, and a sense of place experienced by communities (Dixon, 1996 in Dingwall, 2005:14).

- geodiversity (respectively geomorphodiversity) as “the critical and specific assessment of the geomorphological features of a territory, by comparing them in an extrinsic and in intrinsic way, taking into account the scale of investigation, the purpose of the research and the level of scientific quality” (Panizza 2009).

Similar approach is presented by Zwolinski (2004): the broader meaning of the geodiversity refers to the total range of abiotic elements and treats geodiversity as an objective, value-neutral property of a real geosystem; the strict meaning refers to the idea that geodiversity is a value and it describes the diversity of lithological, morphological and other abiotic issues of a region or site (so the geodiversity of given region or site can be high or low).

In the above mentioned definitions of geodiversity/geoheritage appears the word “natural” (natural geodiversity or primary geodiversity, that means the features formed without the human impact or activity). Obviously, the natural features represent bigger part of geoheritage (both on global and local scale), but the secondary (or man-made) geodiversity (Cílek 2002) should not be omitted as it also represents a significant resource for tourist and recreation activities (Kubalíková, Bajer, Kirchner, 2016, Kubalíková, Kirchner, Bajer 2017, Rypl, Kirchner 2017). Secondary or man-made geodiversity can be defined (analogically to the Gray’s definition of geodiversity) as “the range/diversity of the man-made/anthropogenic landforms, including their assemblages, relationships, structures and systems”.

If the statements mentioned above are accepted and taken into account, the slightly modified definition of the geoheritage can be presented: components or features of primary (natural) and secondary (man-made or anthropogenic) geodiversity which are of significant value to humans, including scientific research, education, aesthetics and inspiration, cultural development, and a sense of place experienced by communities. Those components of secondary geodiversity, which form the part of geoheritage, are generally represented by anthropogenic landforms (or man-made landforms), anthropogenic processes and influences on the relief. Historical anthropogenic landforms represent a significant part of cultural heritage and historical memory of the landscape (Kyselka 2014). Taking into account this concept, we are going to propose the basic principles of the historical anthropogenic landforms assessment in the context of the cultural heritage of the landscape.

RESULTS

Regarding the aim of the project and planned results, we focused on the recognizing the changes of the land use in selected area within ADO. This will allow the heading of the further detailed research of the historical anthropogenic landforms (especially water management landforms).

The landuse changes were proceeded using the interpretation of landuse maps elaborated by The Silva Tarouca Research Institute for Landscape and Ornamental Gardening from the years 1836-1852, 1876-1880, 1953-1957, 1998-1996, 2006 (Havlíček, Chrudina 2013). These issues were dealt within a part of ADO (central Moravia) including 11 districts of municipalities with extended competence (Bystřice pod Hostýnem, Holešov, Hranice, Kroměříž, Lipník nad Bečvou, Olomouc, Otrokovice, Prostějov, Přerov, Valašské Meziříčí, Zlín). This area corresponds with 8 deanery (decanates) of the ADO. This analysis served as a basis for the processing the extension of water management landforms – area of ponds and pond dams. Historical maps of the Austrian military mapping were used (1st Austrian Military Mapping 1763-1768, 2nd Austrian Military Mapping 1836-1852), see Havlíček et al. (2014), Pavelková et al. (2016). During the 1st Austrian military mapping, a total of 405 water surfaces were recorded in the administrative districts of 11 municipalities with extended competence. During the 2nd Austrian military mapping, only 118 were recorded; 106 of them were represented on both mappings and only 12 were newly created (Fig. 3). Some water areas were later re-established (rebuilt) in the second half of the 20th century or recently, but many of them have not yet been restored.

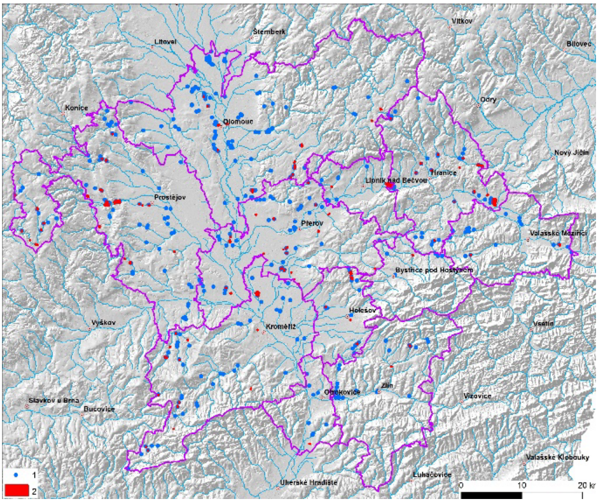


Fig. 3. The extension of the water surfaces in the central part of ADO during the years 1763-1768 and 1836-1852.
Explanations: 1 – water surfaces from 1763-1768, 2 - water surfaces from 1836-1852
Data source: ČÚZK - Czech Office of Surveying and Cadastre.

The location of the original water surfaces and relicts of the pond dams will allow to focus (using fieldworks and DMR 5G (Lidar)) on the morphologically remarkable relics of the dams that represent important secondary geodiversity elements (anthropogenic landforms) and give a historical evidence of the landscape development within the study area (see Fig. 4).

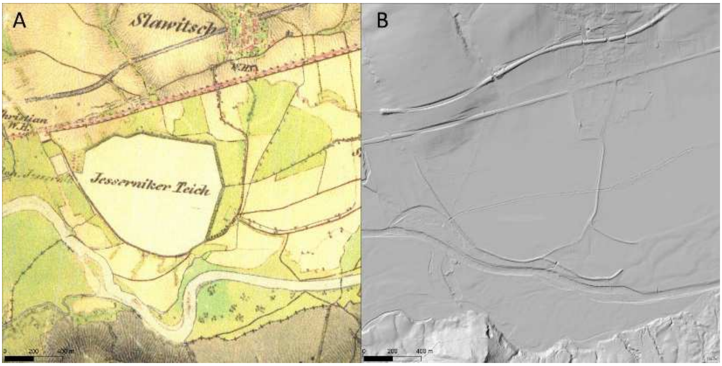


Fig. 4. A - Jezernický pond in the Bečva basin near Slavíč village on the map of the 2nd Austrian military mapping dating from 1837. B - Remains/relics of the side dams of Jezernický pond on the basis of the Digital model of relief of the Czech Republic of the 5th generation (DMR 5G).
Source: ČÚZK - Czech Office of Surveying and Cadastre

CONCLUSIONS

Based on the actual knowledge we characterize the historical anthropogenic landforms as a part of secondary geodiversity. Identification and interpretation of the important historical anthropogenic landforms will allow to complement and increase the cultural heritage diversity and to specify the cultural landscape development. It will be necessary to establish the morphogenetic classification of the anthropogenic landforms and to add other landforms (e.g. topographic anthropogenic landforms). In relation to the observing the historical water management landforms, the assessment method will be proposed with particular regard to their intrinsic value, scientific significance, their role in the historical landscape development (evolution) with respect to the cultural heritage and historical landscape memory.

Acknowledgements: This study was conducted with financial support of the "Cultural heritage of landscape of the Archdiocese of Olomouc - research, presentation and management" grant (num. DGB 16P02B014) as a part of the NAKI II program of the Ministry of Culture of the Czech Republic.

REFERENCES

ANTROP, M. (1997). The concept of traditional landscapes as a base for landscape evaluation and planning. The example for Flanders Region. *Landscape and Urban Planning*. 1997, 38, 105-117. ISSN 0169-2046. https://doi.org/10.1016/S0169-2046(97)00027-3

MACHAR, I., PECHANEC, V., KIRCHNER, K., BRUS, J. a KUDA, F. Cultural landscape heritage of the Olomouc Archdiocese: Lessons learned from the history of floodplain forests. In: *16th International Multidisciplinary Scientific GeoConference Albena SGEM 2016, SGEM2016 Conference Proceedings. Book 3, Vol. 2*, Sofia, 2016, s. 511-516. ISBN 978-619-7105-62-9.

BUČEK, A. a ČERNUŠÁKOVÁ, L. Historické prvky v lokalitách starobylých výmladkových lesů. In: *Černušáková, L. (ed.): Sborník konference Venkovská krajina 2016.* Hostětín: Česká společnost pro krajinnou ekologii CZ-IALE, 2016, s. 18 - 29. ISBN 978-80-7458-083-3.

DOHNALOVÁ, B., FIŘTOVÁ, B., KUČERA, P., DOHNAL, J. a Pavlačková, K. *Metodika identifikace kulturních artefaktů v krajině*. Brno: Mendelova univerzita, 2015. 301 s. ISBN 978-80-7509-382-0.

HÁJEK, T., BUKAČOVÁ, I. *Příběh drobných památek*. České Budějovice: Studio JB, 2001. 137 s. ISBN: 80-900903-9-7.

KYSELKA, I. Drobné historické struktury jako paměť krajiny a její historická stopa. *Životné prostredie*. *2014,* 48(1), 9-14. ISSN 0044-4863.

KUBALÍKOVÁ, L., BAJER, A. a KIRCHNER, K. Secondary geodiversity and its potential for geoeducation and geotourism: a case study from Brno city. In: *Fialová, Pernicová (eds): Public recreation and landscape protection – with nature hand in hand… Conference proceeding 1st – 3rd May 2016. Křtiny.* Brno: Mendel University, 2016, s. 224-231. ISBN (print) 978-80-7509-408-7.

HAVLÍČEK, M. a CHRUDINA, Z. Long-term land use changes in relation to selected relief characteristics in Western Carpathians and Western Pannonian basin – case study from Hodonín district (Czech Republic). *Carpathian Journal of Earth and Environmental Sciences*. 2013, 8, 231–244. ISSN 1842 – 4090.

HAVLÍČEK, M., PAVELKOVÁ, R., FRAJER, J. a SKOKANOVÁ, H. The long-term development of water bodies in the context of land use: The case of the Kyjovka and Trkmanka River Basins (Czech Republic). *Moravian Geographical Reports.* 2014, 22(4), 39–50. ISSN 1210–8812. https://doi.org/10.1515/mgr-2014-0022

PAVELKOVÁ, R., FRAJER, J., HAVLÍČEK, M., NETOPIL, P., ROZKOŠNÝ, M., DAVID, V., DZURÁKOVÁ M. a ŠARAPATKA, B. Historical ponds of the Czech Republic: an example of the interpretation of historic maps. *Journal of Maps*. 2016, 12(1), 551-559. ISSN: 1744-5647.
https://doi.org/10.1080/17445647.2016.1203830

RYPL, J. a KIRCHNER, K. Scientific values of landforms as the basis for the declaration of protected sites (a case study of Mt. Kraví hora in the Novohradské hory Mts., Czech Republic). *Applied Ecology and Environmental Research*. 2017, 15(3), 1537-1550. ISSN 1589 1623. https://doi.org/10.15666/aeer/1503_15371550

ZWOLINSKI, Z. Geodiversity. In: Goudie (ed.) *Encyclopedia of geomorphology, vol 1.* London: Routledge, 2004, s. 417–418. ISBN 0-415-27298-X.

Shrnutí

V rámci řešení projektu NAKI II Kulturní dědictví krajiny Arcidiecéze olomoucké - výzkum, prezentace a management (DGB 16P02B014) se soustřeďujeme na výsledky, které přispějí k udržitelnému rozvoji regionální kulturní identity prostřednictvím aplikovaného výzkumu kulturního dědictví v kulturní krajině zájmové oblasti, která je součástí evropské kulturní krajiny. V této krajině je akceptována historická role člověka, jako rozhodujícího elementu dynamických změn. Proto je nezbytné poznat úlohu člověka ve všech časových, sociálních i prostorových souvislostech a interpretovat rozmanitost a jedinečnost přírodních i kulturně historických hodnot krajiny a jejich podíl na vzniku kulturního dědictví. Při formulování metodického přístupu vycházíme ze skutečnosti, že součástí materiálního kulturního dědictví jsou i člověkem vytvořené antropogenní tvary reliéfu. Vznik antropogenních tvarů reliéfu často souvisí s hybnými silami vývoje kulturními etapami, válečnými událostmi, technickým a vědeckým rozvojem. Při řešení vazeb historických antropogenních tvarů vycházíme z jejich vazeb na geodiverzitu přírody, která je definována jako přirozená rozmanitost geologických, geomorfologických, půdních a hyrologických složek. Zahrnuje jejich soubory, struktury, systémy a vztahy v krajině (Gray 2004, 2013). Primární geodiverzita tvoří podstatnou část geologického a geomorfologického dědictví, ale sekundární (člověkem vytvořená) geodiverzita (viz Cílek 2002) by neměla být opomíjena, protože také reprezentuje geologické a geomorfologické dědictví. Sekundární (nebo antropogenní) geodiverzitu můžeme definovat jako diverzitu antropogenních tvarů, jejich složek, vztahů, struktur a procesů, které tyto tvary formovaly. Představujeme první výsledky k rozšíření vodohospodářských tvarů (rybničních hrází) na střední Moravě na základě historických map 1. a 2. rakouského vojenského mapování.

THE PRE-INDUSTRIAL LANDSCAPE AS A CULTURAL HERITAGE: MALÁ HANÁ

Jaromír Kolejka

Institute of Geonics, Czech Academy of Sciences, Ostrava, Brno branch, Drobného 28, 602 00 Brno, Czech Republic

kolejka@geonika.cz

Abstract: The parts of the territory with a preserved secondary (economic) landscape structure, originated around the middle of the 19th century, may be considered as existing segments of the pre-industrial landscape. Such territory has retained a similar character of plot distribution and land use of that time. These segments have been pre-identified in the contemporary cultural landscape according to the recent colour orthophotomap. The existence of that cultural heritage has been confirmed or excluded by comparison with the maps of the 2nd military survey and indicating sketches of the cadastral survey from the 1st half of the 19th century. The records were systematically carried out according to the cadastral units of the so-called working regions of Moravia. The segments of the pre-industrial landscape identified in laboratory research then underwent a field research, followed by the determination of their properties and the assessment of the state and the threats.

Key words: survey, inventory, Czech Republic

1 INTRODUCTION

The Industrial Revolution, the industrialization of the Czech lands, has profoundly manifested itself in the use and appearance of the cultural landscape. Deep changes touched not only the neighborhoods of industrial cities. Agricultural production responded also to the needs of the industry, e.g. by expanding the cultivation of technical crops, sugar beet and oil plants since the mid-19th century. The land reform after the founding of the Czechoslovak Republic has divided large aristocratic and ecclesiastical estates and the landscape often acquired the idealized character of the mosaic of small multicultural fields, meadows, pastures and groves interposed with ponds. Reinforced mechanization of agriculture after the World War II and in particular the collectivisation made the food production more productive and freed the labor power for cities, while reducing the diversity of the cultural landscape of large fields, the often inappropriate large scale cooperative objects, disrupted the human relationship to the land. Many less acceeessible areas recorded a succesion of the “nature” back into abandoned meadows and fields. The reduced number of rural population and permanent residents, which led to the recession of many municipalities, especially in the less inhabited borderland. Agricultural workers became from the original farmers, whom the free time allowed to maintain remarkable old folk buildings and to build new ones. The “rescues” of traditional rural buildings originated from weekend cottagers (often from the first generation of urbanized villagers).

These processes led to the fact that, under favorable conditions (sometimes the land use intensity was radically increased by the governmental investments in the soil draining), the large-scale farming was largely dominated on the agricultural land, and the municipalities were significantly rebuilt and modernized. Tractors replaced the horses and their pastures were disrupted. Under less favorable conditions with limited agricultural prosperity, the intensity of land use has fallen, a spontaneous afforestation and a grassing of the land often occurred, while old buildings without modernization were kept by the inhabitants of cities as their second-homes for recreation. This polarization was intensified even further after social, economic and political changes since 1990. The romantic landscape, as it was presented in the ancient baroque paintings and in the pieces of work of revival landscape painters was virtually disappeared in these waves of changes. Where to look for the remnants of the cultural landscape before the onset of intense industrial revolution (app. since 1850)? In favorable areas, it was probably disappeared perhaps due to the introduction of the large-scale agriculture and the urbanization of prosperous rural communities, and also due to the decline in interest in the landscape maintenance and due to the “return” of the nature. Therefore, it seems that the remaining segments of the pre-industrial landscape in the Czech Republic could be best preserved at the border of the territory with favorable production conditions on one hand and poor conditions for intensive agriculture on other hand. In such areas, it is expected that suitable areas for agriculture “satisfied” the need for the efficient large-scale production and gave time and power to fewer remaining locals to cultivate neighboring the less-suitable land, albeit not as intensively as before. Such municipalities were also not the object of the weekend cottagers´ preference. The more dissected terrain or the remaining wet areas in the hinterland of the municipalities (not the ravines directly adjacent to the buildings of the municipalities) predetermined a certain degree of preservation of the old way of cultivation. The confirmation of this hypothesis brings the experience from the region of Malá Haná in the west of Central Moravia and it is the subject of this paper.

2 THE TERM OF THE “PRE-INDUSTRIAL LANDSCAPE”

The issue of chronological classification is so far open to the public, at least again in the Czech Republic. The pre-industrial landscape (PreIL) of the Czech Republic may be dated before the main industrial revolution, before 1850. In this paper, it is understood as the “*areas of the present landscape with a preserved ancient secondary structure of the landscape, i.e. with the distribution and representation of arable land, permanent crops, forest, roads and trails, or mining, water and other areas that arose and developed in the time before the formation of the industrial society after app. 1850s”*. It has signs of the relatively uninterrupted socioeconomic and cultural development from the Thirty-years-war period with respect to the local natural conditions. Above all, the industrial revolution and its associated technological, population, administrative, or protectional events often conditioned the radical transformation of landscape structures, especially the economic structure. Nevertheless, relics from the previous period survived for various reasons on the development periphery of that time, and this may not be the result of complicated natural conditions. Such areas of diverse sizes and contents, which have often been out of date, often fully or partially avoided socioeconomic changes.

Preserved relics of the ancient landscape are not systematically recorded in the Czech Republic, except on the declared and prepared landscape historical zones. In some cases, such segments were registered during the preparation of the planning documentation for the territorial system of ecological stability at the municipality level, or in the case of landscape view assessments. A comprehensive study of similar issues was completed for the Novodvorska and Žehušice landscape area in the Kutná Hora district (Lipský, Weber, Stroblová, et al., 2012) and for the significant part of the Ore Mountains (Karel, Kratochvílová, eds., 2013). In connection with the research of the ancient landscape, the terms "historical landscape structure" (Brůna, Buchta, Uhlířová, 2010) and the "material memory structure of the landscape" were presented at the Czech Technical University in Prague. Back into the distant history went the "Academic Atlas of Czech History" on the course of the medieval landscapes (Semotamová, Cajthaml, et al., 2014) and also the Czech non-invasive archeology (Gojda, 2000). More advanced is the recording of "historical landscape structures" in Slovakia (Slámová, Jančura, 2012), for the present at the regional level only. In the monograph "Representative Types of Landscape of Slovakia" (Bezák, et al., 2010), a clear national map at the scale of 1: 500,000 was published representing the four main types of landscape structures (vineyard landscape, landscape with scattered settlement, pastural landscapes, mining landscape). Interestingly, among these types, there are not the arable-woodland landscapes and the wodland-parture lansdscapes numerous in the Czech Republic. Similarly, the map "Types of landscape with historical landscape structures" is included in the Atlas of Representative Geoecosystems of Slovakia (Miklós, Izakovičová, eds., 2006). The results of the nationwide inventory of historical structures on a local level are published in Slovakia (see Hreško, Petluš, eds., 2015; Hreško, Petrovich, Mišovičová, 2015). Interest in old landscapes lasts in Western Europe. An example of a successful inventory of the smaller pre-industrial landscape segments is represented by the Flemish Community of Belgium, where the inventory and classification of identified sites was carried out, but also incorporation of this issue into the regional legislation and planning practice (van Eetwelde, Antrop, 2005). The inventory process was based on the comparison of quality old maps from the end of the 18th century and the contemporary aerial photographs, followed by the verification of selected areas in the field, the follow-up evaluations and recommendations. A similar inventory was carried out by the Walloon Community of Belgium in its territory. The inventory of old landscapes was carried out in the Bretagne region (bocage records) in France, in Alentejo, Portugal (forest-agricultural complex), in the Great Britain (Bunce, et al., 1996) and in the Netherlands (Mücher et al., 2003) within the typology of the European landscapes. UNESCO also considers segments of the ancient landscapes as a valuable cultural heritage (e.g. Bandarin, ed., 2009). For the present time, however, the legislative or conservation standards for this historic type of landscape are not finalized.

3 MATERIALS AND IDENTIFICATION METHODS OF SEGMENTS OF THE PRE-INDUSTRIAL LANDSCAPE

The search for segments of the pre-industrial landscape is based on a comparison of cartographic documentss of different character, origin and quality. All necessary materials have the following key features: (1) to have the resolution to identify similar land use patterns therein, (2) to be online publicly accessible in the required amount and quality, (3) to be usable in the common imaging technology.

The research starting point is based on the idea that the recent high-quality maps allow to distinguish such land use structures that may be anachronistic in the present landscape, especially after the periods of the industrial society and the socialist large-scale farming on arable land, pastureland or in the forest. The most recent colorful orthophoto is best suited for these purposes. An attention is naturally centered on the existing small parcels of the land. Although it exists even in the vicinity of the building from the time of the industrial and socialist society, but if it is immediately adjacent to the building, its dating is easier. It is a typical accompaniment of individual houses. It arises even today (although there is usually no stripped land partition in modern development zones). However, there may also be a situation where the pre-industrial heritage can be represebter by large-scale parcels. An indicator of such a situation may be the presence of large farm estates directly in the village or at its edge. In both cases, the pre-selection of the “suspicious” areas for more detailed study needs the comparison with another key map, which is represented by the maps of the Second (Franciscus´) military survey. It just preceded the general industrial revolution on the territory of the Czech lands. If a similar structure (albeit hintingly due to the quality of map Second military survey and its 1:28 800 scale) occurs in the same place as on these old maps and present aerial imagery, it is possible to go to the detailed data source represented by the indication sketches or the imperial map impressions at the scale of 1: 2 880 and then the final decision about the area's status as a pre-industrial landscape segment can be done.

The PreIL identification process is carried out according to the cadastral units and can be divided into the sequence of steps:

1. The latest colour orthophoto is available online at https://mapy.com/. On the page, the “Basic Map” appears first after opening the page. After the basic map is displayed, the search tool will read the name of the municipality in the given cadastral unit. The outline map of the selected cadastral area appears in the map window. The same outline of the cadastral area will be displayed after switching to a recent orthophotomap and the old map.

2. The search the aerial orthophoto is focused on the areas with small parcels of agricultural land, or large-scale parcels around the isolated estates, and the extent of the forest area is also registered in the selected cadastral area. If an area with the present small parcels of land is found in the cadastral unit, this reality is provisionally verified.

3. The next step of the verification of the segment of the pre-industrial landscape is carried out by comparing the “small parcel areas” found usining by the orthophoto with the analogous territory on the map of the Second. military survey (it is also available online at https://mapy.cz/). This

comparison serves to verify if thepresent landscape structure (the mosaic of land use) seems to similar in the pre-industrial period (i.e. it was registered in the old map of the Franciscus´ survey at the original scale 1:28 800). These maps, however, have a fairly low resolution, and the map makers have neglected small parcels by generalization. If there are doubts about the accuracy of the segment identification, it is necessary to go to the final verification.

4. For the definitive assurance that the identified area has a similar structure of land use already in the pre-industrial period, it is necessary to look at the cadastral indication sketches (with the original 1: 2 880) from the first half of the 19th century administered by the Moravian Land Archive in Brno. Such data source is also available online on its website (www.mza.cz). A given cadastral unit can be found and the existing segment can be verified in the image of the archivedc cadastral indication sketch.

5. The final output for archiving tentative PreIL segments is then represented by the print-screen with the centered identified area over the recent orthophoto. The MS Office tool “paint brush” served to draw out segment´s outlines. This picture was georeferenced and the segment´s outline vectorized. Then it represents the input into the database (the the definite field verification).

6. Any segment is provided with a cadastral location code and a serial number within the cadastre for archiving.

Possible problems in identifying segments of the pre-industrial landscape include, among other things,

1. Some cadastral territories have been merged. When using the search engine on maps.cz for a given municipality, only the outline (in essence) of the built-up area of the given municipality and not its cadastre is displayed. It is possible to visualize the outlines of the cadastres of the neighboring municipalities or visually outline the cadastre in the GIS.
2. Pre-industrial landscape heritage is also forests. In particular, their “facade” (the edge to the open landscape) forms part of the appearance of the country at that time. This edge and interior of the forest could be positionally stable, but could vary according to the species of the growing tree. It is to be imagined, however, that conifers were artificially propagated in the unnatural locations in the territory of today's Czech Republic from about 1780 (mainly by sowing) and their share in lower positions could be higher than at present. As a standard of pre-industrial legacy segment recognition, the current dominance of the broad-leaved tree stands.

4 THE INVENTORY IN WORKING REGION OF MALÁ HANÁ

The inventory of existing segments of the post-industrial landscape in the historical territory of Moravia is supported by the project of the Ministry of Culture of the Czech Republic under the title “The Inventory of the Pre-Industrial Landscape of Moravia and ensuring public awareness of its existence as a cultural heritage” (see Acknowledgments at the end of the paper). The objectives of the project are as follows: (1) The inventory of pre-industrial landscapes within historical boundaries of Moravia on the basis of comparison of historical map documents with the latest cartographic products; (2) The classification of identified areas in quantitative and qualitative categories; (3) The compilation of the text, visual (maps, images, pictures) and tabular documentation for each registered PreIL unit with proposal for measures for the further maintenance and management; (4) The electronic documentation publishing in a form accessible to municipalities and the public with the consent of the Ministry of Culture; (5) The composition of a mobile, regionally adaptable exhibition on "The former landscape in the regions of contemporary Moravia"; (6) The elaboration of an electronic methodical and educational material for schools and the public.

A team of specialists was set up to solve the project tasks. Individual team members process the assigned territory according to a uniform methodology. For these purposes, the territory of the historical Moravia was divided into working regions. The first task was to precisely define the territory of the historical Moravia because the current administrative division of the Czech Republic into the modern regions and the districts does not respect the old borders of Moravia. The definition of the historical territory of Moravia was based on the digital map of the political districts of Czechoslovakia in 1921, when this border was in force. The Moravian Land as one of the top self-governing entities of the pre-war Czechoslovakia existed within these borders until 1928. The distant so-called Moravian enclaves in Silesia were not included in the defined territory of Moravia (with the exception of the village Butovice in the Nový Jičín district, practically adjacent to the coherent territory of Moravia). The comparison with the demarcation of political districts in 1930, when the unified Moravian-Silesian Land already existed, discovered some changes at the border with the Bohemian Land and/or with the original Silesian Land. Relatively numerous detailed border irregularities from 1921 were identified within the current demarcation of the cadastres of municipalities on the border with Bohemia and Silesia. They are, however, totally insignificant. Minor changes of borders with Slovakia took place after the split of the Czechoslovak federation in 1993.

The actual regionalization of the defined territory of the historical Moravia is based on the ethnographic regions of Moravia presented in the available literature. The main source of documents is the Atlas of the Landscape of Czech Republic (2009 – the map of the "Ethnographic Regions" of the authors R. Jeřábek, J. Vařeka, J. Woitsch). There are other sources available: (http://is.muni.cz/el/1431/podzim2009/Z5790/Etnografie_Moravy.pdf - The Folklore Regions of Moravia;
https://dalsimoravak.wordpress.com/2013/11/16/etnograficke-oblasti-moravy / - The Ethnographic regions of Moravia). The ethnoregions defined within them are basically identical, but some local dissonances and differences in subdivisions are evident. The rrangement of the cadastres of the Moravian municipalities into existing "ethnoregions" proceeded from the nuclei of these regions towards their borders by assigning an attribute in the form of the name "ethnoregion" in the corresponding column of the ESRI ArcView attribute table. It was problematic to include municipalities at unclear borders between existing "ethnoregions". There it was necessary to look at the websites of the affected municipalities and, according to the information given there, the ordering was made. If this information was

missing, the physio-geographic regionalization factors were applied. Then high relief objects (ridges and mountains), larger rivers, or large forest areas became the borders between "ethnoregions". Large areas outside the existing "ethnoregions", remaining after the previous demarcation, were divided into "working regions" and obtained names of the geomorphological or hydrogeographic origin (e.g. Jeseníky Mts. area, Podyjí Area – after the River Dyje, Brno Area, Letovice Area etc.). The result is represented by the division of Moravian cadastral units into 12 working regions. They differ in size, especially in the case of existing "ethnoregions". Based on the personal interest of individual members of the project team, they were assigned them for processing.

One of the defined regions is Malá Haná (Fig. 1). It includes both the physio-geographical unit of the same name (as part of the Boskovice furrow – according to the Geomorphological division of Czechoslovakia - Czudek, et al., 1973), and the adjacent edges of the surrounding elevations, reached by the margins of the cadastral areas of the municipalities, mostly located on the border of Malá Haná with the surrounding mountains.

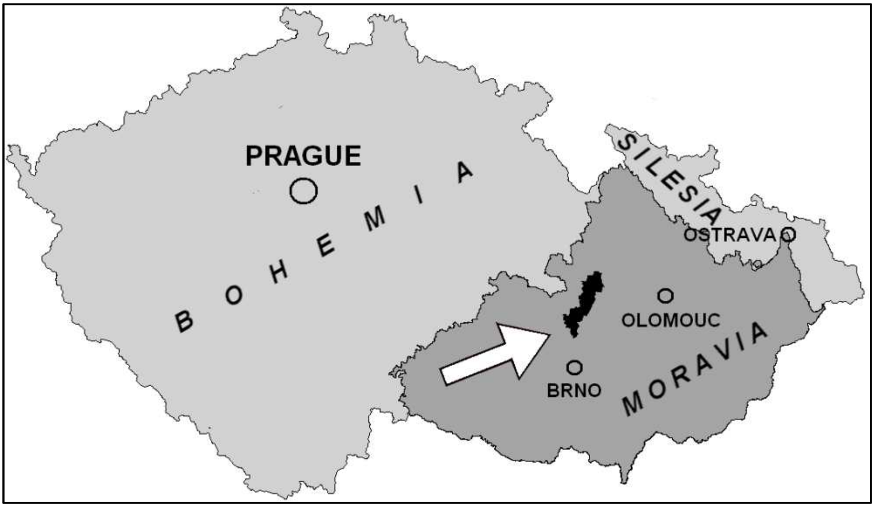


Fig. 1. Location of the Malá Haná Working Region in the historical territory of Moravia within the Czech Republic.
Source: own processing

The region has an area of 275.55 km^2 and belongs to the smallest working regions of Moravia. It consists of 28 cadastral territories of 40 municipalities, of which 6 are towns and cities (Figure 2 - left). It is divided geographically into three diverse parts (Fig. 2 – on the right): a) the basic ethnoregion of Malá Haná in the north between towns Chornice and Boskovice (it occupies about 2/3 of the area of interest); b) the basin near the railway crossing Skalice nad Svitavou; and c) the Lysicko Area as the southernmost part covering approximately 1/3 of the region from Skalice nad Svitavou to Černá Hora. For explanation: The cadastral areas of the villages Lazy, Mezihoří u Městečka

Trnávky, Unerázka, Petrůvka u Městečka Trnávky and Pátíkov, and the town of Trnávka, interfering with the geographical region of Malá Haná, were connected to the ethnoregion (and the working region) Hřebečsko and Zábřežsko, as there was a strong pre-war German-speaking population (in comparison to Czech-speaking Malá Haná). Their territory was occupied by Nazi-Germany after the Munich dictate in 1938.

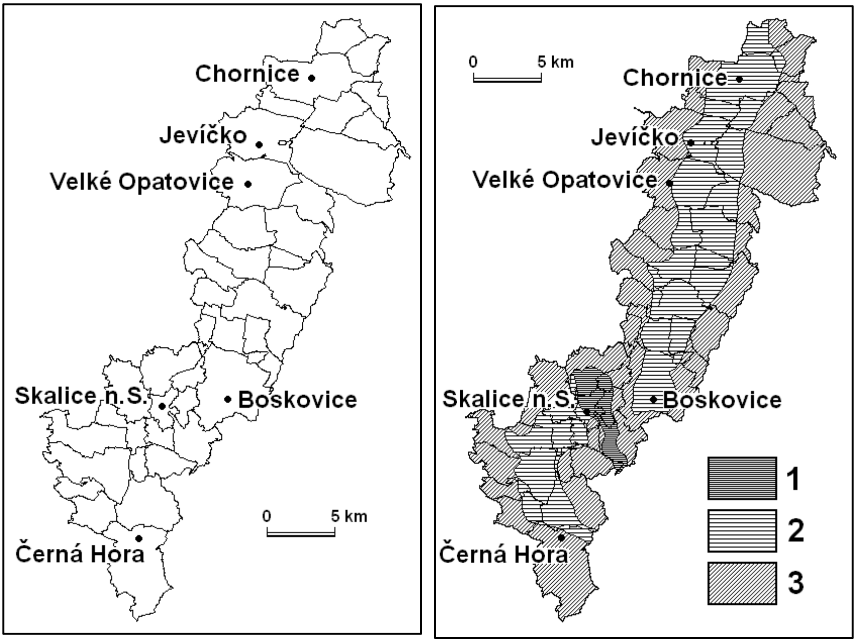


Fig. 2. The internal administrative division of the Malá Haná working region into the cadastral areas of the municipalities. (Key: 1 – alluvial plain of the Svitava River basin, 2 - predominantly flat bottom of the Boskovice furrow, 3 - surrounding mountains of the Bohemian-Moravian Upland, Brno Upland and Zábřežská vrchovina Highland)
Source: own processing

It is clear (see Fig. 2 - right) that the individual cadastral areas share both the flat and fertile bottom of the Malá Haná furrow and their territorial stripes extended into the adjacent mountains. At the bottom, in the warm climate (T_a = 7-8°C), the soil cover consists of mollisols and luvisols developed on the loess and Neogenic sediments, and cambisols originated on the outcrops of hard Permian sedimentary rocks. Surrounding steep elevations rising up to 200 m or more above the bottom of the firrow are built with old crystalline rocks, rarely Cretaceous sandstones, and they are covered with stony cambisols in the app. to 1-2°C colder climate. Only the floodplain of the Svitavy River near Skalice nad Svitavou is covered with an extensive area of fluvisols. They accompany other water courses of the region with narrow strips only.

The field research inventory was carried out according to individual cadastres in this region, in 2016 and 2017. The results are given below.

5 RESULTS OF FIELD RESEARCH AND INVENTORY

The field research consisted of two phases. The first one included the identification suitable segments of the pre-industrial landscape according to the methodology in a laboratory environment on a PC with an Internet connection. The second one took place directly in the field and was targeted on the visit of all selected segments. It should be noted that such segments surprisingly remained in very little number (only in 9 of the 41 cadastral areas of the region – see Fig. 3).

While the arable land is dominated on the flat and fertile bottom of the furrow, the forests cover the steep slopes of the adjacent mountains. The built-up areas of the villages (except the very old Chornice) mostly developed at the edge between the furrow the mountains. Probably already at that time, the founders of villages had in mind the preferential protection of fertile soils before housebuolding, also the location at a source of water and building materials (clay, stone, wood). The identified segments of the pre-industrial landscape of varying sizes and quality survived generally at a short distance from villages located in the open valley mouths from the mountains to the Malá Haná depression as part of the larger Boskovice furrow.

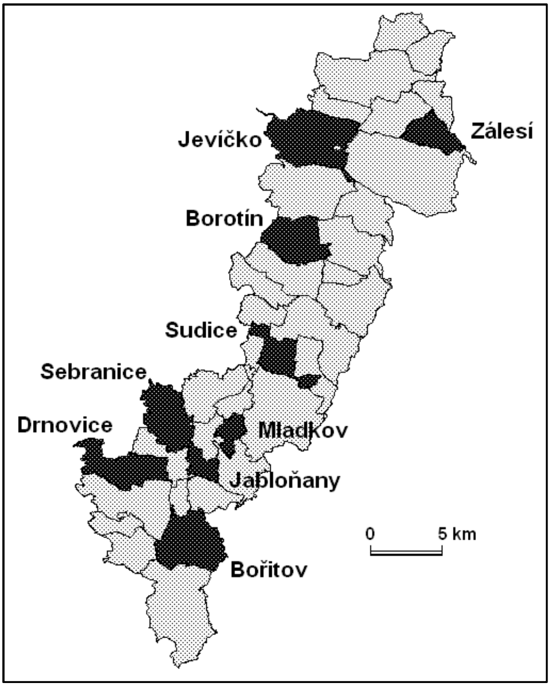


Fig. 3. Malá Haná. Cadastral areas with segments of the pre-industrial landscape marked in black.
Source: own processing

The main parameters of the identified segments of the pre-industrial landscape are documented in Table 1.

The field research demonstrated unequivocally that segments of the pre-industrial landscape recruited most often from previously intensively used arable land on terraced slopes, exceptionally from fields along the slope and separated by distinct edges. Due to the slope and usually low-fertility soils (with the exception of the foothills with better soils), the collectivization had not affected thesize and shape of land parcels here. The land use turned rather from an intense to an extensive farming associated with "greening" both the original farmland and the terrace slopes. The edges of the land parcels were affected by intense succession of bushy and tree vegetation. The joining of plots in flat terrain was partly avoided only in some waterlogged areas in the floodplain near the village of Sudice. However, in connection with the land restitutions after 1989, some small parcels were restored in the flat terrain (the slightly inclined plain) and partly on slopes near Drnovice.

The gradual degradation of pre-industrial landscapes runs in the Malá Haná working region. The main degradation process is represented by the reduction in the intensity of use of less useable plots of land, first of all followed by targeted and spontaneous grassing and gradual afforestation. The succession of shrubs and trees started from the originally grassland on terraced slopes and edges. These are now practically completely overgrown and woody vegetation spreads from the edges into the former arable land, nowadays the meadows and pastures. The tree dissemination process is effectively slowed down where plots on the terraced slope are accessible for agricultural machines (Borotin – Fig. 4). The conversion of the arable land to pastures slows down the succession of tree species, but the accompanying phenomenon of the change in land use is the erosion of soil at the edges (Jabloňany). The process of parcel overgrowing with trees already advanced significantly in some places and grass in these areas are no longer mowed (Sebranice, Bořitov). In the case of Bořitov, the most of the area of the pre-industrial landscape segment enjoys a certain degree of protection of nature as a significant landscape element (VKP Větrník). The subject of protection is represented by dry thermophilous sites, which are threatened by the growth of shrubs and trees. Some old orchards were preserved, partly used and renewed in the cadastral area of the village of Zálesí (now part of the Biskupice municipality). The succession of trees is held back by ongoing fruot tree planting here. The long parcels along the slope are gradually afforested at the village of Mladkov.

Tab. 1: Main natural features od identified segments of the pre-industrial landscape un the Malá Haná working region

PreIK No.	location			
	cadastral area	slope	aspect	soil
1	Borotín	steep	NE-E	cambisol
2	Bořitov	steep	SW	haplic leptosol
3	Drnovice	flat	NE	luvisol/stagnosol
4	Jabloňany	gentle	W-SW	luvisol/cambisol

5	Jevíčko	gentle	SE	cambisol
6	Mladkov	steep	NW	luvisol/cambisol
7	Sebranice	gentle	SE-E	luvisol/cambisol
8	Sudice	flat	-	mollisol/fluvisol
9	Zálesí	steep	W	cambisol

Source: own processing

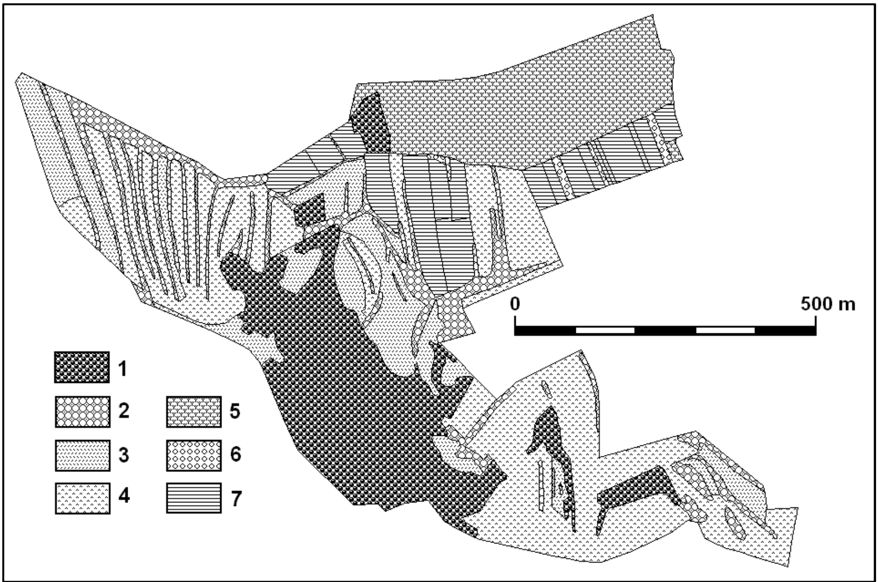


Fig. 4. The segment of the preindustrial landscape south of Borotín in 2017. (Key: 1 - forests, 2 - bushes and trees, 3 - abandoned meadows, 4 - mowed meadows, 5 - gardens, 6 - orchards, 7 – arable land)
Source: own processing

6 CONCLUSION

There is a steady decline of segments of the pre-industrial landscape, initiated in the post-war period by the collectivisation of agriculture in the Malá Haná working region. The original varied agricultural landscape with a small plot of land in the flat territory almost disappeared. An interesting exception is the surroundings of the village Drnovice, where small parcels form a significant part of the land in the flat and gently inclined part of the cadastral area. South of the center of the village Sudice is partly preserved a segment of the ancient landscape in a wide humid valley along the creek adjacent to the estate Sudický Dvůr (Pastvisko – Fig. 5). However, the insertion of breeding fish ponds into the landscape disturbs the original appearance of the segment.

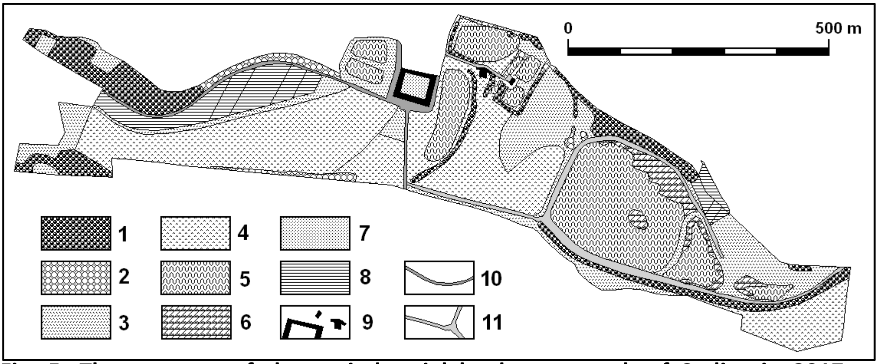


Fig. 5. The segment of the preindustrial landscape south of Sudice in 2017. (Key: 1 - forests, 2 - bushes and trees, 3 - abandoned meadows, 4 - mowed meadows, 5 - water bodies, 6 - reed, 7 – farm courtyard, 8 – arable land, 9 - buildings, 10 - paved roads, 11 - field roads)
Source: own processing

There are also areas of small land holdings outside the village Flintour (part of the of Biskupice municipality) and near the village Jaroměřice in the Malá Haná working region. However, these can not be categorized as segments of the pre-industrial landscape, as on the old maps of the first half of the 19th century they had the form of large continuous plots and their partition seems toik place later in connection with the division of large land holdings in land reforms.

The remnants of the pre-industrial landscapes of the Malá Haná working region thus mostly represent an atypical marginal original cultural landscape with dissected terrain, and their status is usually not a guarantee of their preservation to a more distant future. The promotion of this type of landscape in the public and the increased attendance of sites as an important cultural heritage may push the owners or users of these plots to keep them constantly exploited and thus maintained and protected.

Acknowledgment: The inventory and research of the segments of the ancient landscape is part of the project “Inventarization of the Pre-Industrial Landscape of Moravia and ensuring the public awareness of its existence as a cultural heritage” supported by the Ministry of Culture of the Czech Republic under No DG16P02B042 for the years 2016-2020 within the Program for support of applied research and experimental development of national and cultural identity for the years 2016-2022, with Global Objective 2: Cultural Heritage, and Specific Objective 2.1 Research and its Application - Cultural heritage and areas with historical values.

REFERENCES

BANDARIN, F., ed. World Heritage Cultural Landscapes. A Handbook for Conservation and Management. 1. vyd., Paris: UNESCO, 2009, World Heritage Papers 26.

BEZÁK, P., et al. Reprezentatívne typy krajiny Slovenska. 1. vyd., Bratislava: Ústav krajinnej ekológie Slovenskej akadémie vied, 2010.

BRŮNA, V., BUCHTA, I., UHLÍŘOVÁ, L. Identifikace historické sítě prvků ekologické stability krajiny na mapách vojenských mapování. Ústí nad Labem: Univerzita J. E. Purkyně, 2002, Acta Universitatis Purkynianae, Studia Geoinformatica II.

BUNCE, R. G. H., BARR, C. J., CLARKE, R. T., HOWARD, D. C., LANE, A. M. J. ITE Merlewood Land Classification of Great Britain. Journal of Biogeography. 1996, roč. 23, č. 5, s. 625-634. https://doi.org/10.1111/j.1365-2699.1996.tb00023.x

CZUDEK, T., et al. Regionální členění reliéfu ČSR. Mapa měřítka 1:500 000. Brno: Geografický ústav ČSAV, 1973, Mapy regionálního členění ČSR.

VAN EETWELDE, V., ANTROP, M. The significance of landscape relic zones in relation to soil conditions, settlement pattern and territories in Flanders. Landscape and Urban Planning. 2005, roč. 70, č. 2, s. 127-141. https://doi.org/10.1016/j.landurbplan.2003.10.009

HREŠKO, J., PETLUŠ, P., eds. Atlas archetypov krajiny Slovenska. 1. vyd., Nitra: Univerzita Konštantína Filozofa, 2015.

HREŠKO, J., PETROVIČ, F., MIŠOVIČOVÁ, R. Mountain landscape archetypes of the Western Carpathians (Slovakia). Biodiversity and Conservation. 2015, roč. 24, č. 13, s. 3269-3283.

KAREL T., KRATOCHVÍLOVÁ, A., eds. Proměny montánní krajiny. Historické sídelní a montánní struktury Krušnohoří. 1. vyd., Loket: NPÚ, ÚOP v Lokti, 2013.

LIPSKÝ, Z., WEBER, M., STROBLOVÁ, L., et al. Současnost a vize krajiny Novodvorska a Žehušicka. 1. vyd., Praha: Karolinum, 2013.

MIKLÓS, L., IZAKOVIČOVÁ, Z., et al. Atlas reprezentatívnych geoekosystémov Slovenska. 1. vyd., Bratislava: ÚKE SAV a Ministerstvo životného prostredia SR/Ministerstvo školstva SR, 2006.

MÜCHER, C. A., et al. Identification and Characterisation of Environments and Landscapes in Europe. 1. vyd., Wageningen: Alterra, 2003, Alterra rapport 832.

SEMOTAMOVÁ, E., CAJTHAML, J., et al. Akademický atlas českých dějin. 1. vyd., Praha: Academia.

SLÁMOVÁ, M., JANČURA, P. Typológia historických krajinných štruktúr. In: Konferencia: Krajina-človek-kultúra, 1. vyd., Zvolen: Technická univerzita vo Zvolene, 2012, 15. 1-60.

Shrnutí

Části území se zachovalou druhotnou (ekonomickou) strukturou krajiny, vzniklou cca před polovinou 19. století, lze považovat za existující segmenty předindustriální krajiny. Takové území si zachovalo podobný charakter parcelace a využití pozemků z této doby. Tyto segmenty byly předběžně identifikovány v současné kulturní krajině podle recentního barevného ortofota. Srovnáním s mapou II. vojenského mapování a indikačními skicemi katastrálního mapování z 1. pol. 19. st. byla existence toho kulturního dědictví potvrzena, nebo vyloučena. Evidence probíhala systematicky po jednotlivých katastrálních územích tzv. pracovních regionů Moravy, v tomto případě v regionu Malá Haná (obr. 1). Laboratorně zjištěné segmenty předindustriální krajiny pak prošly terénním výzkumem, na který navazovalo stanovení jejich vlastností a hodnocení stavu a ohrožení.

Terénní výzkum jednoznačně prokázal, že segmenty předindustriální krajiny se nejčastěji rekrutují z dříve intenzivně využívaných polností na terasovaných svazích okolních pohoří lemujících sníženinu Malé Hané, výjimečně z bývalých polí vedených po spádnici a oddělených výraznými mezemi (obr. 2). Díky sklonu svahu a zpravidla půdám nižší bonity (s výjimkou úpatí na úrodnějších půdách) se kolektivizace zásadně nedotkla parcelace pozemků. Spíše zde obvykle došlo k přechodu od intezivního k extenzivnímu hospodaření spojeného s „ekologizací“ jak vlastních zemědělských ploch, tak jejich terasových rozhraní či mezí. Okraje pozemků podlehly intenzivní sukcesi keřové a stromové vegetace. Spojování pozemků v rovinatém terénu se zčásti vyhnuly pouze podmáčené plochy v nivě u obce Sudice. V souvislosti s restitucemi však místy doslo k obnovení drobné parcelace i v rovinatém terénu (mírně ukloněná rovina) a zčásti i na svazích v okolí Drnovic. Celkem bylo v regionu zjištěno 9 hledaných segmentů (obr. 3).

V pracovním regionu Malá Haná probíhá setrvalý úbytek segmentů předindustriální krajiny, zahájený v poválečném období kolektivivizací zemědělství. Příkladem segmentu předindustriální krajiny v členitém terénu je okolí obce Borotín (obr. 4). Původní pestrá zemědělská krajina s drobnou parcelací pozemků v rovinatém území téměř vymizela. Zajímavou výjimkou je okolí Drnovic, kde drobná parcelace se z významné části udržike v ploché i sklonitější části katastru. Jižně od centra Sudic je částečně uchován segment starobylé krajiny ve vlhké sníženině kolem potoka v sousedství statku Sudický Dvůr (Pastvisko – obr. 5). Vkládání dalších chovných rybníků do krajiny však původní vzhled segmentu narušuje.

V pracovním regionu se rovněž vyskytují areály drobné pozemkové držby mimo vlastní zónu záhumenků u obce Flintour (část obce Biskupice) a u obce Jaroměřice. Tyto však nelze zařadit do kategorie segmentů předindustriální krajiny, neboť na starých mapách z 1. poloviny 19. století figurují v podobě rozsáhlých souvislých pozemků a k jejich parcelaci zřejmě došlo později v souvislosti s dělením velkostatků při pozemkových reformách. Rezidua předindustriální krajiny Malé Hané tak většinou reprezentují netypickou původní kulturní krajinu s členitým terénem a jejich stav v současnosti zpravidla není zárukou jejich uchování do vzdálenější budoucnosti. Propagace toho typu krajiny u veřejnosti a tím zvýšená návštěvnost lokalit jako významného kulturního dědictví však může vlastníky, resp. uživatele těchto pozemků přimět k setrvalému využívání a tím k jejich údržbě i ochraně.

NATURAL ASPECTS OF THE DEVELOPMENT OF THE LANDSCAPE WITH DISPERSED SETTLEMENT (EXAMPLE OF THE HRUŠOV VILLAGE CADASTRAL AREA)

Ján Lacika [1], Ján Hanušin [2]

[1] *Department of Geography and Regional Development, FNS CPU in Nitra, Trieda A. Hlinku 1, 949 74 Nitra, Slovak Republic*

j.lacika@ukf.sk

[2] *Institute of Geography of Slovak Academy of Sciences, Štefánikova 49, 814 73 Bratislava, Slovak Republic*

hanusin@savba.sk

Abstract: The landscape with hamlets represents a distinctive type of cultural landscape with a relatively large spread in Slovakia characterized by very close ties between humans and nature. The dispersed type of settlement was formed mainly in more remote regions with difficult conditions for life, in certain specific types of the natural landscape of the Slovak Carpathians. This paper focuses on research into the extent and nature of the impact of natural conditions on the origin and development of the dispersed settlement in the model territory of the cadastral area of the village of Hrušov (district of Veľký Krtíš). Among other things results, we found that the dominant determinant of the character of the dispersed settlement of the model territory is a relief.

Key words: dispersed settlement, cultural landscape, natural landscape, village Hrušov.

1 INTRODUCTION

The type of landscape with dispersed settlements is a distinctive and special phenomenon of the Slovak Carpathians with its own building culture and specific landscape structures that over the course of several centuries have written indelible traces on the Carpathian landscape and have become a permanent part of the tangible and intangible heritage and the unrepeatable genius loci. Scattered settlements in Slovakia are a distinctive type of settlement forming a distinctive type of landscape. They were created during certain historical periods, forcing part of the population to settle in more remote and not easily accessible mountain areas and the cultivation of the surrounding countryside under limited natural conditions. Huba (1989) this type of settlement was characterized as a settlement until the by then anecumene in the remote parts of the townships of older municipalities and, to a certain extent, always constituted an extreme and extemporary residential manifestation. According to Sitár (1967), in the establishment of the dispersed settlements, it must be possible to carry out its basic function of soil cultivation at the given site, even when the conditions at the boundary of load bearing capacity are difficult. Petrovič (2006) draws attention to the example of the region of Nová Baňa, where besides pastors and hunters, scattered settlements were also found and inhabited by woodcutters, charcoal-burner, glassmakers and miners.

Despite the extreme nature of these natural conditions, the type of landscape with dispersed settlements within Slovakia cannot be understood as a marginal phenomenon (marginal = 10%). Five areas with scattered settlements occupy a total of 4 640 km^2, which represents almost one tenth of the territory of Slovakia. Nahálka (1966) states that in 1961 there were 2 899 dispersed settlements in 166 Slovak areas, in which approximately 140 000 people lived. Although the population in these dispersed settlements has been reduced in the following decades, dispersed settlements in the country have largely remained. The type of landscape with dispersed settlements is still present in Slovakia, but increasingly in a neglected or degraded state.

2 STATE OF KNOWLEDGE

Mainly geographers and ethnologists acquit of themes of scattered settlements in Slovakia well. For geographically focused research, a landscape with dispersed settlements is an interesting phenomenon with a very specific type of cultural landscape, closely bound and determined by natural conditions. Ethnologists are attracted to the inhabitants of dispersed settlements with their own and unique way of life in the difficult conditions of the remote corners of the landscape. The first ethnological work on this type of Slovak country emerged during the inter-war period and the most geographic studies were created completed in the 1980s. The agile self-government of the village issued a valuable edition of the monograph entitled Traditional Material Culture of the Village of Hrušov. For us the most beneficial are the works about farming (Brada et al. 2014) and the traditional folk architecture (Brada, Brloš 2013).

3 METHODOLOGICAL BACKGROUND

In the literature, we have found two inspirational studies dealing with the localization of cultural landscape elements in the natural environment. Both have taken advantage of the comprehensive integrated *STATISTICA* system. The work of Izakovičova et al. (2016) used it to evaluate the localization of the castles in Slovakia. It has worked with a set of statistical units with nationwide expansion, which also corresponds to the diversity of natural landscape types. The work of Petrovič (2006) has a more local aspect, worked with statistical files on dispersed settlements and their positional and geomorphologic properties.

Our approach is methodologically more traditional and simple, based on detailed typology of the natural landscape, simple statistical operations and very detailed field research. Between 2015 and 2017, we performed a detailed mapping of the basic elements of the natural and cultural landscape recorded in a basic topographic map at a scale of 1:10 000 and a modified map provided by the *EUROSENSE* aerial photography published on the Mapy.cz web portal (2012). In the framework of research on the dynamics of changes in the historical cultural landscape of the model territory, we applied the method of analysis of the available cartographic data, historical maps of military mapping (National Geoportal SR 2014) and historical orthophotomaps of Slovakia from 1950 (Geodis Slovakia, TU Zvolen et al.).

4 MODEL TERRITORY

Before 1918, the village of Hrušov had (Fig. 1) a very peripheral position, lying on the eastern edge of Hont region far from the regional centres Šahy, Krupina and Modrý Kameň. Its periphery, after the collapse of the Austro-Hungarian monarchy, was further accentuated by the loss of relatively good accessibility to Budapest and in the new Czechoslovak state it developed as part of a neglected and economically unsupported region. At present, the village of Hrušov is incorporated into the district of Veľký Krtíš, 31 km from its centre. The peripheral location and the low degree of economic development of the region causes the village of Hrušov to be depopulated. Of the 1 200 inhabitants in 1970, the population dropped to 849 in 2016.

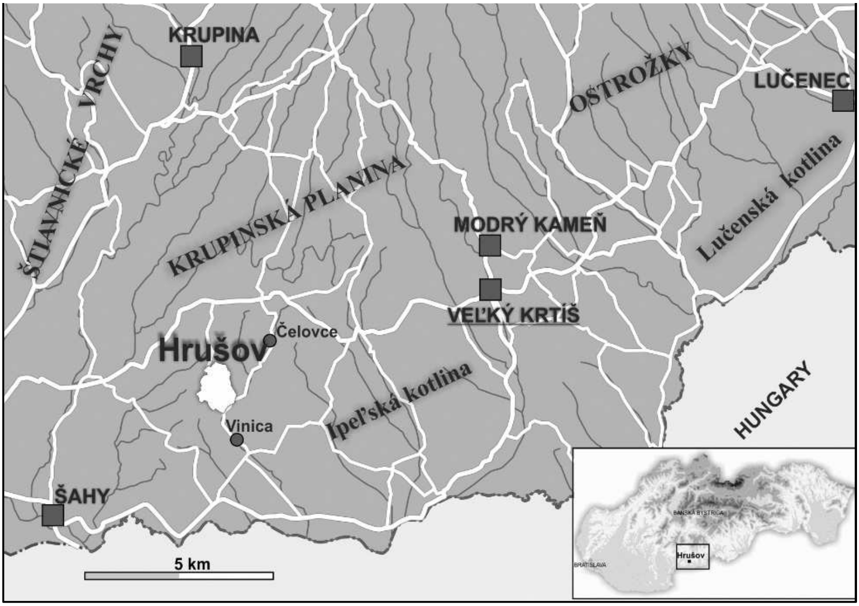


Fig. 1 Position of the model territory

4.1 Development of the natural landscape

The memory of the present natural landscape of Krupinská planina dates back to the period of the Lower Baden, when activated the volcanoes of the Šahansko-lysecka volcanic-tectonic zone (Vass et al 1979 and 1983). The result of their activity is a volcanic complex, which in the studied area is dominated by tuff and tuffitic sands. Since the Sarmat period, the terrestrial development has been free of volcanism. In the form of break tectonics and cyclical changes of the climate, the non-karst plane and the erosion-tectonic basin have gradually been individualized. The model territory is located in the transition zone between the two geomorphological different environments. The southern part is part of the southernmost part of the Modrokamenské úboče Slopes (Mazúr and Lukniš 1978) on the northern part of the bounds which reaches the edge of the Dačolomská planina Plain. The geomorphologic boundary location of this area is determined for the nature of the local natural landscape. The relief along with the subsoil are relevant components determining the properties of its other components (air, water, soil and vegetation) which significantly affect the human activities in it.

4.2 Development of cultural landscape

The archaeological artefacts of the settlement of Baden's culture, exposed by plowing, and the historical references of two medieval settlements suggest, that the historical cultural landscape began in the territory of Hrušov in the very past. The clearer contours of its possible form, however, can be found in our early years. From the 18th century, we can identify it more closely from the historical maps of the military mapping of the monarchy.

On the map of the 1st Military Mapping (1764-1787), the state of the cultural landscape is roughly similar to that of today. Part of it was a mass village connected by a road with the neighbouring Vinica village, which continues to the north, ramifying to the local network of access roads to about thirty settlements in a similar layout as today's dispersed settlements. According to Brada and Brloš (2013), the scattered settlements were created from the so called barns built outside the built-up area which became the temporary dwellings of shepherds and later also the farmers farming the expansive arable land on the plains. Unlike the northernmost lying dispersed settlements inhabited by pastors coming from other regions, the domestic population moved to the Hrušov territory Švecová (1984).

The map of the 2nd military mapping (1810-1869) shows the status after a large splitting of parcels land in the built-up area that was caused by fires. In the area outside the built-up area, we can find several, nowadays used place names of local places. Changes in the cultural landscape, particularly in the non built-up areas on the map of the 3rd Military Mapping (1875-1884), were caused by land merging. Soil consolidation created new large land plots of estates that remained internally differentiated, just with an altered ground plan. The decline of large estates in the first half of the 20th century began the unprecedented boom of the Hrušov area. Besides the increasing of the number of small settlements and their inhabitants they were also rebuilt to adapt to year-round living. The inhabitants of small dispersed settlements in Hrušov area began to use so-called double-residency housing to such an extent like nowhere else in Slovakia (1980 and 1988). The Reeves and their family lived in a settlement outside of a village in the week and only stayed a short time on Sunday in the second house in the village. This way of life was the driving force behind the development of the Hrušov landscape, when it enabled its inhabitants to intensify and better farm on the land while keeping the link between dwellings in and outside the village.

The cooperative farms operating in Hrušov until 1979 were able to develop only some forms of collective agriculture transforming the original landscape.

The most striking intervention in the landscape structure was the destruction of the orchards of the renowned Hrušov fruit farmers. The dispersed settlement country was negatively affected by the forced radical changes in land ownership forcing ex-private farmers to leave the dispersed settlements, which ceased to play the role of remote points of farming. The rate of desolation of the dispersed settlement country in Hrušov in the years 1950 to 2010 is documented in the works of Hanušin and Lacika (2017 in the print). The resulting state captures the map of land cover (Fig 2).

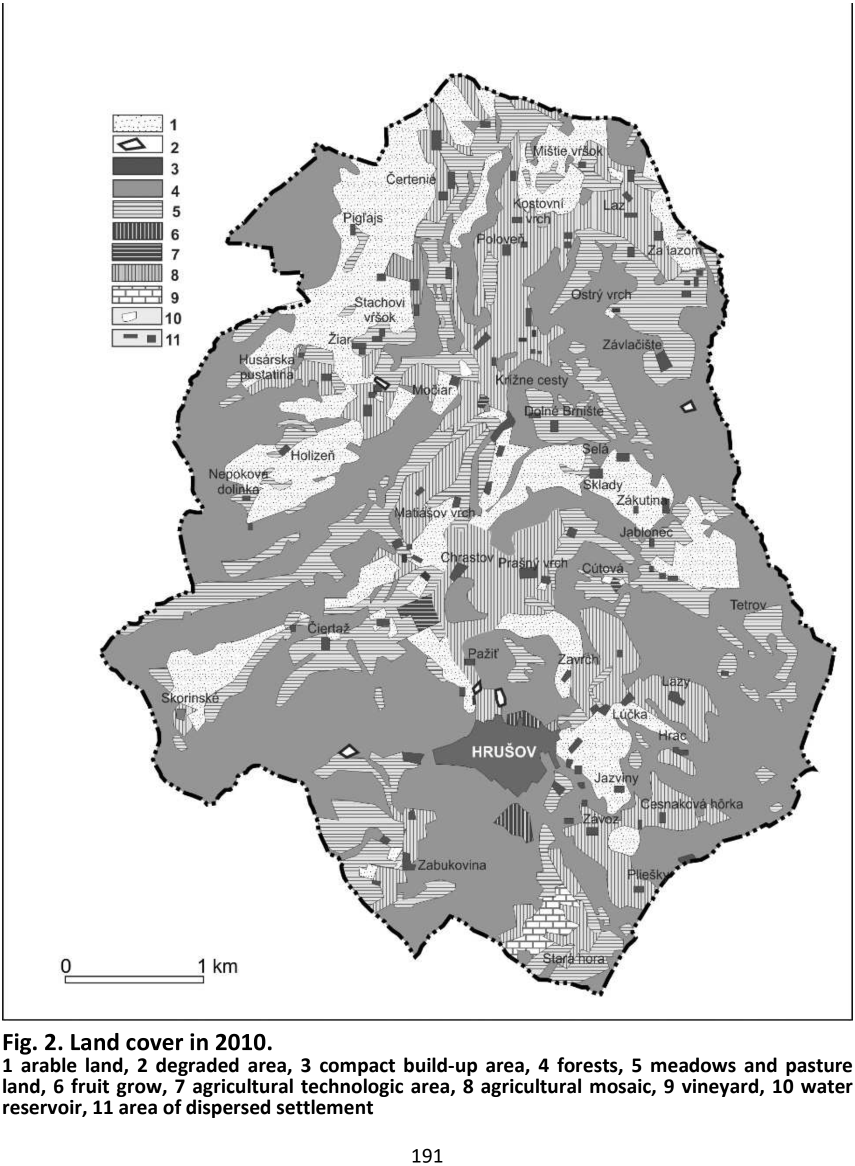


Fig. 2. Land cover in 2010.

1 arable land, 2 degraded area, 3 compact build-up area, 4 forests, 5 meadows and pasture land, 6 fruit grow, 7 agricultural technologic area, 8 agricultural mosaic, 9 vineyard, 10 water reservoir, 11 area of dispersed settlement

The current state of the settlement was determined by field research using local government data. In 2016, outside the built-up areas of Hrušov, there were 205 dispersed settlements, of which 86 were occupied and 110 were used for occasional housing, especially as a holiday cottage. A positive trend in recent years has been the arrival of the so-called homesteaders from the ranks of immigrants who mostly develop beneficial landscaping activities.

5 RESULTS

The geomorphological conditions in the given area of the village of Hrušov are created by the basic features of its natural landscape. Climatic, hydrological, soil and vegetation ratios are also being adapted to the local scale. The geological base here appears to be a relatively homogeneous component of the natural landscape with a local impact on its overall heterogeneity. From the given facts, our classification criterion for the exclusion of the types of the natural landscape of a given territory are the morphometric, morphographic and morphogenetic properties of the relief.

5.1 Types of natural landscape and dispersed settlements

The relevant territory of the cadastral village of Hrušov is part of the geomorphological complex Krupinská Planina Plain, which has developed throughout its territory a natural type of landscape of a non-karst plain. It is possible to single out two types of a lower grade natural landscape (Fig. 3), namely the type of plain (A) and the type of plain slopes (B). This breakdown is based on the fact that the plains are generally made up of plateaus and slopes with which these plateaus are bound.

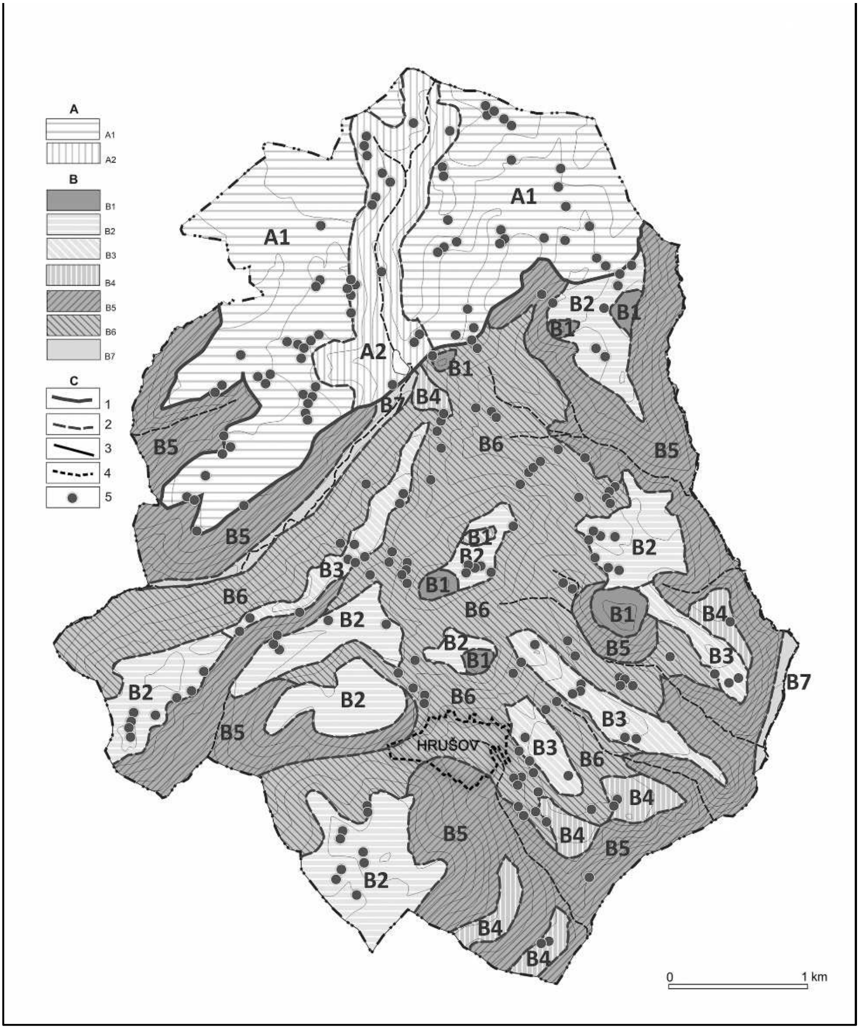


Fig. 3. Types of the natural landscape.

A type of plain plateau: A1 subtype of plateaus, A2 subtype of shallow valleys. B type of plain slopes: B1 subtype of isolated elevations, B2 subtype of isolated plateaus, B3 subtype of flat ridges, B4 subtype of slope and saddle plateaus, B5 subtype of steep valley slopes, B6 subtype gentle valley slopes, B7 subtype of valley bottoms. C Other marks: 1 type border, 2 subtype border, 3

5.1.1 Type of plain plateau A

Type A occupies about a quarter of the bounds. It is made up of a fairly entire flat plateau (subtype A1) divided by relatively short and shallow valleys (subtype A2). The subtype of plateaus **A1** is characterized by the least dissected relief within the given territory, and according to the relative altitude it is a wavy plane to the lower hills. From a topical point of view, this subtype has the highest potential for the development of economic activities and the formation of the settlement and communication network. It is the territory with the lowest degree of internal barriers. Taking into account the choral aspects of the morphographical type of relief according to URBÁNEK (1981) we must also take into account the so called external barrier expressing the remoteness, inaccessibility and isolation of the territory thereby reducing the potential output. Subtype A1 is divided into two plain plateaus. The more compact northwest plateau is a wavy plane with distinctly rounded and convex relief shapes. The integrity of the northeast plateau is disturbed by the shallow valley bent into a U-shaped plan. Its presence provides relief in the highlands with many occurrences of concave shapes.

Subtype of shallow valleys **A2** is inserted between subtype A1 plateaus. It has more dynamic morphographic parameters than the subtype A1. The flat bottom of the valley, with a channel of the permanently flowing Olvár stream, is bordered on both sides by steeply forested slopes up to 60 m high. On the bottom of the valley runs the main road.

5.1.2 Type of plain slopes B

The landscape type of plain slopes B occupies the southern part of the territory of the cadastral area of the village of Hrušov (75% of the area). It is at first glance different from landscape type A. It also has built-in plateaus dominating in type A, but they are much smaller and do not specify the overall landscape. The morphometric parameters of Type B relief are more spatially heterogeneous. This corresponds to the different use of the land with a higher representation of forests and a greater defragmentation of other components of the cultural landscape. The landscape type B is divided into 7 subtypes.

The subtype of isolated elevations **B1** has the highest elevation position in the model area. It consists of 7 small insulated elevations protruding above the plateaus and plateau ridges of the wold slopes. The **B2** isolated subtype forms a set of isolated plateaus on the backs of the plain slopes. The subtype of flat ridges **B3** differs from the subtype B2 in that its flattened relief parts are tapered into long longitudinal wold backs. The subtype of slope and saddle plateaus **B4** is significantly divided into 6 small isolated areas. The subtype of steep valley slopes **B5** is the dominant element of the natural landscape of the wold slope, which determines their overall landscape character. It is the result of the recessed valley network of the southern part of the model territory. It is characterized by the high slopes with a local occurrence of small scale landforms and within the studied area the highest degree of afforestation. The subtype of gentle valley slopes **B6** is located in parts of slopes with a less dissected relief than the subtype B5. We have set them apart because of the differences in economic use. In the subtype of valley bottoms **B7** we find in two areas of very small arrays a significantly elongated ground plan. Both are the lowest lying segment within the local natural landscape.

5.1.3 Layout of dispersed settlements in a natural landscape

By overlaying a map of the spacing of remote dispersed settlements on a map of natural landscape types, we have gained an image of the natural conditions in which the dispersed settlement country of Hrušov was created and developed. We have identified what natural conditions their builders preferred and to which they, on the contrary, avoided. Table 1 shows that the most favourable natural conditions were provided by the type A that occupies the northern quarter of Hrušov bounds. There are 78 dispersed settlements (38%), at a density of 13.5 dispersed settlements per 100 ha. Type A has optimal conditions for various agricultural activities corresponding to climatic conditions at an altitude of over 400 meters and does not create any major barriers for the local road network. Interestingly, quite a lot of dispersed settlements lie on the edges of the plains so that there is enough space for agricultural activity. Within two subtypes, there are more dispersed settlements in subtype A1 (64) than in subtype A2 (14) with less appropriate morphometric relief parameters. One is at the bottom of the valley, one on the slope, and 11 dispersed settlements are linearly positioned on the relief edge between the western plateau and the western slope of the valley.

Tab. 1: Distribution of the dispersed settlement in types of natural landscape areas

Type of natural landscape	Area (ha)	Share of area (%)	Number of dispersed settlements	Relative number of dispersed settlements in type/subtype (per 100 ha)
A	577	24.7	78	13.5
B	1 754	75.3	127	7.2
Subtype of natural landscape				
A1	455	19.5	64	14.07
A2	122	5.2	14	11.48
B1	31	1.3	0	0
B2	291	12.5	32	11.00
B3	107	4.6	24	22.43
B4	67	2.9	5	7.46
B5	616	26.5	3	0.49
B6	609	26.1	63	10.34
B7	33	1.4	0	0
Cadastral area	**2 331**	**100**	**205**	**8.79**

In Type B, the natural conditions for the establishment of dispersed settlements are worse and on top of that internally more diverse. There are a total of 127 dispersed settlements, but for a larger area of 1 754 ha (75.3% of the land area) which means almost half the density (7.2 dispersed settlement for 100 ha). The ridges of the plains subtype B3 provide a smaller area for fields, meadows and pastures, but are not limiting for dispersed settlements and the local road network. Therefore, there are 24 dispersed settlements with the highest density of 22.4 dispersed settlements per 100 ha. In the areas of subtype B2 with similar natural conditions as subtype A1, there are 32 dispersed settlements at a density of 11 for 100 ha. In the areas of subtype B4 there are 5 dispersed settlements. Their isolation and impaired access negate locally better morphometric parameters, which ultimately limits their more intensive economic use. This also applies to the B7 subtype without dispersed settlements. Suitable morphometric parameters did not play a role in the location of the dispersed settlements. The decisive factor was the markedly peripheral and isolated position in an inversely organized cultural landscape. One area lies on the flat wide bottom of the Olvár creek valley pointing out of the region and the area at the bottom of the Veľky Potok Valley is isolated on the edge of the bounds by the great natural barrier of the steep slopes of the valley of subtype B5. The B1 subtype has no dispersed settlements either because small insulated hillocks are less attractive for building dispersed settlements and economic activities.

Although the B6 subtypes have generally worse natural conditions than the areas of plateau subtypes, they are attractive to the inhabitants of dispersed settlements. There are 63 dispersed settlements with a density of 10.3 dispersed settlement for 100 ha. The morphometric parameters of this subtype have almost limited values for agricultural activities as well as road network building. Areas of the B5 subtype with the most unfavourable natural conditions occupy more than a quarter of the territory, but there are only three abandoned dispersed settlements.

5.2 Natural landscape and road network

5.2.1 Road network development

Krupinská Planina Plain is a specific geomorphological environment that significantly influences the communication network of the region. From a topical point of view, according to Urbánek (1981) the relief of the upland plains within the plain appears to be suitable for building communications but the slope of the plain is less suitable. Taking into account the choric aspect, everything may seem different to us. If we look at the Krupinská Planina Plain in relation to the neighbouring geomorphological units, this territory, with its geomorphological nature, appears to be a significant natural barrier that makes the communication link between the Southern Slovak and Central Slovak regions difficult. This barrier involves not only the hills but also the plateaus within the plain.

5.2.2 Barriers of natural landscape

In Hrušov borders, an over-dense network of local roads had to be created, ensuring the connection of individual dispersed settlements with a compact part of the village. Analysing its ground plan properties, we realize that its builders fully respected the natural conditions determined by the geomorphological characteristics of the natural landscape.

Particular segments of the country are a barrier or connection for this road network. According to Urbánek (1981) the barrier and forms of relief are perceived as natural obstacles making it difficult to interconnect points coupled with the road network while connections are forms facilitating the construction and use of transport communications. In the conditions of Slovakia, where the settlement-communication network concentrates on the depressed parts, there are barriers to mountain ridges while the connections are valleys and saddles in mountain ridges. In the model territory, however, a more rare, inverse type of land use has developed, with the headquarters and communications centre on the backs and plateaus, while the valleys are part of a country with a low economic use. In the inverse country of Hrušov the plateaus and plain ridges, there are connections for the road network and the lower lying valley network are barriers. The only main access road from Vinica to Hrušov is out of this scheme where it is built into the steep valley of the Hrušov Creek.

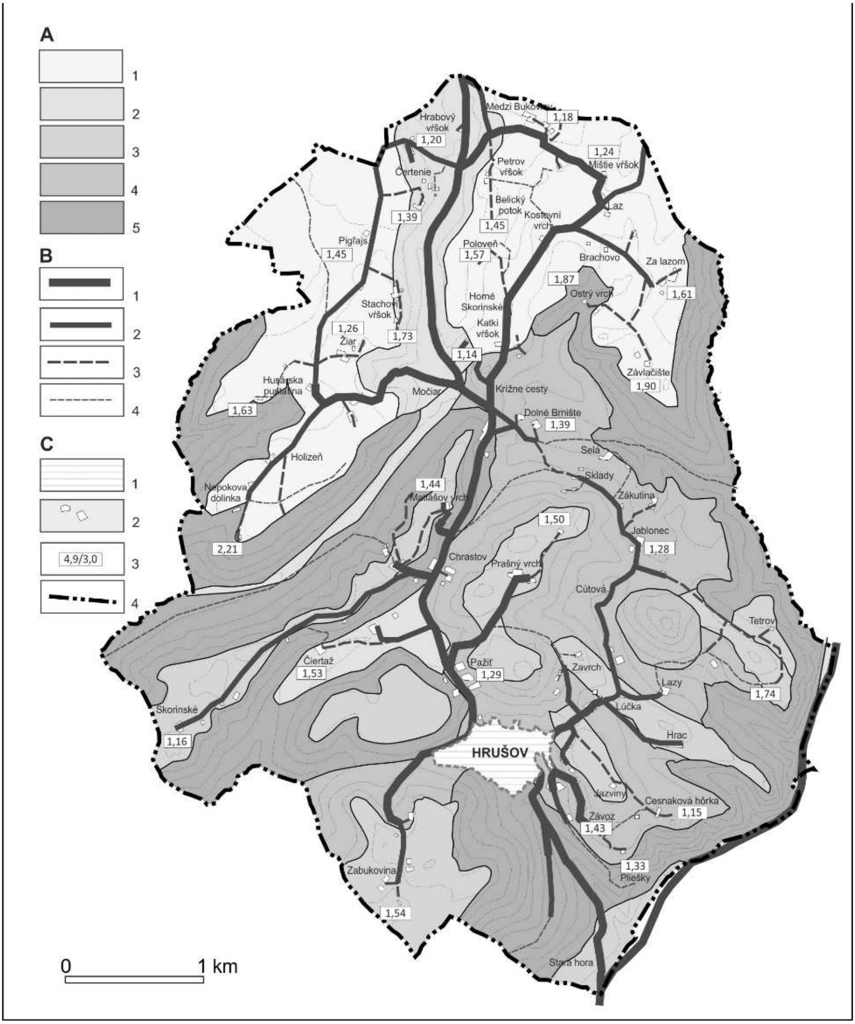


Fig. 4. Accessibility of the dispersed settlements to central village Hrušov.
A Degrees of barrier of natural landscape: 1 very low, 2 low, 3 medium high, 4 high, 5 very high. B quality of access roads: 1 asphalt road. 2 macadam road, 3 road with unpaved or barely reinforced surfaces.4 narrow walkways overgrowing paths. C Other marks: 1 village built up area, 2 dispersed settlement, 3 extension coefficient, 4 cadastral area border

Analysing the topical and choral properties of the relief, which determine the distribution of the joints and barriers in the country, we have set up areas with five degrees of barrier in the model area (Fig. 4). Very low barrier rates have plateau plates that allow easy communication between dispersed settlements in almost all directions. The shallow valley of the plains as well as the flat bottoms of the larger valleys have low barrier rates allowing easy communication links only in the direction of the axis of the given valley. We have assigned a moderate degree of barrier to the area of the local plateaus which are surrounded by areas with a higher degree of barrier. A high and very high degree of barrier is found on the more rugged valley slopes of the Krupinská Planina Plain slope, which, with its geomorphological parameters, makes the communication between the dispersed settlements more difficult.

5.2.3 Accessibility of the dispersed settlements

The natural landscape is largely influenced by the availability of the dispersed settlements from the built-up area of the village, especially through geomorphological properties. To determine accessibility, we used three basic parameters of access paths to dispersed settlements, which determine the degree of their availability. They are: distance from the village, height profile and technical quality

In the territory of Hrušov, we find up to 65 km of local roads and paths, which corresponds to the fact that the model territory is a dispersed settlement type of cultural landscape. Over 200 dispersed settlement settlements need a connection with the built-up area of the village, with many necessary services (shops, offices, church and school). The distances that the inhabitants of each of Hrusov's dispersed settlements have to covering the road to the village ranges from 0.4 to 5.8 km. Less than 1 km from the centre of the village there are 19 dispersed settlements. The most numerous group of 75 dispersed settlements is located within a distance of 1 to 3 km from the village, up to 68 dispersed settlements separates from the village 3 to 5 km of local roads and up to 43 dispersed settlements lay from the centre of the village over 5 km. The most distant is the dispersed settlement Ostrý vrch locality.

Interesting knowledge about the barrier of the landscape is obtained by calculating the extension coefficient, which is expressed by the ratio of the real distance of the dispersed settlement along the local roads and the air distance of the dispersed settlement from the middle of the village. The higher the coefficient, the greater the degree of barrier between the dispersed settlement and the village. The measured value of the coefficient is from 1.14 to 2.21. Low values are achieved by dispersed settlements lying near the main road, which passes relatively straight through the middle of the cadastre from north to south. High values were found in the dispersed settlements on the edges of the cadastre accessible on the roads leading to the plateaus and the plateau ridges bypassing by the larger valleys.

The expansion coefficient helps identify horizontal barriers in a country where roadways need to be avoided. However, the barriers in the country have a vertical dimension, they have a certain height that the road must overcome.

This property of the natural landscape is obnoxious by profiling, made by the altitudinal profiles of roads (Fig 5). Paradoxically, the highest barriers are on the main road. From the turning from the road from Vinice to Čelovce to the centre of Hrušov, the road outclasses the height of 170 m, the steep slope north of the village is 85 m high. The altitude of the village centre is 370 m. Up to 163 dispersed settlements are higher, so the settlers come down to the village and have to climb up from the village. The highest dispersed settlements are situated in Zabukovina locality, they are scattered along a plateau at an altitude of 490 to 510 m. The 46 Hrušov dispersed settlements are situated at an altitude similar to the built-up area of the village but to the 13 settlements the road leads down. The lowest settlements on the Stará Hora and Pliešky localities are already abandoned.

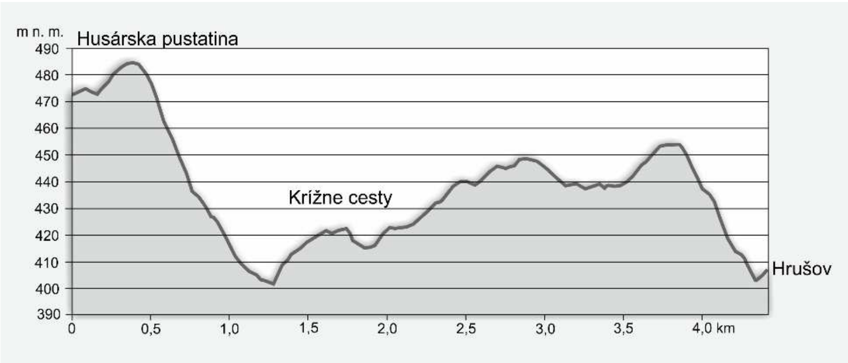


Fig. 5. Altitudinal profile of road connected the Husárska Pustatina dispersed settlement central village Hrušov.

The quality of access roads is an important criterion for the availability of dispersed settlements. According to historical maps, the network of these paths formed together with dispersed settlements, at least in the 18th century, and according to 1950 aerial photography, the underlying ground plan of roads has not changed in 60 years. However, the quality of the roads has undergone radical improvements, which, famously speaking, the dispersed settlements have approached the village which also makes more attractive the relatively remote settlements on the real estate market. Up to 22 km of roads (including streets in the city) have asphalt surfaces. Another 14.5 km have a strong, mostly macadam surface and is also accessible by regular motor vehicles. The use of off-road vehicles requires traveling over 12.6 km of local roads with unpaved or barely reinforced surfaces. Part of the 14.9 km long communications network is not maintained and there are narrow walkways overgrowing paths passable on foot only. Dispersed settlements with access by such a road or path are essentially condemned to extinction.

6 CONCLUSION

We had come to this project with the knowledge that the dispersed settlement landscape represents a distinctive type of cultural landscape with very close ties between man and nature. Our research, however, aims to show this connection in more details and concrete. The results achieved confirm that the model territory of Hrušov village meets this goal very well. In the plain type of natural landscape in Slovakia a relatively rare, inverse type of cultural landscape with a long-lasting scattered settlement has been formed. We have found that the specificity of the development of the Hrušov dispersed settlements is related to their peripheral position within the Krupinská Planina Plain, at an accessible distance from the neighbouring basin natural landscape with much better conditions for the emergence and development of a cultural landscape with a compact type of rural settlements. After collecting very detailed data on the settlement land from the model territory, we want to continue the research by collecting comparative material about the type of cultural landscape of other villages in the Krupinská Planina Plain area as well as from the more remote regions of Slovakia with dispersed settlements or hillside settlements. By detailed research of other model areas, we would like to develop a wider conceived typology of the dispersed settlement landscape in relation to the given natural conditions in another geological and geomorphological environment.

This article was written with the support of the research project VEGA No. 2/0016/18.

REFERENCES

BOTÍK, J. 1980. Dvojrezidenčnosť ako dôsledok lazového osídlenia. *Slovenský národopis*, 28, 1, pp. 78-83.

BRADA P., BRLOŠ, J. 2013. *Tradičné staviteľstvo v Hrušove*. Obec Hrušov, 288 pp.

BRADA, P., ZRNÍKOVÁ, K., BRLOŠ, J. 2014. *Roľníctvo v Hrušove*. Obec Hrušov, 334 pp.

HANUŠIN, J., LACIKA, J. 2017. Vybrané environmentálne súvislosti zmien historickej lazníckej krajiny (na príklade obce Hrušov okres Veľký Krtíš). in print.

HUBA, M. 1989. O niektorých otázkach genézy a súčasného stavu kopaničiarskeho osídlenia na území Slovenskej socialistickej republiky. *Geografický časopis*, 41, 2, pp. 138-155.

IZAKOVIČOVÁ, Z., PETROVIČ, F., RYBANSKÝ, Ľ. 2017. The Assessment of Slovak Castles in Terms of Land and Ecology. In DUCHOŇOVÁ, Diana, FUNDRÁKOVÁ, Anna, eds. *Hrady a hradné panstvá na Slovensku*. Historický ústav SAV, Veda Bratislava, pp. 163-168.

MAZÚR, E., LUKNIŠ, M.. 1978. Regionálne geomorfologické členenie Slovenska. in *Geografický časopis*, 30, 2. Bratislava: VEDA SAV, pp. 101-124.

NAHÁLKA, P. et al. 1966. *Výskum rozptýleného osídlenia na Slovensku*. Bratislava, VÚPS SF SVŠT, 144 pp.

PETROVIČ, F. 2006. Relationship between dispersed settlement and morphometric-position attribute of the relief. *Acta Environmentalica Universitatis Comenianae* 14, 1, 2006, pp. 105-113.

SITÁR, E. 1967. Kopaničiarske osídlenie na Slovensku (Niektoré otázky súčasného stavu). *Vlastivedný časopis*, 16, 3, pp. 125-135.

ŠVECOVÁ, S. 1984. *Lazy v 19. a 20. storočí. Vývoj roľníckych chotárnych sídiel v oblasti Krupinskej planiny*. Univerzita Karlova, 148 pp.

URBÁNEK, J. 1981. Vhodnosť reliéfu pre výstavbu komunikácií. In MAZÚR, Emil ed. Funkčná delimitácia reliéfu pre hospodárske využitie na príklade SSR. *Náuka o Zemi*, geographica 4, Veda, 170 pp.

VASS, D., KONEČNÝ, V., ŠEFARA, J., PRISTAŠ J., ŠKVARKA L. 1979. *Geologická stavba Ipeľskej kotliny a Krupinskej planiny*. Bratislava: Geologický ústav Dionýza Štúra, 277 pp.

Historická ortofotomapa © GEODIS SLOVAKIA, s.r.o., Historické LMS © Topografický ústav Banská Bystrica, Ortofotomapa © EUROSENSE, s.r.o. a GEODIS SLOVAKIA, s.r.o., mapové podklady © Topografický ústav Banská Bystrica, © TU Zvolen

Mapy.cz. 2102. Letecké snímky zo zdroja © Eurosense. Accessible on: Zhttps://mapy.cz/zakladni?x=19.0865350&y=48.1651196&z=13&source=muni&id=20071

Historické mapy vojenských mapovaní. 2014. © SAŽP. Accessible on: http://geoportal.gov.sk/sk/map?permalink=85fee94730605ec9aad47e531552ea54

Zhrnutie

Laznícka krajina predstavuje osobitý typ kultúrnej krajiny s pomerne veľkým rozšírením na Slovensku, pre ktorý je charakteristický veľmi tesnými väzbami medzi človekom a prírodou. Rozptýlený typ osídlenia sa sformoval predovšetkým v odľahlejších regiónoch so sťaženými podmienkami pre život, v určitých špecifických typoch prírodnej krajiny slovenských Karpát. Tento príspevok je zameraný na výskum miery a povahy vplyvov prírodných podmienok na vznik a vývoj lazníckeho osídlenia v modelovom území katastra obce Hrušov (okres Veľký Krtíš). Okrem iného zistil, že dominantným determinantom charakteru lazníckej krajiny modelového územia je reliéf.

Dosiahnuté výsledky nám potvrdili, že modelové územie chotáru obce Hrušov sa na naplnenie tohto cieľa veľmi hodí. Na planinovom type prírodnej krajiny sa sformoval na Slovensku pomerne zriedkavý inverzný typ kultúrnej krajiny s dlhodobo sa rozvíjajúcim rozptýleným osídlením. Zistili sme, že špecifičnosť vývoja hrušovských lazov súvisí s ich okrajovou polohou v rámci Krupinskej planiny, relatívne blízkej vzdialenosti od susednej kotlinovej prírodnej krajiny s oveľa lepšími podmienkami pre vznik a rozvoj kultúrnej krajiny s kompaktným typom vidieckych sídel. Po zhromaždení veľmi detailných dát o lazníckej krajine z modelového územia chceme pokračovať vo výskume zbieraním komparatívneho materiálu o lazníckom type kultúrnej krajiny iných lazníckych obcí v oblasti Krupinskej planiny ako aj zo vzdialenejších regiónov Slovenska s kopanicami, lazmi, štálmi či raľami. Detailným výskumom ďalších modelových území by sme chceli dospieť k vytvoreniu širšie koncipovanej typizácie lazníckej krajiny vo vzťahu k daným prírodným podmienkam v inom geologickom a geomorfologickom prostredí.

NEW APPROACHES TO STUDIES OF EXTINCT PONDS

Aleš Létal[1], Renata Pavelková[1], Patrik Netopil[2], Marek Havlíček[3], Václav David[4], Hana Skokanová[3], Jindřich Frajer[1], Bořivoj Šarapatka[2]

[1] Palacky Univerzity in Olomouc, Faculty of Nature Science, Department of Geography, 17. Listoapdu 12, Olomouc 771 46, Czech Republic

ales.letal@upol.cz, r.pavelkova@upol.cz, jindrich.frajer@upol.cz

[2] Palacky Univerzity in Olomouc, Faculty of Nature Science, Department of Ecology, 17. Listoapdu 12, Olomouc 771 46, Czech Republic

patrik.netopil@upol.cz, borivoj.sarapatka@upol.cz

[3] The Silva Tarouca Research Institute for Landscape and Ornamental Gardening, Lidická 25/27, Brno 602 00, Czech Republic

marek.havlicek@vukoz.cz, hana.skokanova@vukoz.cz

[4] Czech Technical University in Prague, Faculty of Civil Engineering, Department of Irrigation, Drainage and Landscape Engineering, Thákurova 7, Praha 166 29

vaclav.david@fsv.cvut.cz

Abstract: The article deals with applying modern methods and related methodical approaches to spatial data and information collection in the research of extinct ponds in selected catchment areas in Bohemia, Moravia and Silesia. The paper demonstrates an application of modern methods in cabinet and field research using selected examples. The methodical approaches concern mostly the processes of vectorisation and processing of database verification from archive map sources, spatial modelling and applications of lidar data, modelling and applications of RPAS. The results help to complete the missing information within the complex study of landscape development with special respect to water management of the catchment in the past. The acquired facts are the valuable source of data used in studies focusing on the improvement of water management in the current troublesome times.

Key words: lidar data, extinct ponds, Remotely Piloted Aircraft System, small catchment, landscape development

INTRODUCTION

The study of the land use development is important for understanding current and historical relationships between landscape components. Various methods for acquisition, storing, searching and analyzing historical records of landscape changes using electronic data processing were dealt with by Kienast (1993). In order to determine the former location and range of elements in the landscape, it is an ideal use of old maps of significant information sources about the historical landscape (Bas, Pedroli, Borger, 1990; De Boer, 2010; Baily, Riley, Aucott, Southhall, 2011). One of the basic prerequisites for assessing the long-term use of landscape and the development of aquatic areas in a coherent catchment area is the study of old topographic maps, preferably the medium scale (Haase et al., 2007, Swetnam, 2007, Palang et al., 1998; Havlíček et al., 2012)., Medium-scale topographic maps allow relatively accurate tracking of changes in the landscape of Central Europe since the mid-19th century. The oldest more or less usable map sets on the territory of the Czech Republic, the topographical maps of the 1st and, in particular, of the 2nd Austrian Military Mapping Survey made the UIEP Laboratory of Geoinformatics (UJEP) in Most, similar to mapping from the 3rd Austrian Military Mapping Survey (see Brůna et al., 2002). The applicability of map data of the 1st Austrian Military Mapping Survey for detailed analysis of land use changes is limited by their lack of field-level accuracy (Brüna et al., 2002; Frajer, Geletič, 2011). However, it is possible to use these mappings for the indicative discovery of the development of some land use categories. The first study on the development of water bodies in South Moravia was based on older map data such as Müller's maps of Moravia from 1716 (Koláček, 1930). Aerial images and their combination with the old maps were used by Kolejka, Petch (1989), Skaloš et al. (2011) for the analysis of the long-term use of landscape changes in the Czech Republic.

Remote Sensing of the Earth is also an attractive technique for obtaining relevant information about current and past landscapes. Aerial images, lidar data and satellite imagery are used in many landscape surveys. A suitable combination of these remote sensing data can be used in research of various landscape components such as fluvial geomorphology (Winterbottom, Gilvear, 1997), wetland study (Harvey, Hill, 2010), forestry (Suaréz et al, 2005) or archaeology (Cox, 2010).

RPAS (Remote Piloted Aircraft System) technology is a new remote sensing that can extract high-resolution spatial data not only for military purposes but also for civilian use and scientific research. Remote sensing with RPAS has the potential to provide images of unprecedented spatial and temporal resolution capabilities. Their use in the current research of the landscape grows and spreads to various objects of exploration. For example, d'Oleire-Oltmanns et al. (2012) monitored soil erosion in Morocco, other authors combined with the digital terrain model surveyed coastal development in Italy (Mancini, et al., 2013), or research focused on the collection and processing of field data in low-cost agriculture (Xiang, Tian, 2011).

Lidar data is now a new landmark in the complex knowledge of the landscape. LIDAR's technology has provided mapping and analysis capabilities in the necessary detail in wooded or inaccessible areas. The use of lidar data is presented in our case for the reconstruction and mapping of relics of water management structures in the forested Šumice valley around close to Náměšť na Hané city in the Central Moravia Region. Interpretation of mapped shapes and elements of the relief is based on detected structures on processed DTM (Digital Terrain Model) outpouts with the necessary field research, which is focused on exodynamic analysis of relief development and mapping of preserved relics of water management structures or interesting relief shapes with anthropogenic activity in the river basin. The following examples demonstrate the use of modern technologies for extinct ponds or water surface objects research.

MODERN METHODS APPLIED FOR EXTINCT PONDS AND WATER AREAS SURVEY

Remote Piloted Aircraft System (RPAS) usage

The RPAS technology (Remotely Piloted Aircraft System) currently provides a wide and growing selection of applications and experiences a rapid development. Its applications are numerous in research as well. The research aim is always important depending on the selection of the scanner placed in the aircraft. This article presents RPAS applications in the creation of a detailed Digital Surface Model (DSM) in areas with remnants of pond dams which disappeared in the past. Interest localities are located near the town of Blížkovice and Pavlice village (Fig. 1). Specialised scanners are not necessary in such cases and a common camera with an RGB scanner can be used to create a DSM (Digital Surface Model).

The research presented in this article used the Phantom 4 aircraft, an instrument which is commonly available and which does not require any technical modifications. The four rotors drone has integrated 12.4 Mpx camera (4000x3000 pixels). The images were taken in an orthogonal network that covered the dam remnants. The stereo-photogrammetry technique was applied in the Agisoft PhotoScan software to evaluate the acquired images. A point cloud was created based on the evaluation of the images which was then applied in the calculation of a vector 3D model and a raster surface model (Tab. 1).

Tab. 1: Overview of RPAS mapping parameters

Locality	Pavlice	Blížkovice
Number of slides total / used	212/205	276/269
Flight altitude above the ground (m)	44.4	42.2
Number of points of the cloud/dense cloud	253 599	415 099
Surveyed area (ha)	2.94	3.76

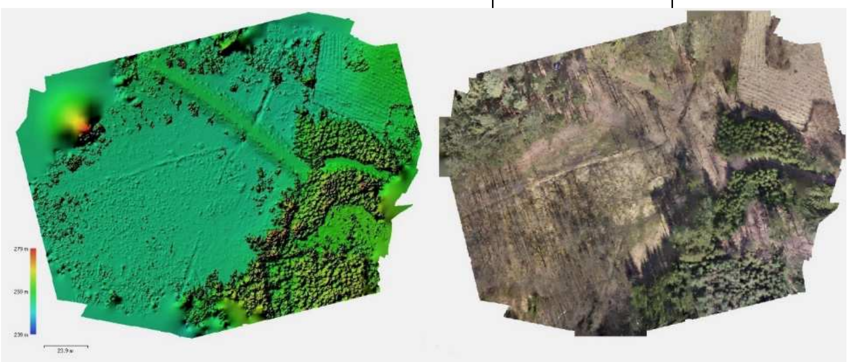


Fig. 1. Blížkovice locality – Digital Surface Model (DSM) a orthophotomap (on the right).

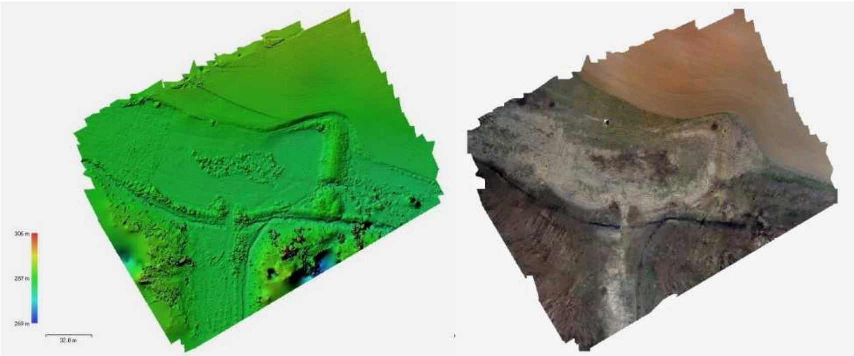


Fig. 2. Pavlice locality – Digital Surface Model (DSM) a orthophotomap (on the right).

The resulting model captures the visible ground in detail and with relative precision in that it also includes vegetation and does not describe the ground itself. Nevertheless, it can be used to analyse the general shape of the earth body, which used to form the pond dam, as can be seen from the previews of the obtained digital layers (Fig. 1, Fig. 2).

Applications of lidar data

Lidar data now present a new milestone in complex landscape recognition. LIDAR technologies have introduced possibilities of mapping and analyses in the required detail in forested or inaccessible areas (Kolejka 2002, 2003). The interpretation of the mapped forms and elements of the relief follow from the detected structures on lidar images with necessary field research which focuses on an exodynamic analysis of relief development and mapping of the surviving remnants of water management structures, or interesting forms of relief connected with an anthropogenic activity in the catchment.

Area of interest

The results of the analyses focused on the location Kruhovský mlýn mill. Kruhovský mlýn on the Šumice River is presently a seriously damaged object with preserved outer walls. An important element in the valley of the area of interest (Fig. 3) is the mill race and the storage reservoir serving the technological needs of the mill. The Šumice valley is carved deep in the area and belongs into the subunit of the Bouzovská vrchovina (Highlands). The predominant rocks are carboniferous offal and slate in combination with conglomerates. Pleistocene loess can be found on the tfoot of hills. The structural conditionality of the relief is manifested on the slopes of the valley. Outcrops of more resistant rocks on erosive slopes were mined in the past. Small mining shapes give evidence of the fact. The less durable parts have relatively thick layers of colluvium, which erode easily as evidenced by distinct ravines, hollow ways, or bundles of hollow ways. The meadow of the Šumice itself is predominantly a flat relief formed by poly-genetic filling of fluvial and deluviofluvial sediments. Specific features are areas of right-sided tributaries of the Šumice, which have the character of wild water courses with vast gravelled positions significantly impacting the course of the main stream bed.

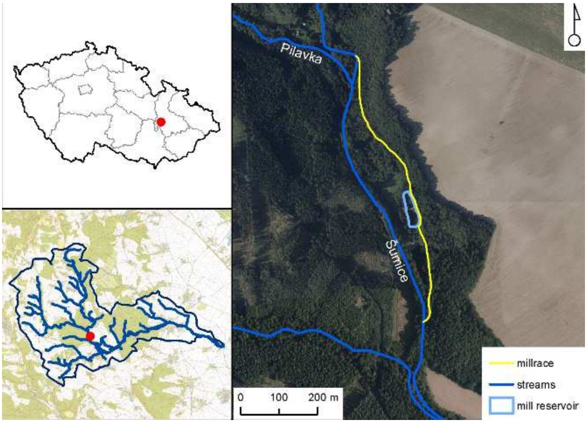


Fig. 3. Area of interest of the "Kruhovský mlýn" mill near the village Krakovec.

Fig. 4. Area of interest in the map of the Stable Cadastre (1834) with the stone step marked.
Source: Moravský zemský archiv v Brně, Krakovec 1834

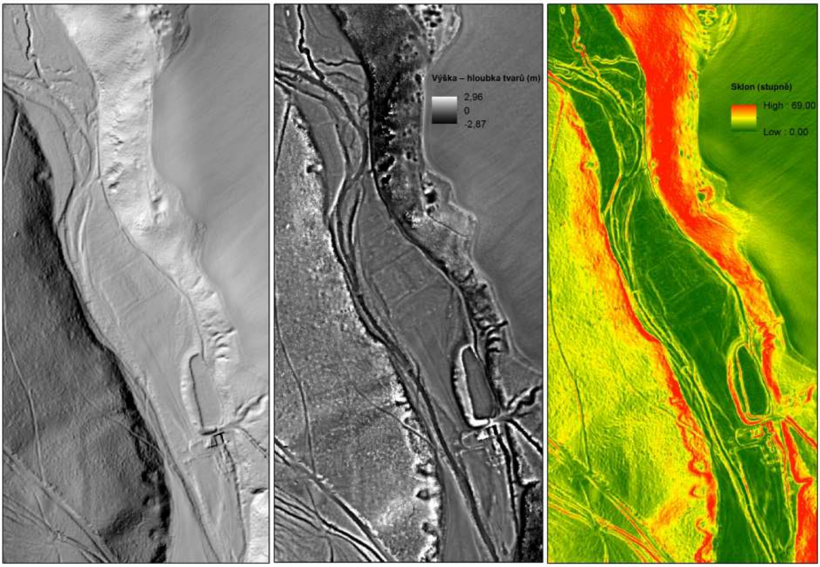


Fig. 5. Important elements and objects displayed using visualisation methods of a digital terrain model in resolution of 1 m.
From the left: Cluster Hillshade – Terrain Analyst 1.1; Local Relief according to Hess – low pass filter mask 10 m; Hill slopes – ArcGIS Spatial Analyst

Airborne laser scanning technology and its processing

Airborne laser scanning technology LIDAR – LIght Detection And Ranging is based on the principle of measuring the distance using a band of laser beams. Airborne laser scanning has an active sensor on board a plane, helicopter or UAV from which the ground is captured in a specific manner (more detail in Šponer 2013 or Dolanský 2004). The acquired measured data are so-called clouds of points which have to be filtered using specific robust algorithms so that the most precise image of the ground or objects on the ground is acquired. The resulting quality is influenced mostly by the quality of the filtering algorithms which process the primary data. The period of scanning is significant; it has to be carried out prior to the vegetation development (tree and shrub foliage, growth of grassland). The real imaging of the objects on the resulting product, the digital terrain model (DTM), or the digital sourface model (DSM) depend on the method of point cloud interpolation which calculates the missing data. Calculations of a high number of elements (tens of millions of points) are very demanding hardware-wise.

Routine procedures and algorithms were used in analysing the lidar data, which are part of standard tools of the ESRI ArcGIS ArcMAP 10.4.1. software. A set of tools of “TerrainTools 1.1” was also used. The calculation of the local relief was accomplished using the procedure of creation of the so-called Local Relief Model published by R. Hess in 2010 (2010). Analyses of a digital relief model, landscape visualisation and capturing existing water management objects were dealt with over lidar data from two resources. The first resource was the data set CDV–NAKI I acquired within the NAKI project: “Research of historical roads in North-West Moravia and East Bohemia”. The second resource was the data set DMR5G from the database “A digital relief model of the 5th generation” of the Czech Office for Surveying, Mapping and Cadastre (ČUZK). The lidar data of the CDV set in the GeoTIFF format were created by interpolation using the IDW method for analyses of areas of interest by Mgr. Jan Martínek of CDV, a public research institution. These data were acquired within the NAKI I project in 2013. The measurement was realised using the Riegl LMS-Q680i scanner in an approximate altitude of 600-900 m with an average density of points of 3-5 points per m2. (further in Martínek et al. 2014). The lidar data of the DMR5G set were interpolated using several methods (IDW, ANUDEM, Natural Neighbour). The Natural Neighbour method provided the most useful results. Further on the limits of data applicability of the new altimeter model of the Czech Republic acquired from the lidar data (Holata, Plzák, 2014).

Detected forms

The results of the digital relief model analyses from the lidar data were carried out from the CDV-NAKI data, whose degree of detail is much higher (compare Fig. 5). It is possible to reconstruct the principles of function of a water management set as well as to verify the energy performance of the set. Identifications of geomorphological forms which help complete the missing information of the dynamics and development of landscape in a given segment are of an equal importance.

The number of anthropogenic forms like hollow ways, small qarriescan be identified in the area of interest, which can be used to extract the required information. A mill race running the length of the foot of the hill is a water management element which can be identified without doubt. It is a derivational water work which conducted water to run the mill away from the main course. The race was regulated by a dam or a weir clearly detectable in the map of the stable cadastre (Fig. 4). The natural conditions of the race conduct were facilitated by the existence of the wild Pilávka in flood conditions. The waste channel enters the Šumice about 250 m from the mill (Fig. 6). The channel had to be maintained regularly and rid of sediments with respect to the position of the race at the foot of the erosive slope. Especially risky were the short episodes connected to water erosion from the source area of the fields below the village Krakovec. This is proven by the existence of ravines partly filled with deluviofluvial accumulations on the erosive slope between the former stone embankment in the bed and the storage reservoir. The race can be activated by the flood water from the Šumice or the Pilávka during higher watering.

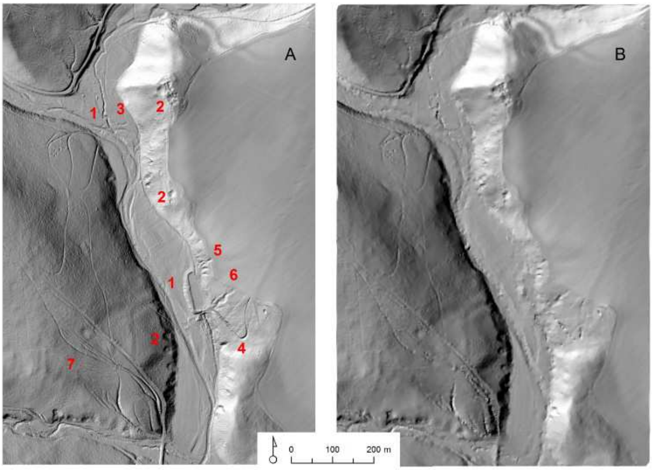


Fig. 6. Visualisation of the DTM created on the basis of available data sets.
A) NAKI–CDV B) DMR5G ČUZK using the Cluster Hillshade method (ESRI Terrain Analyst 1.1).

The shallow storage reservoir is a truly striking element. Using the lidar data, we managed to reconstruct its parameters (Fig. 8). As the Šumice has a flat bed, it was necessary to build a massive lateral embankment of the maximum width 18 m at the base and 10 m at the crown. The reservoir is shallow with the maximum depth of 1.5 m at the draining embankment. The bottom of the reservoir could not be deepened to the level of the main course as it was necessary to maintain the flow to facilitate the mill´s operation. The drainage was achieved through a (floodgate) which enabled complete draining of the reservoir. There is a stone race of 0.3 x 0.6 m next to the floodgate, which was used to conduct water to the water wheels. The stone race was placed in the feed channel and secured the functionality of the mill even when the reservoir was drained. The calculated maximum retention capacity of the storage reservoir is approximately 2,300 m^3 which might secure 3.5-4 hours of full operation during the maximum use of the flow profile (0.18 m^2). At the regular occasions of low flow, the mill´s operation was secured by the so-called cascade waves which were facilitated by 4 mills with storage reservoirs in the catchment above the Kruhovský Mlýn watermill and which had similar parameters.

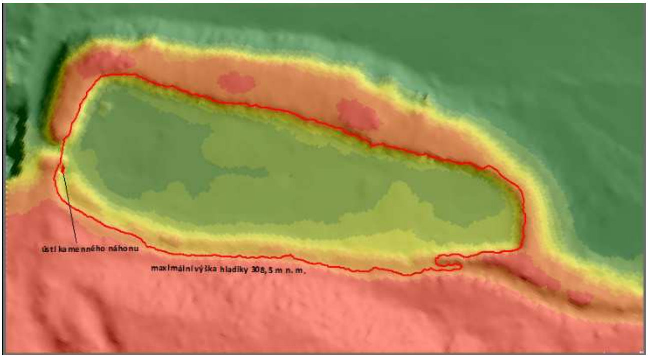


Fig. 8. DTM of the Kruhovský mlýn watermill storage reservoir. Ground Resolution 1 m.

The other elements which are well identifiable are the communication routes in the area of interest. The main access road from Krakovec does not exist any longer; it is detectable in old maps, in an aerial geodetic image from 1953, as well as from vegetation signs of the current orthophotos. The hollow way (the main access road to the mill), which is carved deep in the slope over the Kruhovský mill (Fig. 6), is a clear remnant. There is a small local mine of building stone (gray wacke) clearly visible on the left slope of the valley around St. Anthony´s chapel. Similar small mines can be found in the south-west part along the right valley slope of the Šumice. The riverbed of the Šumice can be crossed at two fords (Fig. 6). There are significant bundles of exits, which prove the existence of a local transport route from Kandie to Raková near Konice on the western (right) slope of the Šumice valley. There is also a clear set of ravines on the adjacent slope above the mill, which are conditioned by anthropogenic activities. The distinct ravine above the mill might be a remnant of a path way (a shortcut) or a remnant of an erosive episode. The noticeable S-shaped bend is caused by a fallen tree. A distinct loess is visible along the foot of the left valley slope which sediments in the race.

CONCLUSIONS

The paper demonstrated the use of modern technologies in the extinct ponds and water areas survey. For these activities, it is of course the most important choice of methods that help us get detailed spatial data that are important for modelling and deriving the size of mapped objects, as well as identify other landscape structures that directly relate to or affect their functions. The presented results show trends in the use of technology to obtain detailed digital terrain models (DTM) and digital surface models (DSM) that are necessary for modelling of hydrological parameters of landscape. For mapping of relief microforms such as dyke bodies or extinct water areas, it is advantageous to use RPAS technology, which at current prices is an interesting alternative to significantly more expensive aircraft lidar data acquisition technology. The lidar data itself and its quality are influenced by a number of factors. The key factor affecting the precision and detail of mapping is the right timing of the measurements during the rest in the growing season and in spring months, if possible, when the penetration of a cloud of laser beams is not obstructed by leaves of not only the tree layer but mainly the shrub and herbaceous layers. To provide a complex assessment and evaluation of analyses, it is necessary to analyse the area of interest of all available map and data resources. It is advantageous to analyse the aerial geodetic images and maps of the stable cadastre or land maps with respect to the changes of landscape structures in the second half of the 20th century. Although the advantage of the lidar data is indisputable and provides us with the much needed detail in forested areas as well, the traditional research methods such as field mapping and prospecting cannot be neglected. A correct interpretation of the analysed forms and processes is impossible without this component. However, the conclusions and results of analyses of the lidar data may not reveal all connections and developmental stages. The fluvial systems are dynamic systems whose distinct changes occur in episodes whose impact is relatively soon covered with the development of the vegetation cover which has optimum conditions in the floodplain areas.

Acknowledgments: The authors of the paper thank the National Agency for Agricultural Research, which supported the project NAZV KUS QJ1620395 entitled "Restoration and building of ponds in forest areas as a part of sustainable water resources management in CR Czech Republic", under which this contribution was also drafted.

REFERENCES

BAILY, B., RILEY, M., AUCOTT, P. & SOUTHALL, H. Extracting digital data from the First Land Utilisation Survey of Great Britain e Methods, issues and potential. *Applied Geography*, 2011, 31, 959–968. https://doi.org/10.1016/j.apgeog.2010.12.007

BAS, G., PEDROLI, M. & BORGER G. J. Historical land use and hydrology. A case study from eastern Noord-Brabant. *Landscape Ecology*, 1990, 4, 237–248. https://doi.org/10.1007/BF00129831

BRŮNA, V., BUCHTA, I., UHLÍŘOVÁ, L. *Identifikace historické sítě prvků ekologické stability krajiny na mapách vojenských mapování*. Vyd. 1. Ústí nad Labem: Univerzita J.E. Purkyně, 2002. Acta Universitatis Purkynianae, Studia Geoinformatica II., 81, 46 p.

COX, C. Satellite imagery, aerial photography and wetland archaeology. *World Archaelogy*, 2010, 24 (2), 249–267.

DE BOER, A. 2010, Processing old maps and drawings to create virtual historic landscapes. *e-Perimetron*, 5, 49–57.

DOLANSKÝ, T. *Lidary a letecké laserové skenování*. Vyd. 1. Ústí nad Labem: Univerzita J.E. Purkyně, 2004. Acta Universitatis Purkynianae. Studia geoinformatica; 99, 100 p.

D´OLEIRE-OLTMANNS, S., MARZOLFF, I., PETER, K. D. RIES, J. UNMANNED Aerial Vehicle (UAV) for Monitoring Soil Erosion in Marocco. *Remote Sensing*, 2012, 4 (11), 3390–3416.

DONEUS, M. Openness as Visualization Technique for Interpretative Mapping of Airborne Lidar Derived Digital Terrain Models, Remote Sensing*, 2013, 5(12)*, 6427-6442.

FRAJER, J., GELETIČ, J. Research of historical landscape by using old maps with focus to its positional accuracy. *Dela*, 2011, 36, 49–67. https://doi.org/10.4312/dela.36.3.49-67

HAASE, D., WALZ, U., NEUBERT, M., ROSENBERG, M. Changes to Central European landscapes – Analysing historical maps to approach current environmental issues, examples form Saxony, Central Germany. *Land Use Policy*, 2007, 24 (1), 248-263. https://doi.org/10.1016/j.landusepol.2005.09.003

HARVEY, K.R., HILL, G.J.E. Vegetation maping of tropical freshwater swamp in the Northern Territory, Australia: A comparison of aerial photography, Landsat TM and SPOT satellite imagery. *International Journal of Remote Sensing*, 2010, 22 (15), 2911-2925. https://doi.org/10.1080/01431160119174

HAVLÍČEK, M., KREJČÍKOVÁ, B., CHRUDINA, Z., SVOBODA, J. Long-term land use development and changes in streams of the Kyjovka, Svratka and Velička river basins (Czech republic). *Moravian Geographical Reports*, 2012, 20 (1), 28-42.

HESSE. R. LIDAR-derived Local Relief Models – a new tool for archaeological prospection. Archaeological Prospection*, 2010, 18*, 67-72.

HOLATA, L.; PLZÁK, J. Examinace procesu optimalizace „archeologicky korektních“ způsobů vyhodnocení dat z leteckého laserového skenování zalesněné krajiny: Potenciál filtrace surových dat, problematika interpolačních algoritmů a způsobů vizualizace antropogenních tvarů v digitálních modelech reliéfu. In: Gojda, M., John, J. (eds). *Archeologie a letecké laserové skenování.* Západočeská univerzita v Plzni. 2014, 49-78.

JONES, A.F., BREWER, P.A., JOHNSTONE, E., MACKLIN, M.G., High-resolution interpretative geomorphological mapping of river valley environments using airborne LiDAR data. *Earth Surface Processes and Landforms*, 2007, 32, 1574–1592.

KOLEJKA, J., PETCH, J. Geografické vyhodnocení digitalizovaných leteckých snímků vodních objektů. *Geografie*, 94, 1989, 241–248.

KOLEJKA, J. Třírozměrný svět hned na monitoru. Laserové snímání v praxi. *Computer Design*, 2. 2002, 50–51.

KOLEJKA, J. Laserové snímání krajiny jako zdroj přesných třírozměrných vstupních dat do GIS. *Geografie – Sborník ČGS*, 108, 1. 2003, 92–93.

MARTÍNEK, J a kol. Identifikace starých cest a dalších objektů za pomoci LLS. In: Gojda, M., John, J. (eds). Archeologie a letecké laserové skenování. Západočeská univerzita v Plzni., 2014, 228-241.

KIENAST, F. Analysis of historical landscape patterns with a geographical information systems. *Landscape Ecolog*y, 1993, 8, 103–118.

KOLÁČEK, F. O vypuštěných rybnících jihomoravských. *Sborník Československé společnosti zeměpisné*, 1930, 158-164.

MANCINI, F. et al. Using Unmanned Aerial Vehicles (UAV) for High-Resolution Reconstruction of Topography: The Structure from Motion Approach on Coastal Environments. *Remote Sensing*, 2013, 5 (12), 6880-6898.

Ministerstvo veřejných prací: *Seznam a mapa vodních děl republiky Československé: stav koncem roku 1930.* Sešit Olomouc. Ministerstvo veřejných prací, Praha 1933. 40 s.

PALANG, H., MANDER, U., LUUD, A. Landscape diversity changes in Estonia. *Landscape and Urban Planning*, 1998, 41 (3-4), 163-169. https://doi.org/10.1016/S0169-2046(98)00055-3

SKALOŠ, J, WEBER, M., LIPSKÝ, Z., TRPÁKOVÁ, I., ŠANTRŮČKOVÁ, M., UHLÍŘOVÁ, L., KUKLA, P. Using old military survey maps and orthophotograph maps to analyse long-term land cover changes – Case study (Czech Republic). *Applied Geography*, 2011, 31 (2), 426-438. https://doi.org/10.1016/j.apgeog.2010.10.004

SWETNAM, R. D. Rural land use in England and Wales between 1930 and 1998: Mapping trajectories of change with a high resolution spatio-temporal dataset. *Landscape and Urban Planning*, 2007, 81 (1-2), 91-103. https://doi.org/10.1016/j.landurbplan.2006.10.013

SUARÉZ, J. C., ONTIVEROS C., SMITH, S., SNAPE, S. Use of airborne LiDAR and aerial photography in the estimation of individual tree heights in forestry. *Computers&Geosciences*, 2005, 31, 253 -262.

ŠTĚPÁN, L. a kol. *Dílo mlynářů a sekerníků v Čechách II*. Praha: Argo, 2008, 316 s.

ŠTRONER, M. et al. *3D skenovací systémy*. Vyd. 1. Praha: České vysoké učení technické v Praze, 2013. 394 s.

WINTERBOTTOM, S.,J., GILVEAR, D., J. Quantification of channel bed morphology in gravel – bed rivers using airborne multispectral imagery and aerial photography. *River Research and Applications*, 1997, 13 (6), 489-499.

XIANG, H., TIAN, L. Development of a low-cost agricultural remote sensing system based on an autonomous unmanned aerial vehicle (UAV). *Biosystems Engineering*, 2011, 108 (2), 174-190. https://doi.org/10.1016/j.biosystemseng.2010.11.010

Internet sources

Czech National Geoportal (2015): *Metadats (2nd Military Survey)*. Retrieved from: http://geoportal.gov.cz/web/guest/catalogue-client

Historické stezky Čech, Moravy a Slezska. Mapserver CCDV, project NAKI. Retrieved from http://naki.vectormap.cz

Indicator Sketches – Moravský zemský archiv v Brně. Retrieved from http://www.mza.cz/indikacniskici/

Kruhovský mlýn. Portál zaniklé obce. Retrieved from:
http://www.zanikleobce.cz/index.php?obec=10939
http://vodnimlyny.cz/poznavame-vodni-mlyny/

“*Základní mapy ČR*”. ESRI ArcGIS Server ČÚZK. Retrieved from: http://ags.cuzk.cz/arcgis/services

Kruhovský mlýn. Portál zaniklé obce. Retrieved from : http://www.zanikleobce.cz/index.php?obec=10939
http://vodnimlyny.cz/poznavame-vodni-mlyny/

http://altigator.com/drone-uav-uas-rpa-or-rpas/

Shrnutí

Příspěvek je zaměřen na praktické ukázky využití moderních technologií a na ně navázaných metodických přístupů určených ke sběru dat a informací v oblasti výzkumu zaniklých vodních ploch. Využití dálkově pilotovaných létajících systémů (RPAS – Remotely Piloted Aircraft System) má uplatnění při získávání detailních výškopisných dat a modelů povrchu na lokální úrovni. Dynamika vývoje daného segmentu a snižující se pořizovací náklady činí z této technologie velmi efektivní a dostupný nástroj pro mapování krajiny na lokální úrovni. Mapování širších souvislostí (regionální měřítko), ale zejména získání detailních modelů terénu i povrchu v zalesněných oblastech nabízí technologie lidarových dat. Jejich pořízení a zpracování je limitováno výrazně vyšší cenou. Dostupná data DMR5G sice pokrývají souvislé území ČR, kvalita a zobrazovaný detail, ale v jistých ohledech pro potřeby výzkumu lokální úrovně nestačí. I přes negativa představují lidarová data a jejich využití při současném výzkumu vývoje krajiny neocenitelný zdroj prostorových informací. Umožňuje totiž získat potřebnou detailní informaci o vývoji využití krajiny, která je zakonzervovaná pod lesními porosty 50, 100, někde i více než 200 let.

Poděkování: Autoři článku děkují Národní agentuře pro zemědělský výzkum, která podpořila projekt NAZV KUS QJ1620395 s názvem „Obnova a výstavba rybníků v lesních porostech jako součást udržitelného hospodaření s vodními zdroji v ČR“, v rámci něhož byl vypracován i tento příspěvek.

WETLAND – YES OR NO (THE PARÍŽ WETLANDS NATIONAL NATURE RESERVE - SLOVAKIA)

František Petrovič [1], Matej Mojses [2], Zlatica Muchová [3]

[1] Department of Ecology and Environmental Studies, Faculty of Natural Sciences, Constantine the Philosopher University, Tr. A. Hlinku 1, 949 01 Nitra, Slovakia

fpetrovic@ukf.sk

[2] Institute of Landscape Ecology SAS, Branch Nitra, Akademick 2, P.O.Box 22, 949 10 Nitra, Slovakia

matej.mojses@savba.sk

[3] Department of Landscape Planning and Land Consolidation, Faculty of Horticulture and Landscape Engineering Slovak University of Agriculture in Nitra, 949 76 Nitra, Slovakia

zlatica.muchova@gmail.com

Abstract: Wetlands are generally considered to be the most vulnerable ecosystems in the landscape. Over recent years, characterized by their continued decline, specific attention is paid to their protection. There are a lot of domestic and international projects, which are focused on ensuring effective protection of wetland ecosystems, based on a thorough knowledge of their internal structure and functionality.

The aim of this paper is to point to the current landscape development of this protected site, focusing on an open water area, the existence of which is a prerequisite for preserving the biodiversity and conservation of this site.

INTRODUCTION

The Paríž wetlands National Nature Reserve (NNR) is a significant wetland with wetland biocenoses and is a significant biotope of aquatic birds. Wetlands are considered to be the most important habitats and most productive ecosystems. In addition to their other functions, the main functions are water accumulation and retention, water purification, nutrient retention and accumulation of sediments and pollutants. In this context, they also fulfill a significant environmental function in the landscape.

Wetland is also a biocentrum of national importance and a part of the National Ecological Network – NECONET. The NNR lies at an altitude of 125 metres above sea level and extends about 5 km between the villages Gbelce and Nová Vieska. At the beginning of the 19th Century, the floodplain of the Paríž stream was represented by large areas of wetlands and lakes, which were gradually regulated by an artificial drainage channel - “Parisian”, named after the French engineer who designed it. Due to the reduced water level in the NNR, a dam was constructed which maintains the wetland’s relatively good hydrological conditions, but the height of the column does not exceed 1.5 m.

For the purpose of planning nature and landscape conservation, it is necessary to know the development of land use changes in order to identify the areas’ conflicts with economic use. The spatial structure of the landscape, thus defining its shape and distribution, provides specific characteristics which enable characterization of any chosen part of the landscape.

BASIC DATA

The Paríž wetlands National Nature Reserve is located in the Nitra region, the Nové Zámky district, in the cadastral territories of Gbelce and Nová Vieska. The Paríž stream drains the territory. The Paríž stream's catchment area lies in the southern part of the Hronská pahorkatina Hills, which according to the regional geomorfological division of Slovakia Mazúr, Lukniš (1978) belongs to the Podunajská pahorkatina Hills within the area of Podunajskej nížina Lowland. The Paríž stream is a right tributary of the Hron river. The catchment area lies in a warm and dry climate area with an average annual air temperature of about 9.5 ° C, the average precipitation (mostly rainfall) ranges from 550 to 650 mm, during the vegetation period from 320 to 380 mm, and in the winter from 230 to 270 mm.

An area of 140.59 ha was declared protected by the National Council of the Slovak Republic for Education and Culture, No. 30 of 25 May 1966. The protected site was pre-categorized into a national nature reserve and expanded to an area of 184,0464 ha under the Ministry of Culture of the Czechoslovak Socialist Republic Order No. 1160 / 1988-32 of 30 June 1988. The State Nature Reserve was pre-categorized into the National Nature Reserve (NNR) according to the Act of the National Council of the Slovak Republic No. 287/1994 Coll. on Nature and Landscape Protection. At the present time, the 4th degree of protection is valid in the National Nature Reserve's territory, which was appointed by the Decree of Department for the protection of environmental elements in Nitra No. 1/2004 of 10 May 2004.

The Paríž wetlands represent an important ornithological site for the occurrence and nesting of many marsh species of birds, many of which are forming the largest concentrations of individuals (pairs) in Central Europe. At the same time, the site is their important migratory stop. The site was included on the List of Wetlands of International Importance under the Wetlands Convention (the Ramsar Convention) under No. 499 (https://rsis.ramsar.org/ris/499) on 2 July 1990 with a total area of 184 ha. The site was declared protected as an internationally important site for marsh birds and waterfowl, rare marsh biocenosis, and as an important Central European nest of marsh birds and waterfowl.

The site as a part of the Paríž wetland-SKCHVÚ020 is included in the National List of Special Protection Areas (area of SPA - 376.58 ha) by the Government Resolution No. 636 of 9 July 2003 and the Decree of the Ministry of Environment of the Slovak Republic No. 23/2008 of 7 January 2008.

Three types of habitats of European importance were recorded in the area (Gajdoš, David, Petrovič (eds.) 2005, Gajdoš et al. 2014):

-Biotope 3150 Natural eutrophic and mesotrophic standing water with vegetation of floating or submerged vascular plants is found mostly on the edge of the reservation and was also recorded on water areas which have been preserved in the area. They are made up of submerged or floating aquatic plants floating freely on water (for example: Lemna minor, Lemna trisulca, Utricularia vulgaris), or rooted on the muddy bottom (for example: species of Potamogeton).

-Biotope 6510 Lowland and submontane mowed meadows /Lowland hay meadows, presented by the alliance Arrhenatherion elatioris, is found on the northern edge of the reserve in smaller areas, and in larger areas near the village of Nová Vieska there are connections to large Carex beds and reeds. The Cirsio cani-Festucetum pratensis community was recorded in the territory. The population of critically endangered plant species Senecio doria was found in this biotope.

- Out of the biotope 91E0 Mixed ash-alder alluvial forests of temperate and Boreal Europe/Alluvial forests with Alnus glutinosa and Fraxinus excelsior (Alno-Padion, Alnion incanae, Salicion albae only smaller, often unrelated vegetation was recorded, which has probably grown on a secondary basis.

Biotopes of national importance were also recorded here:

-Lk10 Large Carex beds, which are mainly Carex elata, Carex acutiformis, Carex riparia, Carex vesicaria, with the occurrence of these species: Iris pseudacorus, Lysimachia vulgaris, Mentha longifolia.

-Kr8 Willow carrs and fen scrubs – widespread in this area, the dominant species are grey willow (Salix cinerea) in the scrub stage, and reed (Phalaris arundinacea) in the herbaceous plant stage.

METHODS

Spatial data that defines land use was digitalised manually according to the visual interpretation of aerial orthophotos (from the years 1949, 2007 and 2015) in the ArcView geographic information system (GIS) environment. We used ArcGIS 9.3 software and a field survey for the years 2005 and 2015 for processing map layers obtained from orthophoto maps. The mapping scale is 1:5,000. Orthophoto maps from 2007 and 2015 were provided by EUROSENSE Slovakia and GEODIS Slovakia. Historical black and white (panchromatic) aerial photos from 1949 were utilized for the first period. These were provided by the Topographic Institute of the Slovak Army in Banska Bystrica. Unlike the processes used in historical maps, ortho-rectification here was performed in a digital photogrammetric system ("Orthobase" module of ERDAS IMAGINE 8.4 program) environment, using the affinity transformation method.

The methodology and its accuracy are verified in assessments of different types of landscape from lowland (Kopecká et al. 2015; Opršal et a. 2016; Skaloš et al. 2012), to highland (Konc, 2008; Machar et al. 2016; Opršal et al. 2018; Pazúr et al. 2014; Skaloš et al. 2010; Súľovský, Falťan 2015) to alpine (Boltižiar, 2005). Its subsequent application was reflected in the identification of the major drivers in the landscape (Druga, Falťan 2014; Falťan, Bánovský, Blažek 2011; Havlíček, Chrudina, 2013; Húska et al. 2017; Kolejka, Klimánek 2015; Mišovičová 2008; Munteanu et al. 2014; Olah et al. 2009; Sklenička et al. 2009; Skokanová et al. 2012; Skokanová et al. 2016) and in the proposals for the management of these territories. (Bezák et al. 2017; Boltižiar, Olah 2013, Havlíček et al. 2014; Kanianska et al. 2014; Kočická, 2000; Kozová et al. 2016; Moyzeová, Izakovičová, 2016; Pechanec et al. 2015; Seidl, Chromý, Habartová, 2010; Skokanová et al. 2017; Špulerová et al. 2015).

LANDSCAPE EVALUATION

The floodplain of the Paríž stream in the Nová Vieska - Gbelce section was declared as a protected area mainly for the protection of aquatic birds, for which the existence of open water is a significant factor. Currently, open water in the NNR occurs only in few places, and in all cases, those are only small areas. An exception is the dredged water reservoir on the way from Nová Vieska to Arad (part of the village), but it does not have a natural relief which is typical of this area - mild sloping banks. This fact confirms the development of the size and number of open water areas in the site. At the site, we took into account the main water channel recipient (Fig. 1), whose stable size was removed from the assessment.

The site shows a rapid decline in the size of open water areas (Tab XY). In 1949, almost 4.5% of the NNR area (almost 8 ha) were water areas, which, despite their considerable number (147), represented an average area of 0.05 hectares. Their highest concentration was mostly in the southern half of the NNR, where the largest areas of about 0.5 ha were located, whereby the largest area in this part represented an area of 1.4 ha. The subsequent degradation process was reflected by a significant decline of water areas of more than 70%. Their size was 2.3 hectares, which meant a decline to 1.28% of the NNR area. The largest area remained in the southern part of the site as in the previous year (1949), but the area only had 0.18 hectares. The number of sites and the average size of water areas (0.03 ha) also dropped significantly. This change was a result of several negative phenomena.

Fortunately, during this period, the trend towards the rescue of the NNR started (Tab. 1). In 2015, the downward trend continued. However, its size was mitigated. The water areas size of 1.92 ha (1.08% of the NNR area) was a result of relatively high number (133) of small areas, out of which the largest had an area of 0.16 ha.

Tab. 1: Development of water bodies area in Paríž wetlands National Nature Reserve (1949-2007-2015)

Year	Water bodies area (ha)	Change in%	Number of polygons	Average size (ha)	Share of NNR (%)
1949	7.963		147	0.054	4.45
2007	2.284	-71.32	69	0.033	1.28
2015	1.927	-15.63	133	0.014	1.08

It should be noted that the current state of the Paríž wetland NNR is lawful. It is a consequence of the natural process of silting up in the shallow water reservoirs, which has been accelerated by human activities in this area over recent decades. There have been particular changes to the water regime following the construction of water reservoirs in the river basin and pollution of the environment (source is mainly agriculture), which, in particular, have brought nutrition and eutrophication to the NNR ecosystems. This has created good conditions for the growth of the common reed on most areas of the NNR, which has had a direct impact on the occurrence of suitable habitats for the life of aquatic birds.

Several measures were implemented in the site to change this state. The first attempts to improve the water regime in the Paríž wetlands and the whole area of the Paríž wetland Special Protection Area were at the end of the last century. The aim was to raise the water level in the wetlands by increasing the overflow edge of the security overflow on the Paríž stream in the southern part of the wetland (at the lock gate). In 1995, the security overflow was 25 centimeters higher than the original, having been in decline since the 1960s due to the unstable base. At the same time, measures were taken to secure the lock gate against unwanted manipulation (uncontrolled discharge of water from the wetland). The effect of these measures was short-lived, as the silting up process in the area continues, and the raising of the dams cannot be realised all the time.

It was discovered that the dam is not tight enough and there are local passages of water leakage from the wetland. The Slovak Hydrometeorological Institute (SHI) stabilized this dam. Due to the flushing nutrients into the Paríž stream from the surrounding agricultural land as well as the penetration of waste municipal water from the municipalities lying above the assessed area, there is a massive eutrophication of water.

For the 1982-2005 period, when the problem of the silting up of the Paríž wetlands began to emerge, many materials were elaborated (projects, care programs, studies) for the rescue of the Ramsar site and the Paríž wetlands National Nature Reserve. The majority of these studies are based on the most friendly interference on the site, with an emphasis on minimizing the necessary funds. Nevertheless, funds have not been found to fully implement the proposed measures.

All hitherto interventions (mowing reeds on the surface – Fig. 2, mowing reeds under water or on ice, attempts to flood reed stubble after mowing with water and subsequent freezing, flooding the polder with a flash flood wave, etc.) have only slowed the silting up process slightly.

Fig. 1. and Fig. 2. Main water channel recipient – Parížsky kanál (1), Management in area - mowing reeds on the surface (2)

PROPOSALS FOR SOLUTION/ MANAGEMENT OF CONDITION IMPROVEMENT

The basis for the rescue of the Paríž wetlands in relation to their subject of protection, is the improvement of the living conditions for birds in the territories by their effective use. This presents mowing reeds focused on its elimination.

The floodplain of the Paríž stream in the Nová Vieska - Gbelce section was declared as a protected area mainly for the protection of aquatic birds, for which the existence of open water is a significant factor. Currently, the open water in the NNR occurs only in a few places, and in all cases, those are only small areas. An exception is the dredged water reservoir on the way from Nová Vieska to Arad (part of the village), but it does not have a natural relief which is typical of this area - mild sloping banks. However, this factor can be changed. The site is directly linked to the NNR and it would be relatively easy to integrate it there. Its size of 2.31 hectares would greatly help to improve the possibilities for waterfowl.

Currently, open water areas in the NNR are found only in few places, and in all cases, these are only small areas. Therefore, it is necessary to implement measures to expand areas with open water. In addition to removing reeds, the following measures should be used to increase the area of open water: the proposed purification (mud removal) of the Paríž canal parts; and joining the open water areas through a system of dredged canals and restored meanders. It is necessary to remove the mud from canals in such a way, so that the regenerated canals will become natural and meandering will form, rather than straight canals. Canal purification must be done sensitively so as not to endanger the existence of aquatic plant communities. A detailed study with regard to hydrology and ecology must be drawn up in the planning of such a purification of the Paríž stream canal. This measure is conditional on the optimization of the water regime in the area within the elaboration of the handling regulations for all water management facilities in the area over the NPR.

It should be noted that the current state of the Paríž wetland NNR is lawful. It is a consequence of the natural process of silting up in the shallow water reservoirs, which has been accelerated by human activities in this area over recent decades. There have been particular changes to the water regime following the construction of water reservoirs in the river basin and pollution of the environment (source is mainly agriculture), which, in particular, have brought nutrition and eutrophication to the NNR ecosystems. This has created good conditions for the growth of the common reed on most areas of the NNR, which has had a direct impact on the occurrence of suitable habitats for the life of aquatic birds.

One of the direct measures is mowing reed and expanding open water areas. The Paríž wetlands NNR were traditionally mowed in the past, the reed was vital and used for industrial processing. At the present time, it is no longer suitable for such a mode of use, as it is considerably thinner and weaker. Reed is a major component of biomass and therefore its accumulation contributes to the silting up of the water areas. During the realization of the rescue program, the winter mowing reed should be ensured in the wetland area according to the current conditions in the specific period.

In order to ensure a favourable state of the Lk1 Lowland and submontane mowed meadows /Lowland hay meadows (6510) and for protected, threatened species of plants and animals and for species from the Annexes to the Habitats Directive within the scope of practical care, it will be necessary to implement the following: regular mowing of meadows after the 15th of June of the current calendar year, a reduction of pioneer and non-native species of trees and removal of invasive plant species by methods according to Annex No. 2a to Decree of the Ministry of Environment of the Slovak Republic No. 24/2003 Coll. which implements Act No. 543/2002 Coll. on Nature and Landscape Protection as amended. These measures should also be applied to mesophilic meadows, including the continued mowing of grassland on the dams. In cases of abandoned wet and mesophilic meadows, it will be necessary to restore their use (mowing or extensive grazing), in cases of pioneer trees in these areas, these plants should be reduced or eliminated. Removal of invasive species in these areas is particularly important, as abandoned areas are often invaded by non-native species. The long-term time horizon of these activities is required.

CONCLUSION

It will be necessary to carry out yearly inspections of the state of the territory, to check whether there is no presence of re-expansion of reeds on the edges of the created water area after the interventions. It will also be necessary to ensure annual monitoring of the occurrence of birds, also focusing on occurrence of bird species bound to the open water level or to carry out targeted monitoring of the impact of the measures implemented on all nesting and migratory birds. Priority species and habitats as well as other significant and endangered plant and animal species should also be monitored (Gajdoš, David, Petrovič (eds.) 2005) states an overview of species for monitoring. It will also be necessary to closely monitor the possible spread of non-native and invasive plant species into the area, which could seriously damage the condition and, in particular, the quality of the habitats subjected to the protection of the area.

If we want to restore the open water level on larger areas that will last for a long time, a part of the territory will return backwards by several stages - within the succession. The measures that will ensure this will be financially costly and should be taken into account when defining the target state. Measures that can quickly improve the situation and will be a benefit over a shorter time period and are stated in the submitted proposal of management measures for the Paríž wetlands National Nature Reserve and its closest areas. These measures will need to be complemented in the coming years by financially more demanding measures, but they will be able to provide a desirable situation for longer time. There is a need for permanent care of the Paríž wetlands NNR ecosystems on the basis of the monitoring of the ecosystem state leading towards the preservation of its value and its ecosystem services to the landscape.

Acknowledgement: This work was supported by the Scientific Grant Agency of the Ministry of Education of the Slovak Republic – VEGA No. 1/0496/16 "Assessment of natural capital, biodiversity and ecosystem services in Slovakia" and KEGA No. 032/UKF-4/2018 0158/14 "Overview of methods and proposal for the application of the ecosystem services concept in the Environmental studies study program".

REFERENCES

BEZÁK, P., MEDERLY, P., IZAKOVIČOVÁ, Z., ŠPULEROVÁ, J., SCHLEYER, C. 2017. Divergence and conflicts in landscape planning across spatial scales in Slovakia: Opportunity for an ecosystem services-based approach? *Int. J. Biodivers. Sci. Ecosyst. Serv. Manag.*, 13, 119–135. https://doi.org/10.1080/21513732.2017.1305992

BOLTIŽIAR, M. 2005. Tvorba historických máp krajinnej štruktúry Tatier na základe archívnych leteckých snímok a ich aplikácia pri hodnotení zmien krajiny (in Slovak). In: Historické mapy. Zborník z vedeckej konferencie. Bratislava: Kartografická spoločnosť SR a Geografický ústav SAV, p. 19-26

BOLTIŽIAR, M., Olah, B. 2013. Land use changes of UNESCO biosphere reserves in the Slovak Carpathians since the late eighteenth century. In Kozak, J., Ostapowicz, K., Bytnerowicz, A., Wyzga, B., eds. The Carpathians: integrating nature and society towards sustainability. Berlin (Springer), pp. 377-391

DRUGA, M., Falťan, V. 2014. Influence of environmental drivers on the land cover structure and its long-term changes – Case study of Malachov and

Podkonice villages in Slovakia. *Moravian Geographical Reports,* 22, 29–41. https://doi.org/10.2478/mgr-2014-0016

FALŤAN, V., BÁNOVSKÝ, M., BLAŽEK, M. 2011. Evaluation of land cover changes after extraordinary windstorm by using the land cover metrics: A case study on the high Tatras foothill. *Geografie,* 116, 156–171. Retrievied from http://geography.cz/sbornik/

GAJDOŠ, P. DAVID, S., PETROVIČ, F. (eds.) 2005. Národná prírodná rezervácia Parížske močiare. Krajina, biodiverzita a ochrana prírody (in Slovak). Ústav krajinnej ekológie SAV v Bratislave, Štátna ochrana prírody SR v Banskej Bystrici, Katedra ekológie a environmentalistiky FPV UKF v Nitre, Nitra, 195 p.

HAVLÍČEK, M., CHRUDINA, Z. 2013. Long-term land use changes in relation to selected relief characteristics in Western Carpathians and Western Pannonian basin – Case study from Hodonín District (Czech Republic). *Carpathian Journal of Earth and Environmental Sciences*, 8, 231–244.

HAVLÍČEK, M., PAVELKOVÁ, R., FRAJER, J., SKOKANOVÁ, H., 2014. The long-term development of water bodies in the context of land use: The case of the Kyjovka and Trkmanka River Basins (Czech Republic). *Moravian Geographical Reports*, 22 (4): 39–50. https://doi.org/10.1515/mgr-2014-0022

HÚSKA, D., JURÍK, Ľ., TÁTOŠOVÁ, L., ŠINKA, K., JAKABOVIČOVÁ, J. 2017. Cultural landscape, floods and remote sensing. *Journal of Ecological Engineering*. vol. 18, no. 3, s. 31-36. ISSN 2081-139X. https://doi.org/10.12911/22998993/69348

KANIANSKA, R., KIZEKOVÁ, M., NOVÁČEK, J., ZEMAN, M., 2014. Land-use and land-cover changes in rural areas during different political systems: A case study of Slovakia from 1782 to 2006. *Land Use Policy*, 36, pp. 554–566. https://doi.org/10.1016/j.landusepol.2013.09.018

GAJDOŠ et al. 2014: Program záchrany pre ramsarskú lokalitu a NPR Parížske močiare a pre Chránený areál Alúvium potoka Paríž (in Slovak). BROZ, ÚKE SAV, ŠOP SR 24 p. [ms.]

LIESKOVSKÝ, J., KENDERESSI, P., ŠPULEROVÁ, J., LIESKOVSKÝ, T., KOLEDA, P., KIENAST, F., GIMMI, U. (2014): Factors affecting the persistence of traditional agricultural landscapes in Slovakia during the collectivization of agriculture. *Landscape Ecology* 29: 867-877. https://doi.org/10.1007/s10980-014-0023-1

KOČICKÁ, E. 2000. Optimisation of the territory exploitation with an example of the complex physical geographical evaluation. *Ekologia Bratislava*, Vol. 19, Issue 2, 2000, p. 92-98 ISSN: 1335-342X

KOLEJKA, J., KLIMÁNEK, M. 2015. Identification and typology of CZECH post-industrial landscapes on national level using GIS and publicly accessed geodatabases. *Ekológia* (Bratislava) 34 (2): 121-136, https://doi.org/10.1515/eko-2015-0013

KONC, L., 2008. Analysis of soil conditions in land consolidation projects, case study Horné Hamre (in Slovak). In: Boltižiar, M. (Ed.): *Ekologické štúdie* VII. Slovak ecological company, Bratislava, pp. 103–111. doi:978-80-968901-5-6

KOPECKÁ, M., ROSINA, K., OŤAHEL, J., FERANEC, J., PAZÚR, R., NOVÁČEK, J. 2015. Monitoring of development dynamics on local level (Study area of

Trnava) (in Slovak). *Geographia Slovaca* 30. ISSN 1210-3519, ISBN 978-80-89580-11-8

MACHAR, I., SIMON, J., REJSEK, K., PECHANEC, V., BRUS, J., KILIÁNOVÁ, H. 2016. Assessment of Forest Management in Protected Areas Based on Multidisciplinary Research. *Forests* 7(11): https://doi.org/10.3390/f7110285

MAZÚR, E., LUKNIŠ, M. 1978. Regionálne geomorfologické členenie Slovenskej socialistickej republiky (in Slovak). Geografický časopis, 30, p. 101-125.

MIŠOVICOVÁ, R. 2008. Landscape-ecological assumptions of the development of Nitra and its contact area (in Slovak). – Nitra: Constantine the Philosopher University in Nitra, ISBN 978-80-8094-212-0

MOYZEOVÁ, M., IZAKOVIČOVÁ, Z. 2016. Attitudes of the involved subjects to the issue of biodiversity conservation in the Protected Area of the Malé Karpaty Mts (Results of personal interviews). Ekologia Bratislava, 35, 4, pp. 392-400, ISSn 1335-342X

MUNTEANU, C. et al. 2014. Forest and agricultural land change in the Carpathian region—A meta-analysis of long-term patterns and drivers of change. – Land Use Policy 38: 685-697. https://doi.org/10.1016/j.landusepol.2014.01.012

OLAH, B., BOLTIŽIAR, M., GALLAY, I. 2009. Transformation of the Slovak cultural landscape since the 18th cent. and its recent trends. *Journal of Landscape Ecology* 2 (2): 41-55. https://doi.org/10.2478/v10285-012-0018-z

OPRŠAL, Z., HARMÁČEK, J., PAVLÍK, P., MACHAR, I. 2018. What factors can influence the expansion of protected areas around the world in the context of international environmental and development goals? *Problemy Ekorozwoju*, 13(1), pp. 145-157 ISSN:1895-6912

PAZÚR, R., LIESKOVSKÝ, J., FERANEC, J., OŤAHEĽ, J. 2014. Spatial determinants of abandonment of large-scale arable lands and managed grasslands in Slovakia during the periods of post-socialist transition and European Union accession. *Applied Geography*, 54, 118-128. https://doi.org/10.1016/j.apgeog.2014.07.014

OPRŠAL, Z., KLADIVO, P., MACHAR, I. 2016. The role of selected biophysical factors in long-term land-use change of cultural landscape. *Applied Ecology and Environmental Research*, 14, 23–40. https://doi.org/10.15666/aeer/1402_023040

KOZOVÁ, M., DOBŠINSKÁ, Z., PAUDITŠOVÁ, E., TOMČÍKOVÁ, I., RAKYTOVÁ, I. 2016. Network and participatory governance in urban forestry: An assessment of examples from selected Slovakian cities. Forest Policy and Economic. In press.

PECHANEC, V., BRUS, J., KILIÁNOVÁ, H., MACHAR, I. 2015. Decision support tool for the evaluation of landscapes. *Ecological Informatics* 30: https://doi.org/10.1016/j.ecoinf.2015.06.006

SEIDL, T., CHROMÝ, P., HABARTOVÁ, P. 2010. Perceptions of marginality: The role administration and other stakeholders in issues of future development of Czech military training areas. Acta Universitatis Carolinae, Geographica, v. 45, n. 2, p. 89-100, ISSN 2336-1980

SKALOŠ, J., ENGSTOVÁ, B. 2010. Methodology for mapping non-forest wood elements using historic cadastral maps and aerial photographs as a basis for management, *Journal of Environmental Management*, 91 (4), pp. 831-843. https://doi.org/10.1016/j.jenvman.2009.10.013

SKALOŠ, J., MOLNÁROVÁ, K., KOTTOVÁ, P. 2012. Land reforms reflected in the farming landscape in East Bohemia and in Southern Sweden – Two faces of modernisation. Applied Geography, 35, 114–123. https://doi.org/10.1016/j.apgeog.2012.06.003

SKLENIČKA, P., HLADÍK, J., STŘELEČEK, F., KOTTOVÁ, J., LOSOSOVÁ, L., ČÍHAL, L., ŠÁLEK, M. 2009. Historical, environmental and socio-economic driving forces on land ownership fragmentation, the land consolidation effect and the project costs. *Agricultural Economics*, 55, 571–582.

SKOKANOVÁ, H., FALŤAN, V., HAVLÍČEK, M. 2016: Driving forces of main landscape change processes from past 200 years in central Europe – differences between old democratic and post-socialistic countries. – Ekológia (Bratislava) 35 (1): 50-65. https://doi.org/10.1515/eko-2016-0004

SKOKANOVÁ, H., HAVLÍČEK, M., BOROVEC, R., DEMEK, J., EREMIÁŠOVÁ, R., CHRUDINA, Z., MACKOVČIN, P., RYSKOVÁ, R., SLAVÍK, P., STRÁNSKÁ, T., SVOBODA, J., 2012. Development of land use and main land use change processes in the period 1836-2006: Case study in the Czech Republic. *Journal of Maps*, 8 (1), pp. 88-96. https://doi.org/10.1080/17445647.2012.668768

SKOKANOVÁ, H., HAVLÍČEK, M., KLUSÁČEK, P., MARTINÁ, S. 2017. Five military training areas – five different trajectories of land cover development? Case studies from the Czech Republic. *Geographia Cassoviensis* XI 2/2017, p. 201-213.

SÚĽOVSKÝ, M., FALŤAN, V. 2015. Analysis of land-use changes and their relationship to topographic factors: Case study of the municipality Lietavská Svinná-Babkov. *Geographical Journal*, 67, 45–62.

ŠPULEROVÁ, J., PISCOVÁ, V., GERHÁTOVÁ, K., BAČA, A., KALIVODA, H., KANKA, R., 2015. Orchards as traces of traditional agricultural landscape in Slovakia. *Agriculture, Ecosystems and Environment,* 199, pp. e67-e76. https://doi.org/10.1016/j.agee.2014.08.021

ANALYSIS AND ASSESSMENT OF LAND COVER CHANGES AND LANDSCAPE STABILITY IN THE NITRA RIVER BASIN (SLOVAKIA)

Matej Vojtek

Department of Geography and Regional Development, Faculty of Natural Sciences, Constantine the Philosopher University in Nitra, Trieda A. Hlinku 1, 949 74 Nitra, Slovakia

mvojtek@ukf.sk

Abstract: The impact of human society on landscape is also documented by changes in land cover. Land cover/use changes in a basin frequently result in increased surface runoff, reduced groundwater recharge or transfer of pollutants. On the other hand, landscape stability refers to the share of (stable) areas that are identically used during the whole studied period. The aim of the paper is to analyze and assess land cover changes and landscape stability in the Nitra River Basin (Slovakia) in the years 1990 and 2012 based on CORINE Land Cover data. Geographic information systems (GIS) were used to compare and quantify the size of land cover classes (LCC). The landscape stability was determined by the overlay method using GIS. The LCC 211 recorded the most significant decrease by 1.97% (8826.64 ha). On the other hand, the share of LCC 313 increased the most by 1.22% (5469.72 ha). The total stable area represents 88.48% out of the total basin area. The largest share out of the total stable area was recorded in LCC 211 (50.85%) and 311 (27.11%). Economic development, accession to the EU and processes of (sub)urbanization were dominant driving forces behind the land cover change in the Nitra River Basin.

Key words: landscape, land cover, stability, GIS, Nitra River Basin

INTRODUCTION

Land cover refers to the physical characteristics of the Earth's surface, which are captured in the distribution of vegetation, water, soil and other physical components of the land, including those created solely by human activities e.g. settlements, industrial factories, etc. On the other hand, land use refers to the way in which land has been used by humans and their habitat usually with emphasis on the functional role of land for economic activities. The land use/cover pattern of a particular region is thus an outcome of natural and socio-economic factors and their utilization by man in time and space (Feranec, Oťahel, 2001, Lu et al., 2004, Rawat, Kumar, 2015, Munteanu et al., 2014).

Furthermore, land use/cover change has an impact on biodiversity and aquatic ecosystems. In a basin, land use/cover changes may result in increased surface runoff, occurrence of flood situations, reduced groundwater recharge, transfer of pollutants, etc. (Solín, Feranec, Nováček, 2011, Vojtek, Vojteková, 2016). Therefore, the assessment of land use/cover and its change is crucial to planning and management of water resources in a particular basin. Moreover, it is important for better understanding of interactions and relations between human activities and natural phenomena.

The use of remotely sensed data made possible to study the land cover changes in less time, at lower cost and with better accuracy. Geographic information systems (GIS) provide suitable platform for data analysis and update (Singh, 1989, Oetter et al., 2001, Yuan et al., 2005).

The term landscape stability refers to spatial and functional stability of individual land use categories or land cover classes over the time. Its value represents the share of stable areas between the first and last time horizon (Forman, Godron, 1986, Turner, Gardner, O'Neill, 2001). Different methods can be used to determine the landscape stability. One of them is the overlay method where the land cover maps from different years are overlaid and stable/unstable patches are calculated (Vojteková, 2013). On the other hand, the use of fuzzy theory for landscape stability identification in GIS is also discussed and it was used in several studies e.g. Arnot, Fischer (2007) or Verstraete, Hallez, De Tré (2007).

The aim of the paper is to analyze land cover changes and landscape stability in the Nitra River Basin (Slovakia) in two time horizons (1990 and 2012). Geographic information systems were used create land cover maps based on CORINE Land Cover data as well as to determine landscape stability. Moreover, the changes in land cover classes during the studied period as well as the size and share of stable patches were quantitatively assessed.

STUDY AREA

The study area is represented by the Nitra River Basin (fig. 1). The Nitra River springs in Malá Fatra (mountain) under the Reváň peak (1205 m a.s.l.). It has a length of 167 km and it creates a left tributary of the Váh River. The total basin area is 4492.70 km^2.

The geographical coordinates of the study area are: North - 48º58'N and 18°34'E, South - 47º57'N and 18°08'E, West - 48°09'N and 17º52'E, East - 48°44'N and 18°49'E.

According to the geomorphological division of Slovakia (Mazúr, Lukniš, 1986), the study area is classified into the following geomorphological units: Podunajská rovina (plain), Podunajská pahorkatina (hills), Tribeč (mountain), Strážovské vrchy (mountain), Hornonitrianska kotlina (basin), Žiar (mountain), Považský Inovec (mountain), Vtáčnik (mountain), and Pohronský Inovec (mountain).

The highest point has an elevation of 1346 m a.s.l. (Vtáčnik peak) and it is located in the eastern part of the basin. The lowest point is located in the confluence of Nitra River and Váh River (near Komoča municipality) and it has an elevation of 109 m a.s.l. The left-sided tributaries are e.g. Handlovka, Žitava, Vyčoma while the right-sided tributaries include e.g. Nitrica, Bebrava, Radošinka or Dlhý kanál.

From the administrative point of view, most of the study area belongs to the Western Slovakia (NUTS II), Trenčín Region and Nitra Region (NUTS III). Only a small part of the basin extends to Banská Bystrica Region (NUTS III). The

Nitra River flows through five district towns: Prievidza, Partizánske, Topoľčany, Nitra, and Nové Zámky.

DATA AND METHODS

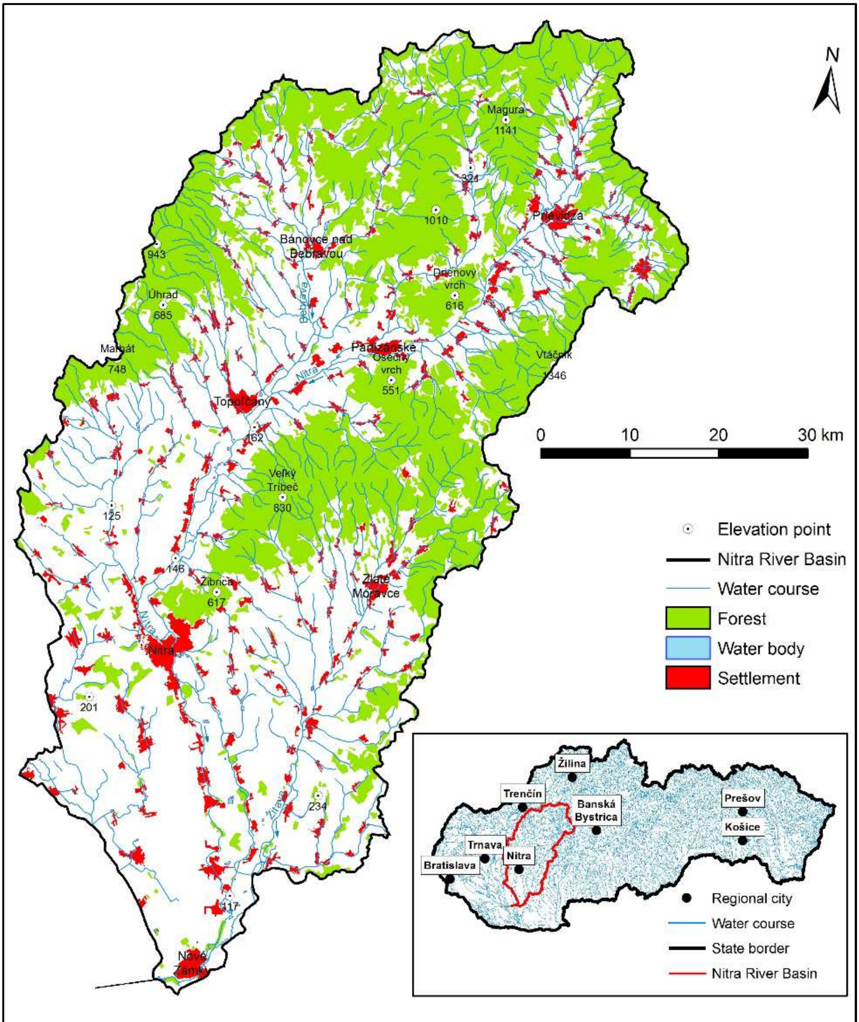


Fig. 1. Study area of the Nitra River Basin.

Source: VMAP200

For the creation of land cover maps of the study area, the CORINE Land Cover (CLC) database was used, particularly vector layers of CLC 1990 and CLC 2012. The land cover maps were processed in ArcGIS 10.2.2 software. Moreover, the size and percentage of individual land cover classes were calculated in this software.

The stability analysis was performed using the vector polygon-on-polygon overlay method (union tool) in ArcGIS 10.2.2 software. The resulting union layer contained all the features from the two input layers (land cover from 1990 and 2012) and the stable land cover classes were then gradually selected from this layer. The size of stable patches of individual land cover classes was also quantified in the mentioned software.

RESULTS

As for the creation of land cover maps, twenty-four land cover classes were identified in both years 1990 and 2012 (fig. 2 and fig. 3). Furthermore, the size and share of land cover classes are shown in tab. 1.

Tab. 1: Size and share of land cover classes (LCC) in 1990 and 2012

LCC Code	CLC90 Area (ha)	CLC90 (%)	CLC12 Area (ha)	CLC12 (%)	Difference (ha)	Difference (%)
111	111.61	0.02	38.18	0.01	-73.43	-0.02
112	29378.67	6.54	30361.20	6.76	983.70	0.22
121	3106.77	0.69	3481.63	0.77	374.86	0.08
122	39.64	0.01	563.60	0.13	523.96	0.12
124	169.75	0.04	28.88	0.01	-140.87	-0.03
131	333.28	0.07	473.61	0.11	140.33	0.03
132	453.62	0.10	331.67	0.07	-121.95	-0.03
133	32.45	0.01	138.20	0.03	105.75	0.02
141	25.10	0.01	54.63	0.01	29.53	0.01
142	606.30	0.13	851.49	0.19	245.19	0.05
211	217083.89	48.32	208252.00	46.35	-8826.64	-1.97
221	2850.46	0.63	2002.62	0.45	-847.84	-0.19
222	2026.68	0.45	2181.07	0.49	154.39	0.03
231	10790.12	2.40	10532.10	2.34	-258.02	-0.06
242	2578.67	0.57	6223.04	1.39	3644.57	0.81
243	24745.44	5.51	23523.72	5.24	-1233.93	-0.27
311	117385.97	26.13	117479.98	26.15	88.84	0.02
312	4461.23	0.99	4371.17	0.97	-90.06	-0.02
313	24198.99	5.39	29668.71	6.60	5469.72	1.22
321	98.05	0.02	69.54	0.02	-28.51	-0.01
324	8375.92	1.86	8016.50	1.78	-359.42	-0.08
411	89.78	0.02	175.00	0.04	85.22	0.02
511	91.18	0.02	223.57	0.05	143.22	0.03
512	236.76	0.05	228.18	0.05	-8.58	0.00
Sum	449270.27	100.00	449270.27	100.00	-	-

Source: CORINE Land Cover; own calculations

In both years 1990 and 2012, the largest land cover class is represented by LCC 211 (Non-irrigated arable land). Compared to 1990, this LCC decreased by 1.97% (8826.64 ha) mostly due to urbanization processes, construction of industrial units (e.g. new industrial parks or factories) and agricultural land abandonment.

The second largest land cover class is represented by broad-leaved forests (LCC 311) which share increased only by 88.84 ha (0.02%). On the other hand, the share of coniferous forests (LCC 312) decreased by the same percentage (0.02%). The biggest increase, especially due to natural afforestation, was recorded in mixed forests (LCC 313) by 1.22% (5469.72 ha).

Regarding the LCC 112 (Discontinuous urban fabric), it represents the third largest land cover class and its share increased by 0.22% (983.70 ha) as a result of housing construction and construction of new industrial or commercial units.

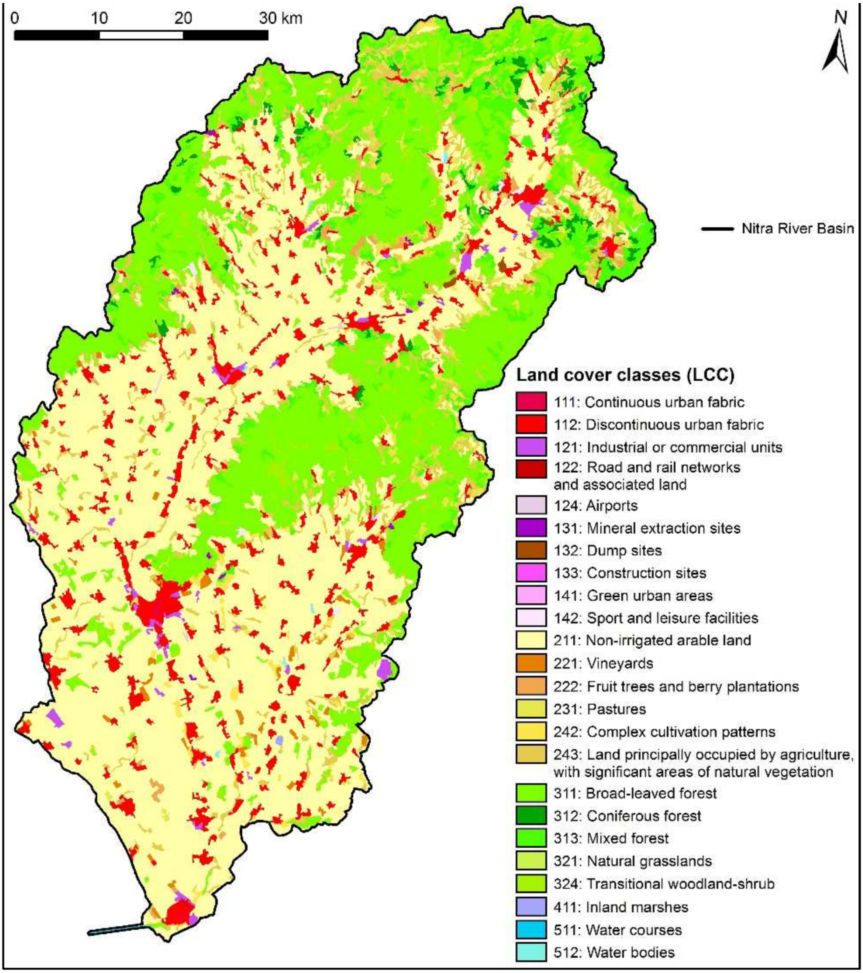


Fig. 2. Land cover in the Nitra River Basin in 1990.
Source: CORINE Land Cover

Another quite significant difference was recorded in LCC 242 (Complex cultivation patterns) which increased by 0.81% (3644.57 ha). On the other hand, LCC 243 decreased by 0.27% (1233.93 ha). Moreover, the share of vineyards decreased by 0.19% (847.84 ha) which is also a result of land abandonment.

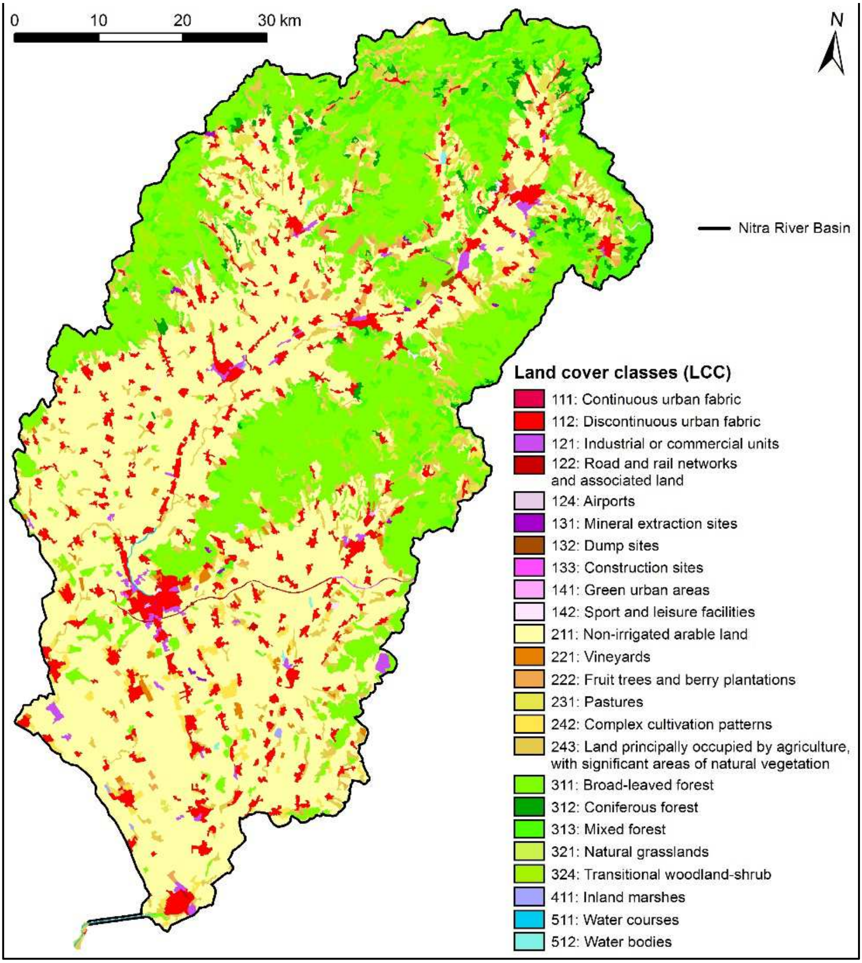


Fig. 3. Land cover in the Nitra River Basin in 2012.
Source: CORINE Land Cover

After the creation of landscape stability map with 23 land cover classes (excluding LCC 133 Construction because of not being overlaid) (fig. 4), the stable patches of individual land cover classes were quantified (tab. 2).

Tab. 2: Size and share of stable areas of land cover classes

LCC Code	Area (ha)	% out of total stable area	% out of total basin area
111	37.17	0.01	0.01
112	27764.95	6.98	6.18
121	2843.70	0.72	0.63
122	37.33	0.01	0.01
124	27.61	0.01	0.01
131	306.94	0.08	0.07
132	284.07	0.07	0.06
141	24.56	0.01	0.01
142	554.84	0.14	0.12
211	202118.37	50.85	44.99
221	1473.73	0.37	0.33
222	1089.19	0.27	0.24
231	7310.74	1.84	1.63
242	2170.19	0.55	0.48
243	17056.08	4.29	3.80
311	107752.60	27.11	23.98
312	3340.61	0.84	0.74
313	21194.63	5.33	4.72
321	67.86	0.02	0.02
324	1695.65	0.43	0.38
411	81.85	0.02	0.02
511	73.55	0.02	0.02
512	198.37	0.05	0.04
Sum	397504.59	100.00	88.48

Source: CORINE Land Cover; own calculations

The total area of stable patches in the period of 1990-2012 has the size of 397504.59 ha which represents 88.48% of the total basin area. The largest share out of the total stable area was recorded in LCC 211: Non-irrigated arable land (50.85%), LCC 311: Broad-leaved forest (27.11%) and LCC 112: Discontinuous urban fabric (6.98%). The smallest share (0.01%) was recorded in LCC 111: Continuous urban fabric, LCC 122: Road and rail networks and associated land, LCC 124: Airports and LCC 141: Green urban areas.

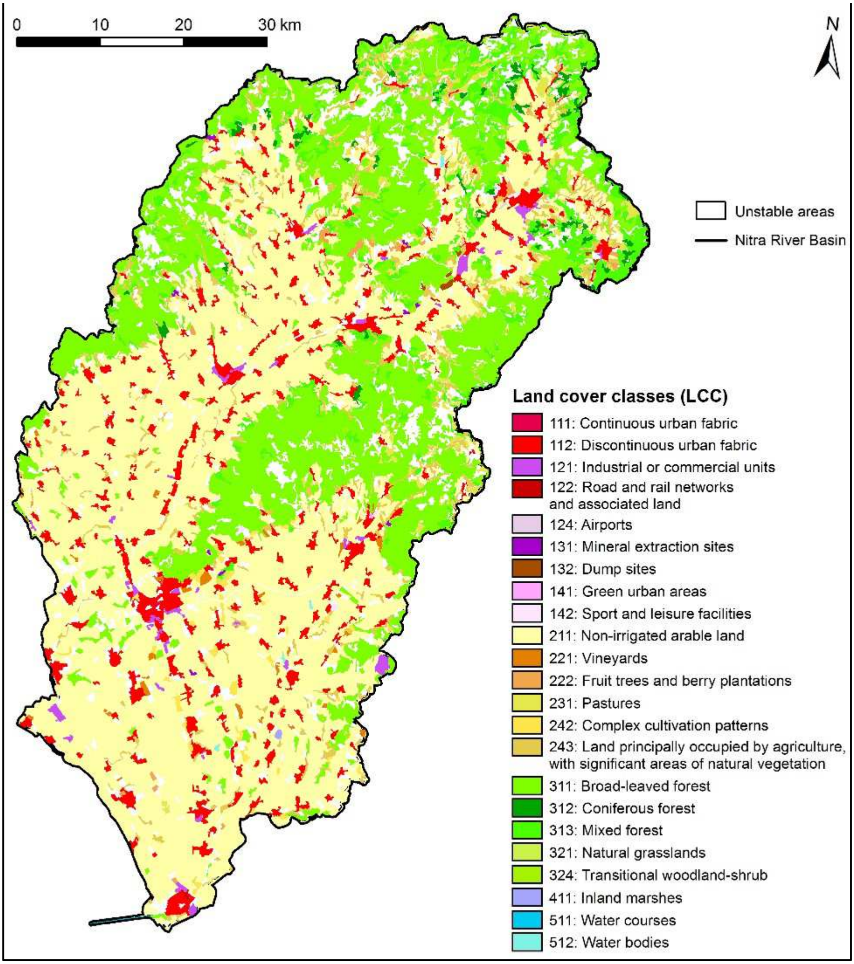


Fig. 4. Stable areas of land cover classes in Nitra River Basin (1990-2012).
Source: CORINE Land Cover

CONCLUSION

The change in land cover during the studied period of 22 years is evident in the size of individual land cover classes and also in their localization. The size of LCC 211 (Non-irrigated arable land) recorded the most significant decrease by 8826.64 ha. On the other hand, the size of mixed forests (LCC 313) increased the most by 5469.72 ha, LCC 242 (Complex cultivation patterns) by 3644.57 ha and LCC 112 (Discontinuous urban fabric) by 983.70 ha.

As for the results of the landscape stability analysis, the stable patches represent 88.48% of the total basin area. The largest share out of the total basin area was recorded in LCC 211: Non-irrigated arable (44.99%), LCC 311:

Broad-leaved forest (23.98%) and LCC 112: Discontinuous urban fabric (6.18%). Based on the results, it can be assumed that the share of unstable areas will increase in the future due to increasing processes of economic development, (sub)urbanization or land abandonment.

The land cover and landscape stability maps can represent a potential input into landscape-ecological or spatial planning. Based on the results of land cover change analysis and determination of stable areas, it is possible to propose suitable locations for various activities in the landscape as a part of planning the sustainable development and management of the study area.

Acknowledgements: This paper was prepared within the grant project VEGA no. 1/0934/17: Land-use changes of Slovak cultural landscape over the past 250 years and prediction of its further development and project UGA no. VIII/29/2017.

REFERENCES

ARNOT, C., FISCHER, P. Mapping the Ecotone with Fuzzy Sets. **In:** Morris A., Kokhan S. (eds.): *Geographic Uncertainty in Environmental Security*, pp. 19-32, 2007.

FERANEC, J., OŤAHEL, J. *Land Cover of Slovakia*. Bratislava: VEDA, 2001. 124 p. (in Slovak)

FORMAN, R. T. T., GORDON, M. *Landscape Ecology*. New York: Wiley, 1986. 640 p.

LU, D., MAUSEL, P., BRONDÍZIO, E., MORAN, E. Change Detection Techniques. *International Journal of Remote Sensing*. vol. 25, no. 12, pp. 2365-2407, 2004. https://doi.org/10.1080/0143116031000139863

MAZÚR, E., LUKNIŠ, M. *Geomorphological Division of SSR and ČSSR. Slovakian part*. Bratislava: Slovenská kartografia, 1986. (in Slovak)

MUNTEANU, C., KUEMMERLE, T., BOLTIŽIAR, M., BUTSIC, V., GIMMI, U., HALADA, L., KAIM, D., KIRÁLY, G., KONKOLY-GYURÓ É., KOZAK, J., LIESKOVSKÝ, J., MOJSES, M., MÜLLER, D., OSTAFIN, K., OSTAPOWICZ, K., SHANDRA, O., ŠTYCH, P., WALKER, S., RADELOFF, V. C. Forest and agricultural land change in the Carpathian region-A meta-analysis of long-term patterns and drivers of change. *Land Use Policy*. vol. 38, pp. 685-697.

OETTER, D. R., COHEM, W. B., BERTERRETCHE, M., MAIERSPERGER, T. K., KENNEDY, R. E. Land Cover Mapping in an Agricultural Setting Using Multiseasonal Thematic Mapper Data. *Remote Sensing of Environment*. vol. 76, no. 2, pp. 139-155, 2001. https://doi.org/10.1016/S0034-4257(00)00202-9

RAWAT, J. S., KUMAR, M. Monitoring Land use/cover Change Using Remote Sensing and GIS Techniques: A Case Study of Hawalbagh Block, District Almora, Uttarakhand, India. *The Egyptian Journal of Remote Sensing and Space Science*. vol. 18, no. 1, pp. 77-84, 2015. https://doi.org/10.1016/j.ejrs.2015.02.002

SINGH, A. Digital Change Detection Techniques Using Remotely Sensed Data. *International Journal of Remote Sensing*. vol. 10, no. 6, pp. 989-1003, 1989. https://doi.org/10.1080/01431168908903939

SOLÍN, Ľ., FERANEC, J., NOVÁČEK, J. Land Cover Changes in Small Catchments in Slovakia During 1990–2006 and Their Effects on Frequency of Flood Events. *Natural Hazards*. vol. 56, no. 1, pp 195-214, 2011. https://doi.org/10.1007/s11069-010-9562-1

TURNER, M. G., GARDNER, R. H., O'NEILL, R. V. *Landscape Ecology in Theory and Practice: Pattern and Process*. New York: Springer-Verlag, 2001. 406 p.

VERSTRAETE, J., HALLEZ, A., DE TRÉ, G. Fuzzy Regions: Theory and Application. **In:** Morris A., Kokhan S. (eds.): *Geographic Uncertainty in Environmental Security*, pp. 1-17, 2007.

VOJTEK, M., VOJTEKOVÁ, J. GIS-based Approach to Estimate Surface Runoff in Small Catchments: A Case Study. *Quaestiones Geographicae*. vol. 35, no. 3, pp. 97-116, 2016. https://doi.org/10.1515/quageo-2016-0030

VOJTEKOVÁ, J. *Trends in Development of Mining Landscape in the Upper Nitra Region*. Nitra: UKF v Nitre, 2013. 152 p. (in Slovak)

YUAN, F., SAWAYA, K. E., LOEFFELHOLZ, B., BAUER, M.E. Land Cover Classification and Change Analysis of the Twin Cities (Minnesota) Metropolitan Area by Multitemporal Landsat Remote Sensing. *Remote sensing of Environment*. vol. 98, no. 2, pp. 317-328, 2005.

Zhrnutie

Vplyv spoločnosti na krajinu je tiež dokumentovaný zmenami v krajinnej pokrývke. V povodí vedú zmeny v krajinnej pokrývke/využití krajiny často k zvýšenému výskytu povodňových situácií, zvýšenému povrchovému odtoku, zníženiu dopĺňania podzemných vôd alebo prenosu znečisťujúcich látok.

Na druhej strane, stabilita krajiny vyjadruje podiel (stabilných) plôch, resp. území, ktoré sú rovnako využívané počas celého sledovaného obdobia.

Cieľom príspevku je analyzovať a vyhodnotiť zmeny krajinnej pokrývky a stabilitu krajiny v povodí rieky Nitry (Slovensko) v rokoch 1990 a 2012 na základe údajov databázy CORINE Land Cover.

Na porovnanie a kvantifikáciu veľkosti jednotlivých tried krajinnej pokrývky (TKP) boli použité geografické informačné systémy (GIS). Stabilita krajiny bola určená metódou overlay v prostredí GIS.

Najvýraznejší pokles o 1,97 % (8826,64 ha) zaznamenala TKP 211 Nezavlažovaná orná pôda. Na druhej strane najviac vzrástol podiel TKP 313 Zmiešané lesy, a to o 1,22 % (5469,72 ha). Stabilné plochy predstavujú 88,48 % celkovej plochy povodia. Najväčší podiel zo stabilných plôch mala opäť TKP 211 Nezavlažovaná orná pôda (50,85 %) a TKP 311 Zmiešané lesy (27,11 %).

Ekonomický rozvoj, vstup krajiny do EÚ, procesy (sub)urbanizácie a pustnutia krajiny predstavujú dominantné hybné sily, ktoré podmienili zmenu krajinnej pokrývky v povodí rieky Nitry.

USING MULTICRITERIAL ANALYSIS TO ASSESS THE DIVERSIFICATION OF RURAL LANDSCAPE

Michaela Žoncová[1], Jana Vojteková[2]

[1] *Department of Geography and Geology, Faculty of Natural Sciences, Matej Bel University, Tajovského 40, Banská Bystrica,*

michaela.zoncova@umb.sk

[2] *Department of Geography and Regional Development, Faculty of Natural Sciences, Tr. A. Hlinku 1, Nitra*

jvojtekova@ukf.sk

Abstract: The Slovak countryside is looking for new poles of development after the decline of the primary agricultural function after 1989 and becomes a multifunctional space. As the rural function changes, this change also affects the overall landscape diversity. The aim of the paper is to evaluate the degree of diversification of the rural landscape using multi-criteria analysis. There are 13 indicators of different focus (demographic, economic, landscape-ecological) entering into this method. The indicators were analyzed in the MCA7 program, which serves to evaluate the multi-criteria analysis. For the model territory was selected the Termal microregion, which consist of 13 municipalities. A central municipality Podhájska is known especially for the development of tourism, which is based on the thermal spring.

Key words: rural landscape, diversification, multicriterial analysis

INTRODUCTION

Landscape is a dynamic system that changes in time and space. A rural landscape (countryside) is the specific type of landscape, which has been formed mainly by the primary agricultural function in the past. Johnston (1986) defines the countryside as an area with extensive land use with low population density. Woods (2011) argues that agriculture, the impact of human activity on rural areas and land use are explored from the perspective of geography in case of rural space. After 1989, the Slovak economy has been reorientated to the market economy, resulting in rapid changes in the ownership of the business, production processes or competition in the market. The position of agriculture in the countryside has also been changed, which in that period began to form the new visual aspect and the meaning of the countryside. The countryside and rural municipalities have changed their character and started to fulfil different functions, other than agriculture. There appeared a new phenomenon - the diversification of the countryside, i.e. transformation of the agricultural (monoproductive) rural area to a multifunctional system that seeks to maximize its potential and to move capital into various activities that have been represented mainly in the urban area - industrial activity, tourism, etc. Holmes (2006, 2012) regards the multifunctional transition as switching from production functions to consumption and protection functions, a new strong political force appears - environmentalism. Hansen - Francis (2007) deals with the theme of the multifunctional countryside on the example of the state of Nebraska or Brouwer - Heide (2009) on numerous case studies from Europe, North America and developing countries. The importance of rural diversification is also highlighted in the strategic documents of the Slovak Republic. In The Rural Development Programme 2007-2013, diversification was included in the separate axis 3 Quality of life in rural areas and diversification of the rural economy. Diversification is also mentioned in the current strategic document, The Rural Development Programme 20142020. The aim of the document is to facilitate the diversification, establishment and development of small businesses as well as job creation, increasing the diversification of agricultural production (focusing on livestock production and specialized crop production). The diversification of the rural economy should be concentrated on a field focused on the development of tourism and agritourism development (recreational and relaxation activities), provision of services for the target group of children, seniors and citizens with reduced mobility, processing and marketing outside of agriculture. In rural areas, there appears diversification, i.e. increase of landscape diversity, change of rural countryside functions. The aim of the paper is to assess the level of diversification of municipalities in the area of interest on the basis of several indicators and to capture changes between 1989 and present.

METHODS

The level of countryside diversification was studied by way of an example of the model territory, for which we have chosen the Termal microregion. The Termal microregion is located in western Slovakia, in the Nitra self-governing region, in the district of Nové Zámky. The area of the microregion in 2016 was 20 639, 631 ha. It consists of 13 municipalities - Bardoňovo, Čechy, Dedinka, Dolný Ohaj, Hul, Kolta, Maňa, Podhájska, Pozba, Radava, Trávnica, Veľké Lovce and Vlkas. The tourist center of the micro-region is the municipality of Podhájska, which is famous for its thermal swimming pool and thanks to it, it was placed on the 4th place in the ranking of the most attractive thermal baths and aquaparks in Slovakia in 2013. The degree of diversification in the area of interest was assessed on the basis of thirteen indicators. The widely used diversification rating tool is the gross index of diversification. This index is most often used to assess employment diversification in the economy. However, we also want to analyze rural change from other aspects than from the point of view of employment in individual sectors. We have, therefore, defined a set of criteria that will ultimately decide about the overall level of diversification. We can talk about creating a multi-criteria analysis to assess the level of diversification in the rural area. The multicriteria method generally includes methods of quantitative evaluation – analysis and results is an overall assessment of the status and comparison of several variants. The method can be applied when the analyzed problem depends on various factors that are relatively problematic for comparing and evaluating on the same platform. The decision-making tasks in which the consequences of a decision are judged by multiple criteria are called multi-criteria decision-making, sometimes interpreted as multicriterial decision-making (Korviny, 2003). Multicriterial analyzes in the rural development research were also used by Bournaris - Moulogianni - Manos (2014) in the assessment of the rural development plans and Burian - Macková - Mirijovsky (2011) in the assessment of the suburbanization processes in Olomouc area. Because our goal is to assess the changes in the rural landscape, we compare the two border points of the time interval, i.e., at the beginning and end of the monitored period (according to the available statistical data, some data are not followed annually, but they are obtained at the Census every ten years). The criteria for assessing changes in the countryside are shown in Table 1.

Tab. 1: Indicators used in multicriterial analysis

Category of indicators	Indicators	Time interval
Demographic	Population	1991 a 2015
	Migration to city of work	1991 a 2011
	The ageing index	1991 a 2014
Economic	Gross index of diversification GiD	1991 a 2011
	Drawn funds from EU funds for municipality development per capita	2013
	Number of entrepreneurs	2004 a 2014
	Defert's tourist function (TF) index	2016
	Transport avalaibility	2016
Landscape-ecological	Land use index	2003 a 2016
	Number of houses	1991 a 2011
	Number of unoccupied houses	1991 a 2011
	Number of multi-storey houses	1991 a 2011
	Number of attractions for tourism	2016

Source: Žoncová, 2017

The primary purpose was to compare statistical data from 1986 and 2016, where the period before the transformation period and the current state would be captured. However, the data from the year of 1986 was not possible to get (data unavailable at the Statistical Office of the Slovak Republic), therefore the oldest available data from this period was used. We assume that despite this, we will be able to capture the transformation changes that have led to the diversification of the countryside. Afterwards we put data into MCA7 program, which is used to perform multi-criteria analysis (Korviny, 2003). The program allows to perform the applied calculation of the following multicriteria analysis methods:

- WSA - Weighted Sum Approach,
- IPA - Ideal Points Analysis,

- TOPSIS - Technique for Order Preference by Similarity to Ideal Solution – it is the principle of minimizing the distance from the ideal variant, the ideal variant is the variant for which all the values of the criteria reach the best values (Korvíny, 2003).
- CDA - Concordance Discordance Analysis – this method has a wide use and is based on a comparison of pairing alternatives. It measures the level to which selection alternatives and factor weights confirm or reverse the degradation ratio between alternatives (Korvíny, 2003).

In the multi-criteria evaluation F1, F2,..Fn factors are selected, which affect the solution of the problem. Criteria may be of the same level of importance or may be hierarchically divided (Filová – Dávid – Sosedová, 2012). Our aim was to identify the municipality that was most dynamic in the monitored indicators. We consider all the criteria equivalent, although their character and focus are different. Any characteristic is not preferred; we have determined the same weight of the criteria. Our goal was only to monitor the intensity of change, not its nature (negative change or positive change). In particular, data of percentage change over the observed period were included in the multi-criteria analysis, as long as statistical data were available. The index of change was reflected as the percentage increase or decrease of the indicator.

Demographic indicators are one of the basic indicators in the assessment of rural changes, which are explored closely in research of Repaská - Vilinová (2016) on the example of the Nitra region. In the case of an indicator that talks about the amount of drawn money from EU funds, data were used only for the last programming period 2007-2014. Defert's tourist function (TF) index enters the multi-criteria analysis with data for the current period, i.e., year 2016, because there were no accommodation capacities in the region before 1989, and in the first available statistics in 1996 there was only one accommodation facility in the Termal microregion - a tourist hostel in Podhájska with 96 beds. Transport availability is also expressed only by data for the current period. Land use index is observed on the basis of research by Šveda, Vigašová (2010). The number of attractions for tourism is also an important indicator for assessing the diversification of the countryside, as it captures the potential of a municipality that can be used in the future for municipality development (number of cultural and historical monuments).

ASSESSMENT OF INDICATORS USING MULTICRITERIAL ANALYSIS

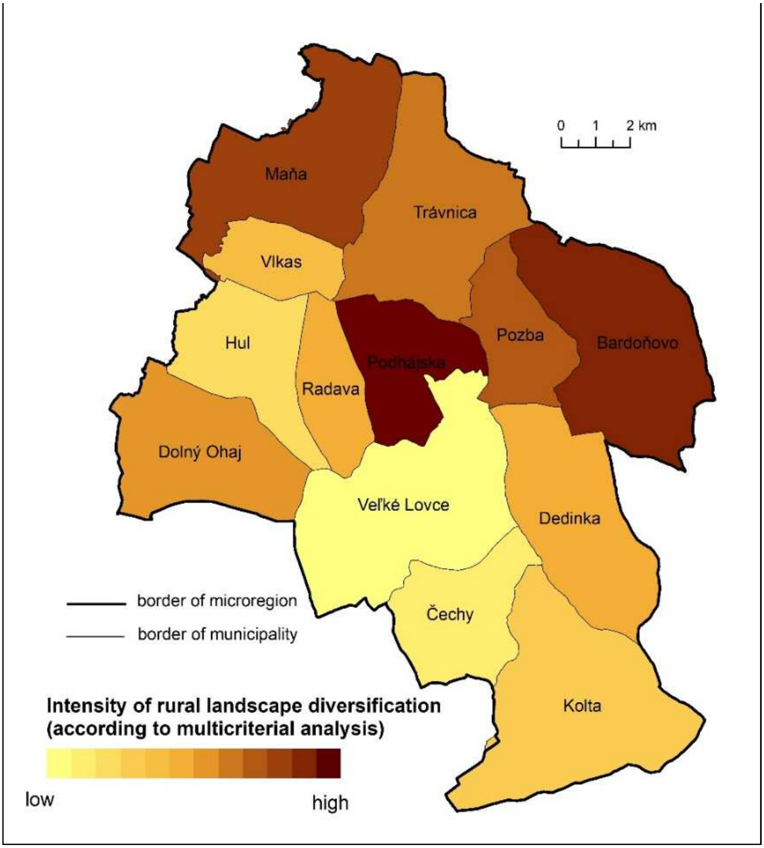
To evaluate the degree of changes that occurred in the transformation period after 1989, we used a multicriterial analysis involving 13 indicators grouped into three main groups. After inserting the necessary data (values of indicators) into the MCA7 program, the program determined the ranking of the municipalities based on the results of the above-mentioned four methods - from the municipality where the changes were the most dynamic and the most significant to the municipality where the development was relatively stable and there were no changes and municipality has no strong potential for development in the future (Table 2). The software gave us a ranking of municipalities in the four methods. We then created the overall order by making the average of the individual rankings, and we found the total intensity of the change in the rural area of the Termal microregion (map 1). Each method uses a different calculation method in the multicriterial analysis, the results differed only slightly in the ranking of the municipalities. However, the ranking of municipalities in the first two places is the same in all methods, the value of the CDA method is other than IPA, WSA, TOPSIS on the third place.

Tab. 2: Multicriterial Analysis Results in the MCA7 Program

Municipality	Ranking in methods				Average rank
	IPA	CDA	WSA	TOPSIS	
Bardoňovo	2	2	2	2	2
Čechy	12	13	12	11	12
Dedinka	8	7	8	7	7-8
Dolný Ohaj	7	4	7	10	6
Hul	11	9	11	12	11
Kolta	10	8	10	9	10
Maňa	3	5	3	3	3
Podhájska	1	1	1	1	1
Pozba	4	3	4	4	4
Radava	6	10	6	8	7-8
Trávnica	5	6	5	6	5
Veľké Lovce	13	12	13	13	13
Vlkas	9	11	9	5	9

Source: Žoncová by MCA7, 2017

The municipality of Podhájska, the center of microregion was the most dynamic. The development of tourism is booming there and it also reflects the diversification of economic activities in the municipality, new building at the expense of declining agricultural land area, the growth of number of permanently unoccupied houses and their transformation for recreation facilities, the increase of accommodation facilities, the higher frequency of transport connections with the surrounding towns as well as the main city.



Map 1: Intensity of Rural Landscape Diversification in Termal Microregion
Source: Žoncová by ArcGIS 10.1, 2017

The municipality also has local resources, which is usable for further development of the municipality, and also uses its potential to finance various development projects. With the development of tourism in the future there may also be a decline of the population, when the municipality loses its peaceful, rural environment and changes into a dynamic village throughout the whole year.

On the second place, the municipality of Bardoňovo is placed, where are some significant changes from the point of view of the economy. There was an increase in the number of entrepreneurs in the municipality and an increase in the diversification of economic activities. The municipality also invests a lot of money in its future development through development projects. The municipality is developing in the tourism sector, although it lags behind in the number of beds and values of Defert's tourist function index. On the basis of geological surveys, it was planned to build a spa area, a relaxing promenade as well as establish a tourist-information office on the basis of geological surveys. However, preferably reconstruction of the manor house and construction of the relaxation zone were realized. There are also changes in the landscape where part of vineyards, permanent grassland, orchards and gardens have been transformed into agricultural land or other area.

On the third place is the municipality of Maňa, which profits from its good location near the town of Vráble. Also the position on the main road in the direction Vráble – Nové Zámky and the railway line is the big advantage for its development. The municipality of Maňa has good transport connection with the surrounding towns. There is also balanced state and composition of the population. The aging index gained the best results in Maňa. The village becomes attractive for the young population as well as for the building of new residential buildings. In the future, there is a prospects due to a wide range of local wealth that can be exploited and the nearness of the industrial park is also an advantage. However, there is not enough accommodation in the municipality.

Dynamics of municipalities can also be analyzed at the level of three categories of indicators (demographic, economic, landscape-ecological) where the ranking of municipalities in the first three places changed (Table 3). Podhájska maintained its first place in terms of economic indicators and landscape-ecological indicators. In terms of demographic indicators, the municipality of Podhájska ranked on third place, what reflects the development of the municipality in terms of tourism and other sectors of the economy, but there is an outflow of inhabitants outside the municipality. The municipality of Podhájska is transformed into a tourist resort, which is characterized by an increased concentration of visitors, higher prices as well as the overall rush in the village.

An interesting position was achieved by the municipality of Čechy, which placed in the overall ranking of the dynamics in the penultimate place, but from the point of view of the economic indicators it ranked third. The municipality is economically dynamic, but it lags behind in the other indicators. The opposite case occurred in the municipality of Maňa, which ranked third in the overall assessment but had uneven positions in the partial indicators. Within the results of the landscape-ecological indicators, the municipality of Maňa was placed second, because it had a dynamic development, especially from the point of view of the landscape, where a larger number of multi-storey houses was built. However, the municipality also has a lot of local wealth in the form of cultural and natural heritage, which can be used in the future for the development of tourism.

Tab. 3: Dynamics of municipalities on the basis of partial results of multicriterial analysis

municipality	ranking			overall ranking
	demographic indicators	economic indicators	landscape-ecologic indicators	
Bardoňovo	1	2	5	2
Čechy	11	3	13	12
Dedinka	10	6	6	7-8
Dolný Ohaj	4-5	11	9	6
Hul	13	4	11	11
Kolta	6	5	12	10
Maňa	8	7	2	3
Podhájska	3	1	1	1
Pozba	2	10	3	4
Radava	4-5	9	10	7-8
Trávnica	9	8	4	5
Veľké Lovce	12	13	7	13
Vlkas	7	12	8	9

Source: Žoncová by MCA7

In the multicriterial analysis, it is appropriate to use as many criteria as possible. Therefore, there may be a slight distortion of the results when it is evaluated individual categories of indicators where 3 to 5 criteria were used. We therefore consider results for all the 13 indicators as a decisive result, because the overall results give us a more accurate picture of the dynamics of the rural municipalities of the Termal microregion in term of transformation changes.

CONCLUSION

The countryside, which was a symbol of agricultural production in the past, has changed under the influence of political, socio-economic changes. These changes were reflected in the looking for new poles of development and the countryside is becoming a multifunctional space. A new phenomenon is coming to the fore - rural diversification, i.e. the transformation of agricultural (productive) countryside into a multifunctional system that seeks to maximize its potential and to move capital into various economic activities. It is precisely obvious in the monitored area of Termal microregion that tourism based on a thermal swimming pool in Podhájska is the driving force of microregion development. A good tool for assessment of rural diversification is multifunctional analysis in which we can explore changes from multiple perspectives. We have used 13 indicators that we have evaluated in the MCA7 program, which serves to evaluate multicriterial analysis. The availability of statistical data in the required time periods to the level of the municipalities can be a problem in application of a multicriterial analysis. In the monitored area, the municipality of Podhájska reached the highest intensity of diversification, in which functions related to the development of tourism are concentrated. There is a wide offer of accommodation facilities of various quality and restaurant facilities, too. The village also has a good transport connection to other municipalities and towns by rail and bus. The negative effect is the departure of the population for employment outside the municipality and the overall decrease of the population in the municipality, which was also reflected in the ranking of the municipality in the multicriterial analysis in the part of the demographic indicators in the third place. The results of the multicriterial analysis can be helpful and useful in creating strategic documents of the Termal microregion and in allocating financial resources to municipalities that have been placed in research in the last places, i.e. municipalities of Veľké Lovce, Čechy and Hul. By this way it is possible to ensure sustainable development in all municipalities of the microregion and to ensure the development of backward municipalities.

REFERENCES

BOURNARIS, T. – MOULOGIANNI, CH. – MANOS, B. A multicriteria model for the assessment of rural development plans in Greece. *Land Use Policy*, vol. 38, 2014, p. 1-8, ISSN 0264-8377. https://doi.org/10.1016/j.landusepol.2013.10.008

BROUWER, F.M. – HEIDE, M. *Multifunctional rural land management: economics and policies*. London: Earthscan Publications Ltd, 2009. ISBN 9781844075775

BURIAN, J. – MACKOVÁ, M. – MIŘIJOVSKÝ, J. Suburbanizace Olomouce – hodnocení pomocí analýzy statistických dat. *Urbanismus a územní rozvoj*, vol. 14, 2011, p. 10-16, ISSN 1212-0855

FILOVÁ, E. – DÁVID, A. – SOSEDOVÁ, J. Multikriteriálna analýza v metodike hodnotenia centier turizmu. *Doprava a spoje – elektronický časopis Fakulty prevádzky a ekonomiky dopravy a spojov Žilinskej univerzity v Žiline*, 2012, p. 51–75, ISSN 1336-7676

HANSEN, T.M. AND FRANCIS, CH.A. *Multifunctional Rural Landscapes*. Economic, Environmental, Policy and Social Impacts of Land Use Changes in Nebraska. [online]. [29-09-2017]. Dostupné na http://agronomy.unl.edu/ FarmingSystems/organic/MultifunctionalRuralLandscapes.pdf

HOLMES, J. 2006. Impulses towards a multifunctional transition in rural Australia: Gaps in the research agenda. *Journal of Rural Studies*, vol. 22, 2006, p. 142-160, ISSN 0743-0167. https://doi.org/10.1016/j.jrurstud.2005.08.006

HOLMES, J. 2012. Cape York Peninsula, Australia: A frontier region undergoing a multifunctional transition with indigenous engagement. *Journal of Rural Studies*, vol. 28, 2012, p. 252-265, ISSN 0743-0167. https://doi.org/10.1016/j.jrurstud.2012.01.004

JOHNSTON, R. J. et al. *The dictionary of human geograph*y. 2. ed. Londýn: Basil Blackwell, 1986. ISBN 0631146555

KORVINY, P. *Aplikace multikriteriální analýzy při nasazování dálkově řízených prvků v distribučních sítích vysokého napětí*. Ostrava: Ostravská univerzita, 2003. Dizertační práce

REPASKÁ, G. – VILINOVÁ, K. Analysis of population aging process in the Nitra self-governing region (2000-2014). **In:** Lnenička, L. ed. *Central Europe Area in*

View of Current Geography. Brno: Masarykova univerzita, 2016, p. 238-245, ISBN 978-80-210-8313-4

ŠVEDA, M. – VIGAŠOVÁ, D. 2010. Zmeny vo využití zeme v zázemí veľkých slovenských miest. *Geografie*, vol. 115, n. 4, p. 413-439, ISSN 1212-0014

WOODS, M. *Rural geography: Processes, Responses and Experiences in Rural Restructuring*. London: SAGE, 2011. 352 p. ISBN 9780761947615

Shrnutí

Vidiecka krajina bola v minulosti chápaná ako symbol poľnohospodárstva a poľnohospodárskej krajiny a vidiek tak plnil prvotne produkčnú funkciu. Po roku 1989 sa však hospodárstvo Slovenska preorientováva na trhové hospodárstvo, čo malo za následok prudké zmeny z hľadiska vlastníckych vzťahov podnikov, výrobných postupov, či konkurencie na trhu. Do popredia sa dostáva nový fenomén – diverzifikácia vidieka, t.j. prerod poľnohospodárskeho (produkčného) vidieka na polyfunkčný systém, ktorý sa snaží maximálne využívať svoj potenciál a presúvať kapitál na rôzne činnosti. Dochádza tak k procesu diverzifikácie, t.j. zmene, obmene krajiny v dôsledku spoločenských zmien a prejavom týchto zmien je zvýšenie rozmanitosti (diverzity) funkcií vidieckej krajiny, t.j. prechod z monofunkčnosti na multifunkčnosť. Za modelové územie sme si zvolili mikroregión Termál, kde zohráva veľkú úlohu cestovný ruch založený na termálnom kúpalisku v obci Podhájska, ktoré je hnacou silou rozvoja v mikroregióne. Cieľom príspevku je určenie tej obce z mikroregiónu Termál, ktorá po roku 1989 dosiahla najvyššiu intenzitu zmeny, a to z rôznych uhľov pohľadov. Na zhodnotenie stupňa diverzifikácie sme použili *multikriteriálnu analýzu*, kde sme brali do úvahy 13 ukazovateľov – demografické (index zmeny počtu obyvateľov, dochádzka do zamestnania, index starnutia), ekonomické (hrubý index diverzifikácie HiD, čerpané financie z fondov EÚ na rozvoj obce prepočítané na obyvateľa, počet podnikateľských subjektov, Defertov index, dopravná dostupnosť), krajinno-ekologické (index zmeny vo využívaní krajiny, index zmeny počtu neobývaných domov, index zmeny počtu domov index zmeny počtu viacpodlažných domov, počet zaujímavostí pre cestovný ruch). Dané ukazovatele v časovom horizonte zachytávajú začiatok transformačného obdobia (r. 1986) a súčasnosť (r. 2016). Tieto ukazovatele sme zhodnotili v programe MCA7, ktorý zoradí obce na základe daných ukazovateľov podľa metód WSA, IPA, TOPSIS a CDA. Najvyšší stupeň diverzifikácie bol zaznamenaný v obci Podhájska, kde prekvitá rozvoj cestovného ruchu, čo sa odzrkadľuje aj na diverzifikácii ekonomických činností, novou výstavbou na úkor poklesu poľnohospodárskej pôdy, nárastom trvalo neobývaných domov a ich určením na rekreáciu, nárastom ubytovacích zariadení, vyššou frekvenciou dopravného spojenia s okolitými mestami ako i s hlavným mestom. Obec taktiež disponuje lokálnym bohatstvom, ktoré je využiteľné pre ďalší rozvoj obce a taktiež svoj potenciál využíva vo financovaní rôznych rozvojových projektov. S rozvojom cestovného ruchu v budúcnosti môže nastať aj pokles trvalo žijúceho obyvateľstva, nakoľko obec stráca pokojné, vidiecke životné prostredie a mení sa na dynamickú obec počas celého roka. Výsledky multikriteriálnej analýzy môžu byť nápomocné a užitočné pri tvorbe strategických dokumentov mikroregiónu

Termál a pri alokovaní finančných zdrojov do obcí, ktoré sa umiestnili vo výskume na posledných miestach, tj. do obcí Veľké Lovce, Čechy a Hul. Takýmto spôsobom je možné zabezpečiť trvalo udržateľný rozvoj vo všetkých obciach mikroregiónu a zabezpečiť tak rozvoj zaostalých obcí.

UTILIZATION OF GIS IN MAPPING INVASIVE PLANT SPECIES OF THE RIVER NITRA

Michaela Bencová, Vladimíra Lišková, Jozef Ťažký, Dávid Tomko-Králo

Constantine the Philosopher in Nitra, Faculty of Natural Sciences, Department of Ecology and Environment, Trieda A. Hlinku 1, 949 74 Nitra, Slovak Republic,

michaela.bencova@ukf.sk

Abstract: The River Nitra is a significant bio corridor in the Hornonitrianska basin. The river is prone to occupation by invasive species due to the disturbances caused by floods and also because a part of the river had been transferred to a new river bed. Geographic information systems tools are necessary to investigate the occurrence and distribution of these species as they help to infer the factors that affect their occurrence. Our contribution includes the results of field mapping of the River Nitra, which was carried out from 2016 to 2017. The study area of the river was divided into segments with a length of 500 m, where the occurrence of invasive species was recorded. Mapping took place within 50 m of the cunette. By using the GIS software, the values obtained were incorporated into the resulting map. Subsequently, we deduced factors which influence the increased occurrence of invasive species in some segments. The results show that a major part of the segments was attacked by at least one invasive species. The predominant species are Helianthus tuberosus and Solidago canadensis.

Key words: Invasion, Plants, Nitra, River, GIS

INTRODUCTION

Invasive ecology is one of the most dynamic and developed branch of ecology (Williamson, 1996). In last years, the problem of invasive organisms has been discussed more frequently. The development of the traffic and industry helps to the transport of unoriginal species to new areas, where they could have got by their own migration only exceptionally. Various biotopes differ among each other in the degree of invasion, hence in the amount of unoriginal species that exist there (Chytrý et al., 2005). The extensity of the invasion in the given location is influenced by the amount of unoriginal species diasporas penetrated to environment, attributes of the unoriginal species and susceptibility of the environment to invasions (Hajzlerová and Matějček 2011). In Slovakia, unoriginal species represent 21.5% of the species from the total flora, whereby 3.3% of them express as invasive (Medvecká et al., 2012).

In the process of invasive species dissemination, river corridors have the unsubstitutable mission (Saumel and Kowarik, 2010). They create extensive hydrologic network that influence hydrologic regime and the stability of whole country. The corridors are important mainly in the transfer of diasporas and diversion of bank communities by floods, whereby they create new places for invasions. They also constitute the source of diasporas for invasions in the surrounding country (Wall, 1994). In consequence, the bank communities, in which the foreign specie is successfully established, can serve as natural centres for next extension to forward country (Pyšek and Prach, 1993). The occurrence of the invasive species brings changes of the ecosystems along the watercourses (Tickner et al., 2001). At the communal level, the displacement of the original kinds of plants is the effect resulting from the dominance that the invasive plants are able to reach in attacked locations. In the broad sense, this invasion causes flora homogenization, in which the original botanical-geographical entities became similar thanks to the massive invasion (Hejda and Pyšek, 2006).

The surrounding of the watercourses belongs to the areas which are mostly concerned by invasive species and belongs to the most dynamic ecosystems at the mainland (Naiman et al., 1993). A lot of successful invasive species were firstly observed especially at these locations. The biggest amounts of unoriginal plants which are naturalized in the natural vegetation in the Central Europe occur in the bank vegetation. Twelve of thirteen the most frequently occurred invasive taxons are presented especially in these areas (Müller and Okuda, 1998).

The extension of the invasive species along watercourses and overflow lands was observed by various authors, e.g.: Hood and Naiman (2000), Richardson et al. (2000), Säumel and Kowarik (2010), Stohlgren et al. (1998) and others.

The aim of the article is the analysis of the particular results from survey at River Nitra in years 2016 – 2017 and evaluation of the bank grassland attacked by invasive species.

CHARACTERISTICS OF THE AREA

The research took place at the defined passage of the River Nitra in Prievidza district. Whole area belongs to the Hornonitrianska basin. It is jagged depression at the upper watercourse of Nitra which consists of the particular walleyes. The River Nitra stems at south slope of Malá Fatra. It runs by Podunajská pahorkatina and at the area of Podunajská rovina, on the north from Komárno, it joins the River Váh. The length of the watercourse is 196.7 km and the total area is 5 144 km^2 (Mazúr and Lukniš, 1980; Porubský, 1991).

The interested stretch of river had the length 20 kilometres, whereby ran trough Bojnice, Nováky, and Prievidza and villages Diviacka Nová Ves, Lazany, Opatovce nad Nitrou and Zemianske Kostoľany (fig. 1). At this place, left-hand tributary river – Handlovka joins the river, too. In 2009, a part of stream bed was transferred by reason of brown coal-mining at the region. The rivers were transferred to new stream beds, whereby degradation of the area happened and the rivers were naturally meandering accompanied flooded vegetation (Micková, 2010).

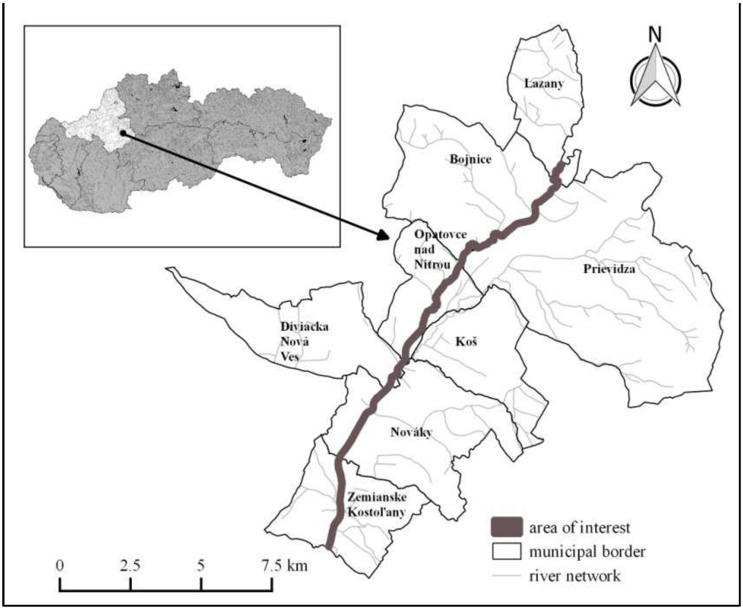


Fig. 1. Location of interested area in Slovakia.
Source: Bencová, 2017

METODOLOGY

The research took place on the particular river stretch of River Nitra with the length 20 kilometres, extended from border line of the village Zemianske Kostoľany (48°40'39.93"N, 18°30'53.03"E), to border line of the village Lazany (48°48'10.06"N, 18°37'52.87"E). Both of the stream-banks were surveyed.

The research was carried out in a period of 2016 – 2017, and it concentrated on the occurrence of the invasive species of herbs and woody plants. Especially, the extent of invasive species continuity to watercourse was surveyed. Particular identified populations were listed into maps with map scale 1:1000. The research was coming up from the methodology established for identification of long-term changes in coastline ecosystems in overflow land along watercourses (Langhammer et al., 2005; Matějček, 2009). Whole interested stretch of the river was divided into segments with length 500 m (±150m) and width 50 m from the coastline cunette (Mahy et al., 2006). Observed invasive taxons were chosen according to publication of Gojdičová et al. (2002), whereby the observed categories were: 1 – invasive taxons (that are divided into 1 a) neophytes and 1 b) archaeophytes) and 2 – potential (regional) invasive taxons. In every population area vegetation cover (in m^2) and rate were noted. We established the rate according to logarithmic scale (1 – 9 specimen = 1; 10 – 99 specimen = 2; 100 – 999 = 3; etc.). In case that the population is composed by various kinds of invasive taxons, to each species was given the same part from whole area vegetation cover. For next calculations the middle rate was used (category 1: 1 – 9 specimen = rate 5;

2–50; 3 – 500; etc.). The river was divided into 40 stretches, whereby for each river stretch was calculated maximum load index according to the formula: I=log PJ + PT, kde PJ=total number of specimen from all invasive kinds and PT=number of recorded taxons (Matějček, 2009).

Obtained data were subsequently processed through programs QGis and ArcMap. At the website Open Street Map we chose section Export. We have manually chosen area which data we needed. In our case it was area of Prievidza and Zemianske Kostoľany. In next step we chose option Export, Overpass API. We downloaded the file "map" and subsequently added it as a layer to QGIS (2.14.8). We chose display lines elements from the options (points, lines, multilinesstring, multipolygons, other_relations). We subsequently saved them as shapefile. We added the layer into project ArcMap (10.2.1), where we selected particular lines, in our case river, riverbank. From the selected elements we created new shapefile layers. We converted riverbank from the line to polygon. By function Buffer 7(geoprocessing tools), we achieved cut-out of the area needed for next research. On the basis of ortho-photograph with resolution 0.5 m, we identified particular elements of the country structure, that interfered into interested area. The result was to make statistical representation of the particular elements in interested area and their percentage representation in interested area of the River Nitra. Particular elements and groups of the elements were classified according to the work of Petrovič, Hreško et al. (2009).

RESULTS

Out of the total 97 mapped species that are filed according to Gojdičová et al. (2002) to the category invasive and potentially (regionally) invasive, we positively determined 26 (Tab. 1). The majority consists of the species from category 1 a) – invasive neophytes, 61%. Invasive archaeophytes represented 27% and potentially invasive species only 13%. Woody plants were represented by species *Ailanthus altissima*, *Negundo aceroides* a *Robinia pseudoacacia*. The other taxons represented invasive herbs. In particular segments the most frequent were species *Solidago canadensis* (67.5%), *Helianthus tuberosus* (57.5%) and *Fallopia x bohemica* (52.5%). On contrary, only in one segment the species: *Ambrosia artemisiifolia*, *Galinsoga parviflora*, *Iva xanthiifolia* a *Melilotus officinalis* were represented.

Tab. 1: Total summary and characteristics of identified species

Latin title	Gojdičová et al. (2002)	Medvecká et al. (2012)		
	Category	**O**	**TI**	**IS**
Ailanthus altissima	1a)	As	1850	Inv
Amaranthus retroflexus	2	NAm	1830	Inv
Ambrosia artemisiifolia	1a)	NAm	1949	Inv
Amorpha fruticosa	2	NAm	1850	Nat
Aster lanceolatus	1a)	-	-	-
Cichorium intybus	1b)	E As Af	-	Nat
Cirsium vulgare	1b)	-	-	-

Conyza canadensis	1a)	NAm	1971	Inv
Echinocystis lobata	1a)	NAm	1933	Inv
Fallopia japonica	1a)	As	1920	Inv
Fallopia sachalinensis	2	As	1946	Nat
Fallopia × bohemica	1a)	H	1996	Nat
Galinsoga parviflora	1a)	SAm	1853	Inv
Helianthus tuberosus	1a)	NAm	1830	Inv
Impatiens glandulifera	1a)	As	1958	Inv
Impatiens parviflora	1a)	As	1897	Inv
Iva xanthiifolia	1a)	NAm	1934	Nat
Melilotus albus	-	E As Af	-	Nat
Melilotus officinalis	1b)	E As	-	Nat
Negundo aceroides	1a)	NAm	1794	Inv
Robinia pseudoacacia	1a)	NAm	1720	Inv
Solidago canadensis	1a)	NAm	1872	Inv
Solidago gigantea	1a)	NAm	1909	Inv
Stenactis annua	1a)	NAm	1791	Inv
Tanacetum vulgare	1b)	-	-	-
Tripleurospermum perforatum	1b)	E	-	Nat

Legend: Category 1a) invasive taxa neophyte, 1b) invasive taxa archaeophyte, 2 - potential invasive taxa, O - Origin of the taxon: Af - Africa, As - Asia, E - Europe, H - hybrid, NAm - North America, SAm - South America. TI - time of introduction, IS - invasive status: inv – invasive, nat – naturalized.

The majority is formed by the species transferred from North America, mainly neophytes, e. g. *Helianthus tuberosus*, *Solidago canadensis*, *Conyza canadensis* and others.

By obtained data we interpreted the presence of the particular species. In programme QGis we divided data on the basis of the rates into four categories according to the taxons in particular segments. In the map (fig. 2) the frequency of invasive species is not the same for each river stretch.

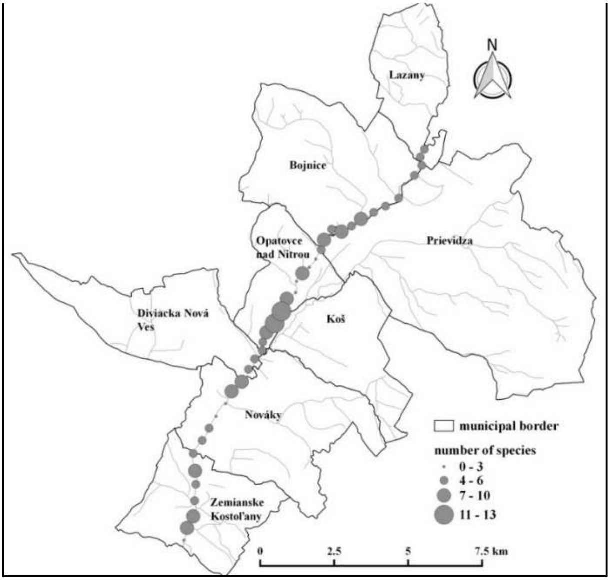


Fig. 2. Number of species in particular segments.
Source: Bencová, 2017

The number of taxons in the stretches moves from 0 to 13 taxons. There were 8 segments (20%) in span 0 – 3. Invasive species have not occurred at places with active maintenance, mainly in town and village residential areas where by the reason of frequent mowing time are not proper conditions for their growing. By the reason of two private estates that particular stretch could not have been mapped. The most frequent span was from 4 – 6 species that is represented in 19 stretches (47.5%). It was dominant at irregularly mowed stretched and in rural zones and represented by species *Helianthus tuberosus* and *Solidago canadensis*. The second frequent span was from 7 – 10 taxons (27.5%). In the river junction area of Nitra and Handlovka we recorded two stretches (5%) with span from 11 – 13 species. In 2009 there was transfer of the stream bed at both rivers by the reason of coal mining. That is the reason why proper conditions were created for the unoriginal species that have not already been able to create monodominant vegetation cover as at the other stretches of the river.

After analysis of the relationship between total vegetation cover that particular species have and number of segments the most dominant species became *Helianthus tuberosus*. This species covered 31.9% of invasive vegetation cover and was presented in 57% mapped segments. The second most frequent species was *Solidago canadensis*. This segment covers 14.1% of area covered by invasive species that represents 67.5%. Dependence between vegetation cover and occurrence in particular segments is presented in fig. 3 (species that have vegetation cover < 0.5% were deleted from the graphic chart).

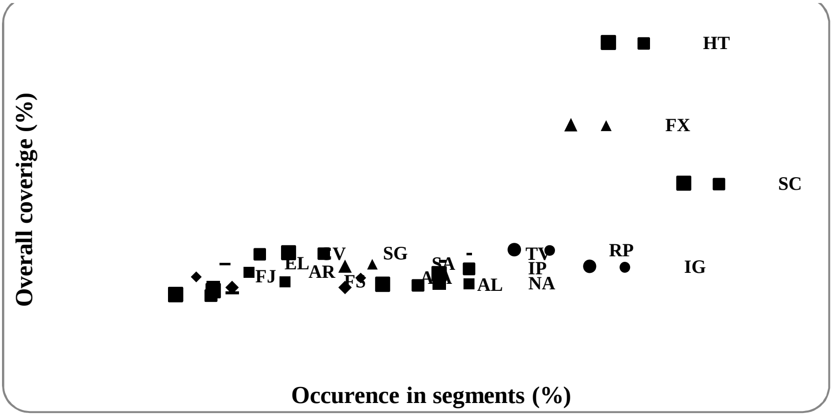


Fig. 3. The relation between vegetation cover and its presence in segments.
Legend: AiA - Ailanthus altissima, AL - Aster lanceolatus, AR - Amaranthus retroflexus, CV - Cirsium vulgare, EL - Echinocystis lobata, FJ - Fallopia japonica, FS - Fallopia sachalinensis, FX - Fallopia x bohemica, HT - Helianthus tuberosus, IG - Impatiens glandulifera, IP - Impatiens parviflora, NA - Negundo aceroides, SA - Stenactis annua, SC - Solidago canadensis, SG - Solidago gigantea, RP - Robinia pseudoacacia, TV - Tanacetum vulgare.

In the defined river stretch we have appraised composition of segments of the secondary structure (tab. 2). This implies that in neighbourhood of the River Nitra mainly big block fields (20.65%) and meadows (15.68%) are dominated. Those segments belong into four groups of secondary country structure (fig. 4).

Tab. 2: Areal and percentage representation of the land utilization

The form of land utilization	**ha**	**%**
Road communications	3.59	3.26
Cottage settlements	1.16	1.05
River-bed	18.12	16.43
Bush vegetation	3.04	2.76
Small forests	1.82	1.65
Wood line vegetation	31.62	28.68
Meadows	17.29	15.68
Road protect vegetation	0.17	0.15
Railways protect vegetation	0.04	0.04
Fields	22.77	20.65
The groups of trees	5.64	4.95
Build up area	0.43	0.39
Small garden cottage settlements	4.37	3.96
Railway lines	0.19	0.17
In total	**110.25**	**100**

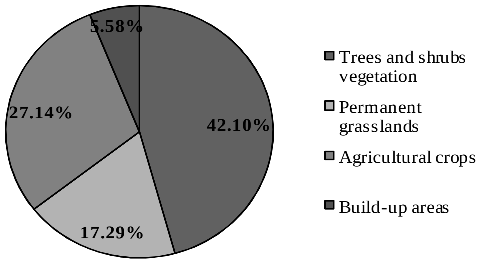


Fig. 4. Percentage representation of the groups of segments secondary landscape structure in interested area.

Dominance of semi natural segments creates proper conditions for extension of invasive and potentially invasive species. By range management some disturbances are produced that gives the unoriginal species chance to grow better than at other localities. Big block and small block field makes together with grass-herb vegetation dominant segment in region of Horná Nitra.

During the research 40 km of coastline and accompanying vegetation was observed at the both river banks. The River Nitra was divided into 40 segments with length 500 m (± 150m). At particular river stretches we calculated the degree of municipal border load by invasive species according to the formula: I = log PJ + PT that is presented in figure 5.

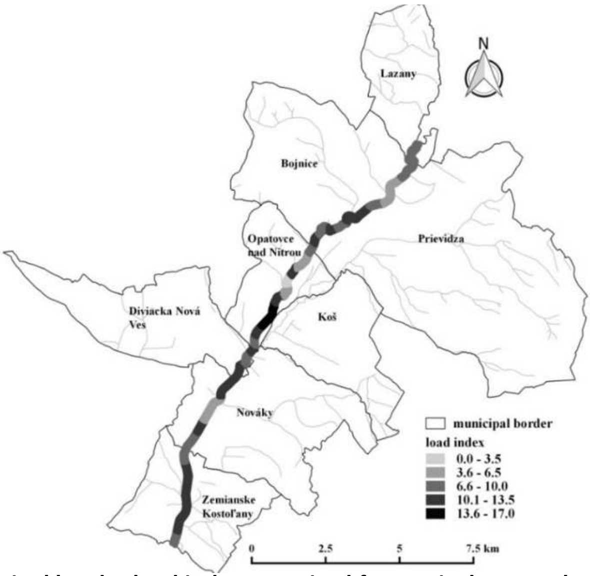


Fig. 5. Municipal border load index appraised for particular stretches of the River Nitra.
Source: Bencová, 2017

This implies that whole stretch of the watercourse is expressively marked by the presence of invasive species. The highest rates were observed at the area where the transfer of river bed took place. At this place we recorded the highest number of invasive species for a stretch.

CONCLUSIONS

Coastline vegetation represents dynamic and fragmented ecosystems that are very important country biotope. By the reason of floods regular disturbances occur here and make proper environment for seral and invasive plants. Those can later be extended by water to new areas along the river flow.

By the research of invasive species extension, high rate of municipal border load by invasive species have been found out. Globally, 26 species were identified as invasive and potentially invasive species of herbs and woody plants.

Acknowledgement: This paper is published thanks to the financial support of the project UGA VIII/3/2017 named: Evaluation of the occurrence of invasive plant species in the banks of the Handlovka and Nitra rivers.

REFERENCES

GOJDIČOVÁ, E., CVACHOVÁ, A. & KARASOVÁ, E. 2002. *Zoznam nepôvodných, inváznych a expanzívnych cievnatých rastlín Slovenska*. In: Ochrana prírody, roč. 21, 2002, 59-79 pp.

HEJDA, M., PYŠEK, P. 2006. *What is the impact of Impatiens glandulifera on species diversity of invaded riparian vegetation?* Biological Conservation. 132: 143–152 pp. https://doi.org/10.1016/j.biocon.2006.03.025

HAJZLEROVÁ, L. and MATĚJČEK, T. 2011. *The spread of invasive neophytes in the riparian vegetation of The Tichá Orlice*. Revija za geografijo – Journal for Geography 6: 33–46 pp.

HOOD, W. G. and NAIMAN, R. J. 2000. *Vulnerability of riparian zones to invasion by exotic vascular plants*, Plant Ecology, 148: 105 – 114 pp.

CHYTRÝ, M., PYŠEK, P., TICHÝ, L., KNOLLOVÁ, I. & DANIHELKA, J. 2005. *Invasions by alien plants in the Czech Republic: a quantitative assessment across habitats*. Preslia 77: 339–354 pp.

LANGHAMMER, J., KŘÍŽEK, M., MATOUŠKOVÁ, M., MATĚJČEK, T. 2005. *Metodika mapování upravenosti říční sítě a následků povodní (výzkumná zpráva)*. Praha, PřF UK, MŽP ČR. Depon. in: Library KFGG PřF UK, MŽP ČR.

MAHY,G., VANHECKE, L., MEERTS, P., NIJS, I. 2006. *Invasive plants in Belgium: Patterns, processes and monitoring (Inplanbel)*, Belgian Science Policy, 2006, 103 p.

MATĚJČEK, T. 2009. *Rozšíření invazních neofytů v břehové vegetaci vodních toků*. Dizertační práce, katedra fyzické geografie a geoekologie, Přírodovědecká fakulta UK, Praha, 2009, 131 s.

MAZÚR, E., LUKNIŠ, M. 1980. *Geomorfologické jednotky*. Mierka 1 : 500 000. In: Atlas SSR. Mazúr, E. red. Bratislava: SAV, SUGaK, 1980. 54-55 pp.

MEDVECKÁ J., KLIMENT J., MÁJEKOVÁ J., HALADA Ľ., ZALIBEROVÁ M., GOJDIČOVÁ E.,FERÁKOVÁ V. & JAROLÍMEK I. 2012. *Inventory of the alien flora of Slovakia*. Preslia, Praha, 84: 257–309 pp.

MICKOVÁ, Ž. 2010. *Košské mokrade – oblasť pozmenená ťažbou*. Zborník vedeckých prác doktorandov a mladých vedeckých pracovníkov "Mladí vedci 2010", 375 – 384 pp.

MÜLLER, N., OKUDA, S. 1998. *Invasion of alien plants in floodplains - a comparison of Europe and Japan*, Plant Invasions: Ecological Mechanisms and Human Responses, Backwell Publishers, Leiden, 321-332 pp.

NAIMAN, R. J., DÉCAMPS, H., POLLOCK, M. 1993. *The role of riparian corridors in maintaining regional biodiversity*. Ecological Applications, 3, 209–212. https://doi.org/10.2307/1941822

PETROVIČ, HREŠKO et al. *GEO Information 5*. 2009. Nitra: Constantine the Philosopher University in Nitra ISSN: 336-7234 pp.

PORUBSKÝ, A. 1991. *Vodné bohatstvo Slovenska*. Bratislava: VEDA, 1991. 318 s. ISBN 80-224-0107-2.

PYŠEK, P., PRACH, K. 1993. *Plant Invasions and the Role of Riparian Habitats: A Comparison of Four Species Alien to Central Europe*, Journal of Biogeography Vol. 20, No. 4, 413-420 pp. https://doi.org/10.2307/2845589

RICHARDSON, D. M., PYŠEK, P., REJMÁNEK, M., BARBOUR, M. G., PANETTA, F. D. & WEST, C. J. 2000. *Naturalization and invasion of alien plants: concepts and definitions*. Diversity and Distributions 6: 93-107 pp. https://doi.org/10.1046/j.1472-4642.2000.00083.x

SÄUMEL, I., KOWARIK, I. 2010. *Urban rivers as dispersal corridors for primarily wind-dispersed invasive tree species*, Landscape and Urban Planning, Volume: 94, Issue: 3-4, 244-249 pp., ISSN: 0169-2046. https://doi.org/10.1016/j.landurbplan.2009.10.009

STOHLGREN, T. J., BULL, K. A., OTSUKI, Y., VILLA, C. A. & LEE, M. 1998. *Riparian zones as havens for exotic plant species in the central grasslands*, Plant Ecology, 138: 113 – 125 pp. https://doi.org/10.1023/A:1009764909413

TICKNER, D. P., ANGOLD, P. G., GURNELL, A. M. & MOUNTFORD J. O. 2001. *Riparian plant invasion: hydrogeomorphological control and ecological impacts*. Progress in Physical Geography. 25(1): 22–52 pp. https://doi.org/10.1177/030913330102500102

WALL, L. C. 1994. *Ecology and management of invasive riverside plants*, John Wiley and Sons Ltd., Chichester, 217 p.

WILLIAMSON, M. 1996. *Biological invasions*. London: Chapman&Hall London, 244 p.

Zhrnutie

Cieľom príspevku bolo priblíženie čiastkových výsledkov z mapovaní v rokoch 2016 – 2017 na rieke Nitra. Sledovaný úsek rieky mal dĺžku 20 riečnych km a prechádzal katastrami miest: Bojnice, Nováky, Prievidza a obcí Diviacka Nová Ves, Lazany, Opatovce nad Nitrou, a Zemianske Kostoľany. Celý mapovaný úsek vodného toku bol rozdelený na segmenty s dĺžkou 500 m (± 150). V danom území bolo identifikovaných 26 inváznych a potenciálne inváznych taxónov. V jednotlivých segmentoch sa najčastejšie vyskytovali druhy *Solidago canadensis* (67.5 %), *Helianthus tuberosus* (57.5 %) a *Fallopia x bohemica* (52.5 %). Na druhej strane, len v jednom úseku boli zaznamenané druhy: *Ambrosia artemisiifolia*, *Galinsoga parviflora*, *Iva xanthiifolia* a *Melilotus officinalis*. Počet druhov v úsekoch sa pohyboval od 0 do 13 taxónov. Najčastejšie sa vyskytujúcim intervalom bol od 4 do 6 druhov, do ktorého spadalo 19 úsekov (47.5 %). Prevládal na nepravidelne kosených úsekoch a v extraviláne miest a obcí. Najčastejšie bol tvorený druhmi *Helianthus tuberosus* a *Solidago canadensis*. Po vyhodnotení vzťahu medzi celkovou pokryvnosťou, ktorú majú jednotlivé druhy v území a počtom segmentov obsadených daným druhom sa ukázal ako eudominantný druh *Helianthus tuberosus*. Tento druh pokrýval 31.9 % plochy pokrytej inváznymi druhmi a bol prítomný v 57 % zmapovaných segmentov. V záujmovom území sme tiež vyhodnotili zloženie prvkov sekundárnej krajinnej štruktúry. Z výskumu vyplynulo, že v blízkosti rieky Nitra dominujú okrem líniovej drevinovej vegetácie hlavne veľkoblokové polia (20.65 %) a lúky (15.68 %), ktoré vytvárajú vhodné podmienky na obsadenie inváznymi druhmi.

NEW MAPS OF THE TRANSPORT INFRASTRUCTURE'S IMPACT ON BIODIVERSITY

Ivo Dostál[1], Petr Anděl[2], Marek Havlíček[1]

[1] *Transport Research Centre (CDV), Líšeňská 33a, 636 00 Brno*

[2] *TU Liberec, Fakulta přírodovědně-humanitní a pedagogická, Univerzitní nám. 1410/1, 461 17 Liberec*

Abstract: The transport infrastructure is the significant factor affecting not only its immediate surroundings but also the landscape in the macroscopic scale due to the fragmentation and barrier effect. The original 'Impact of the road traffic on biodiversity atlas' was issued back in 2008 introducing maps of conflicts between green and transport infrastructure and evaluating the degree of landscape fragmentation. But a lot has changed since then. New motorways and expressways intersecting the landscape created new barriers, and the overall intensity of traffic increased. Therefore conditions for wildlife migration became worse. The opportunity to update this set of maps came with the publication of results from the National traffic census 2016. These maps are designed for the use of the strategic planning of transport sector due to the scale and the level of detail. The main purpose is to support the screening phase of the EIA process – to determine whether an area may be affected by traffic and which level of risk should be expected. Another usage is to compare the change over the past ten years by comparison of original and updated maps

Key words: transport infrastructure, biodiversity, landscape fragmentation, SEA/EIA, Czech Republic

INTRODUCTION

The major current threat to wildlife populations in developed countries is the anthropogenic fragmentation, caused mainly by linear transport infrastructure such as roads, railway lines, shipping channels, etc. (Iuell et al., 2003) and by the growth of built-up areas. New infrastructure also makes it easier for other human activities to penetrate into the natural landscape. Along with the direct land-take due to road construction, the disturbances such as noise, artificial lighting or air pollution from the traffic on roads is also another source of harmful impacts to ecosystems. All of these impact together and act as barriers to the free movement of animals. So the overall barrier effect of roads is the combination of the above mentioned impacts – physical impermeability of the barrier (due to the technical design of road – guardrails, fences, ditches, etc.) and the traffic intensity (mortality, disturbances).

The significance of these phenomena has accelerated in the context of the rapid development of transport infrastructure and the city growth due to urban sprawl and suburbanization with the socio-economical changes after the fall of communist regime. This process is evident in all Central and Eastern European countries (Dostál et al., 2010; Pătru-Stupariu et al., 2005; Angelstam et al., 2017).

The rapid fragmentation is mostly affecting these groups of animals that are tied to a preserved natural environment, have demands on the larger home territories and migrate regularly. This is typical for the group of large mammals whose main type of migration is long-distance linear migration (Anděl et al., 2005). In the conditions of the Czech Republic, among its representatives are the brown bear (*Ursus arctos*), the wolf (*Canis lupus*), European lynx (*Lynx lynx*), red deer (*Cervus elaphus*) and moose (*Alces alces*). These species with high ecological demands are so-called umbrella species - if their requirements for a suitable environment is ensured, it is very likely to say that less demanding species are also satisfied.

This work follows the original 'Impact of the road traffic on biodiversity atlas' (Anděl et al., 2008), issued back in 2008, and introduced maps of conflicts between green and transport infrastructure and evaluated the degree of landscape fragmentation based on assessment of the potential negative impact of roads. But a lot has changed since its issue, and it is time to update it.

Contrary to the approach based on identifying potential barriers, an often discussed topic is also mortality of animals on roads. The analyses is performed on common game species such as roe deer (*Capreolus capreolus*) or wild boar (*Sus scrofa*) as the intensity of road-kills is mostly dependent on traffic volume and the size of population (Grilo, Ferreira, Revilla, 2015). For the assessing of roadkills data availability crucial, thus mapping and registering applications were developed for the evidence of animal-vehicle collisions along transportation networks (Bíl, Kubeček, Sedoník, Andrášik, 2017). Another relevant topic is landscape structural changes and their role in wildlife-vehicle collisions (Keken, Kušta, Langer, Skaloš, 2016).

METHODOLOGIES

The main data source for the assessment are the results of the National traffic census (ŘSD, 2016) which take place at regular five-year intervals, usually in the years ending 0 and 5. The current census, however, did not take place for technical reasons until 2016. The traffic intensity is presented in the form of a traffic-engineering characteristic called Annual Average Daily Traffic (AADT) - see Bartuška, Biba, Jeřábek (2016). It is expressed in the number of vehicles for 24 hours on a given section of the road and represents the average value for all days of the year, i.e., weekends or lower periods (winter). Counting occurs at approximately 8 700 count points and includes the entire network of motorways, expressways, 1st and 2nd class roads. Some other sections (3rd class, municipal roads) are also included.

For the practical use of maps for the transport infrastructure's impact on biodiversity, roads are split into categories according to the traffic intensity regardless their administrative status - see tab. 1.

Tab. 1: The categorisation of roads by intensity used for analyses

level	intensity (vehicles per day)	risk of negative impacts
1	less than 500	negligible risk
2	between 500 and 1000	low risk, possible growth
3	between 1000 and 10 000	Potential
4	over 10 000	likely, rising with intensity

Contacts of green and transport infrastructure

Chosen were all the sections of roads where the recorded traffic intensity was higher than 10 000 vehicles / 24 h to analyse contacts between the elements of ecological networks (so-called green infrastructure) and the transport networks. However, because the impact of individual roads also affects the area in their proximity a buffer zone in width according to the table below was considered in the maps.

Tab. 2: Disturbance zones for administrative categories of road

category	buffer of disturbance zone [m]
motorway	500
expressway	300
first class road	200
second class road	100
other roads	50

Source: Anděl et al., 2008

Spatial data on existing ecological networks used for identifying conflicts were provided by Nature Conservation Agency of the Czech Republic. These sets of data consist of large-scale conservation areas (national parks, protected landscape areas) and from small-scale conservation areas.

Assessing of the landscape fragmentation

The assessing was based on the fact that certain parts of the landscape are relatively poorly affected by high-traffic roads and can, therefore, be considered as unfragmented. Such areas are called UAT (unfragmented area by traffic) and are defined as a segment of the landscape that is bordered by motorways or roads with a traffic density of more than 1 000 vehicles / 24 h or multitrack railways and larger than 100 km^2 (Gawlak, 2001; Anděl et al., 2005).

It is a simple indicator for the quantification of landscape fragmentation. Contrary to earlier analyses of UAT polygons in Anděl et al. (2008), the cross-border aspect has been taken into account. The results of the traffic census 2015 or 2016 were used to determine road traffic barriers in the Czech Republic, Slovakia and Poland; for the territory of Germany and Austria, where no traffic intensity information was available, a complete network of federal and provincial roads was used to construct polygons. Multi-track railways were used from data of State Railway Administration and manually complemented by lines in neighbouring countries.

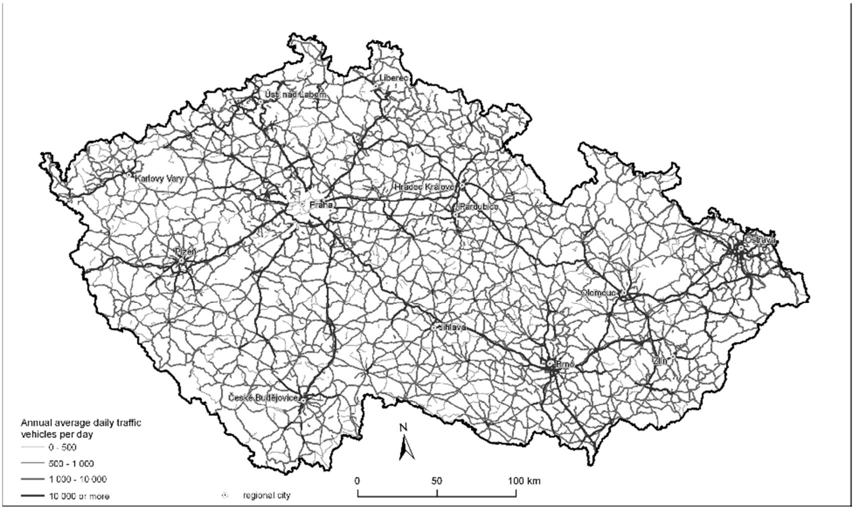


Fig. 1. AADT in 2016 (vehicles per day) in the Czech Republic.

RESULTS AND DISCUSSION

The highest annual average daily intensity reaching more than 10 000 vehicles per day with large negative impacts was recorded at 1 616 out of the total of 8 768 road sections in National traffic census. Their spatial distribution shows that mainly the most important motorways, expressways, some first-class roads and lower class roads in the hinterland of large cities and agglomerations are classified in this category. Out of the 244 census sections on motorways, the daily intensity of 10 000 vehicles per day was exceeded for most sections, namely 230. There are 916 sections on first-class roads with these high intensities. The remaining 470 sections were on lower class roads, mostly in the larger cities and their surrounding settlements. (see figure 1).

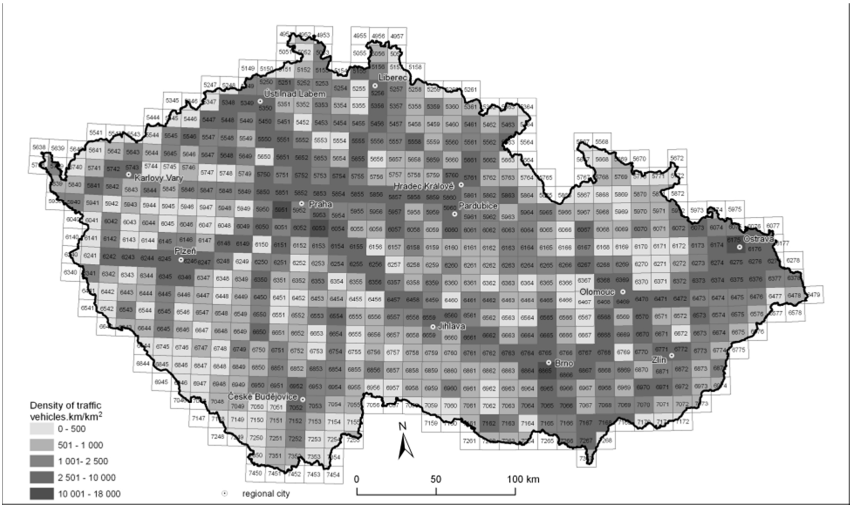


Fig. 2. Density of traffic in the Czech Republic (2016).

Another indicator of the spatial distribution of traffic is Density of traffic, which is calculated from the traffic intensity and the length of respective road sections per area unit in a particular polygon. The graticule segments from the European mapping network of the occurrence of animal and plant species have been used for the analysis in the figure 2. The density of transport performance is the highest in these graticules, which are intersected by the core road network including motorways and 1st class roads, as well as in these located in the metropolitan areas of large cities. The effect of the relief is reflected in spatial distribution as the highest density is to be found along the rivers and lowlands while the lowest densities are in the mountainous sparsely populated areas. In addition to the spatial distribution of the population, these facts are affected by the easier construction of roads in flat areas.

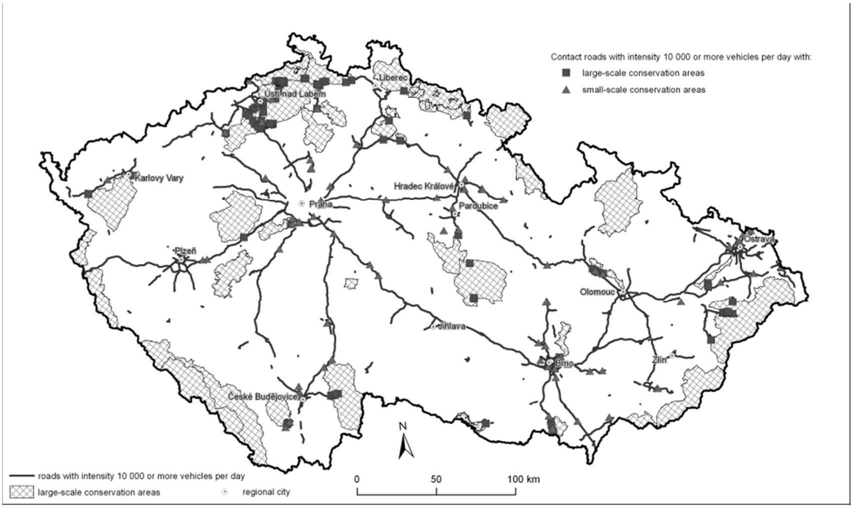


Fig. 3. Contacts of roads with intensity 10 000 or more vehicles per day with large-area and small-scale specially protected areas in the Czech Republic.

The contacts of green and transport infrastructure, roads with a daily intensity of 10,000 or more vehicles per day and large-scale and small-scale conservation areas are shown in the figure 3. There were 20 large-scale conservation areas out of a total of 30 found to be affected in some way by one or more roads with AADT higher than 10 000 vehicles per day. The most traffic census road sections were recorded in the Protected Landscape Area České Středohoří - 48. In the case of small-scale conservation areas, the conflicts with roads with an intensity of more than 10,000 vehicles per day were observed in 107 traffic census road sections. In these localities, the very negative effects of traffic on biodiversity, especially on the occurrence and migration of mammals, amphibians, and reptiles, can be expected.

On the basis of the methodology described, the new map of UATs was defined for the Czech Republic and the border areas (see figure 4). A total of 278 UAT polygons were identified that should be considered as not affected by transport in 2016 and have the potential for the occurrence of wildlife including protected animal species such as large mammals. The area of these polygons is 59 847 km^2 (75,9% of the whole Czech Republic). Not surprisingly most of the UATs is located in the mountainous areas while analysis considered cultural landscapes in lowlands as highly fragmented.

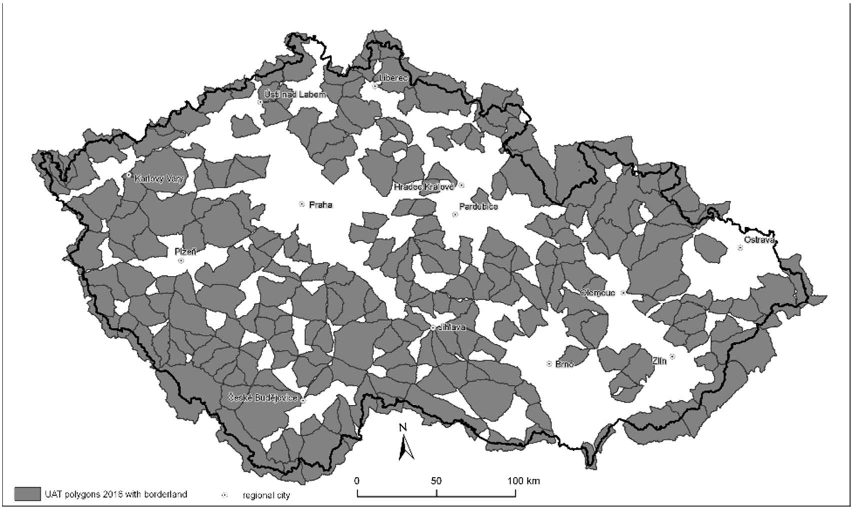


Fig. 4. Unfragmented area by traffic (UAT polygons) in 2016 in the Czech Republic including crossborder areas.

It was found by comparing the definition of UAT polygons created on the basis of traffic censuses in the Czech Republic in 2000 and 2016 that in the meantime, a total of 128 polygons had been removed, or larger polygons were cut (figure 5). Total of 5,980 km^2 of unfragmented landscape was lost, which represents 7.58% of the whole Czech Republic. Increased traffic intensity and the construction of new transport infrastructure resulted in a reduction in UAT polygons by more than 6,000 km^2, so the area suitable for the occurrence and movement of larger mammals in the Czech Republic has significantly decreased. There were only three cases (of area 390 km^2), that new UAT polygons were formed, probably due to the decrease in traffic intensity in sparsely populated areas suffering from depopulation and high unemployment rate. The analysis confirmed that unhappy perspective of the growth of the fragmentation up to 2040 presented in the articles of Anděl (2010 and 2013) is slowly becoming a reality.

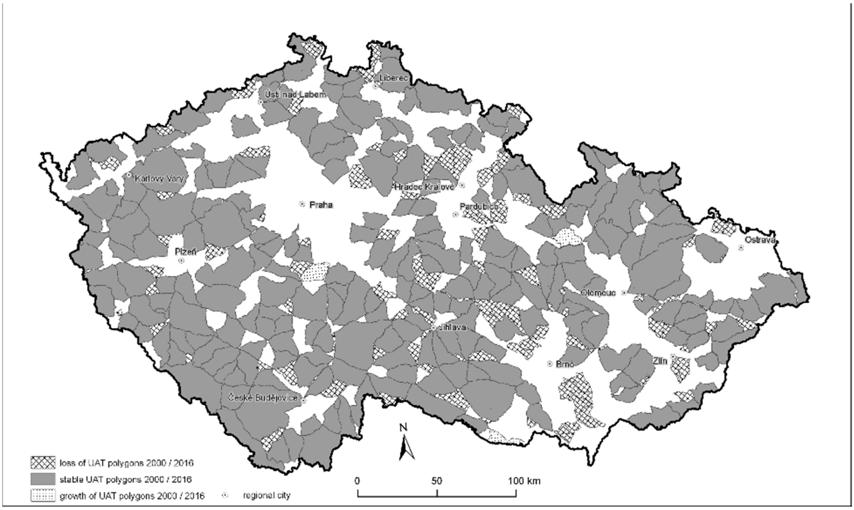


Fig. 5. Comparison of UAT polygons in 2000 and 2016 in the Czech Republic.

Known gaps and further steps in research

Basic gaps and generalization resulting from the methodology:

- The traffic intensity is known only on roads where the national traffic census was carried out. Therefore, presented analyses cannot include roads of lower categories where there might also be traffic intensity with some potential risk. The only way to overcome this limit at regional and local levels is the usage of relevant transport models if available.
- The real permeability of each road is not taken into account. This requirement needs individual approach and extremely exceeds workload necessary for easy analysis for screening purposes. For the same reason cannot be taken into account the mitigation measures adopted to improve road's permeability for wildlife

Further steps which should be implemented in the near future:

- Data on traffic intensity from traffic census in Austria and Germany for cross-border analyses of UAT polygons instead of whole national and provincial road network
- Further specification of the quality for individual UATs as areas suitable for the occurrence and migration of certain animal species. The quality is determined by the proportion of suitable biotopes to be used for land cover maps such as Corine Land Cover (CLC). However, only pan-European CLC map of 2012 is currently available, which is commonly used for analyses of certain types of landscape in specific EU countries (Maráková et al., 2016) or even for comprehensive studies comparing most EU countries (Ustaoglu, Williams, 2017). The use of Corine Land Cover data can also be found in studies of continental biogeographical regions (Szumacher, Pabjanek, 2017). Therefore, it is appropriate to use the

expected data of the new CLC map layer 2016 to assess the quality of UATs when available.

- The maps of projection roads impact to biodiversity in future are not completed as there are no new factors of traffic intensity growth published yet.
- A comprehensive publication of the entire set of maps on a more detailed scale is going to be implemented as a supplement to the upcoming electronic book on transport infrastructure's ecological impacts.

CONCLUSION

This paper presents some of the maps from larger set. All maps were prepared for the territory of the Czech Republic, but the methodology for the creation of individual types of analytical maps is of general validity and can be applied to any other territories of respective scale.

According to the results, the trend of landscape fragmentation in the Czech Republic is continuing. Almost 6 000 km^2 of unfragmented landscape was lost between 2000 and 2016.

This set of maps is considered to be a tool for assessing transport impacts on biodiversity. Due to the level of detail and scale of the processing, it is mainly intended for use in spatial planning and decision making in the transport sector at the strategic level within the SEA. It is also usable during the screening phase of the EIA process - determining whether the area is potentially affected by traffic and what level of risk can be expected. Due to the dynamically developing transport sector, regular map updates will be needed in the future in the subsequence to the results of future National Traffic Censuses.

Acknowledgement. This article was prepared with the financial support of the Ministry of Education, Youth and Sports within the National Sustainability Programme I, project of Transport R&D Centre (LO1610), on the research infrastructure acquired from the Operation Programme Research and Development for Innovations (CZ.1.05/2.1.00/03.0064).

REFERENCES

ANDĚL, P., GORČICOVÁ, I., HLAVÁČ, V., MIKO, L., ANDĚLOVÁ, H., 2005. *Hodnocení fragmentace krajiny dopravou. Metodická příručka*. Praha: Agentura ochrany přírody a krajiny ČR, 2005, 99 pp (in Czech).

ANDĚL, P., GORČICOVÁ, I., PETRŽILKA, L., 2008. *Impact of the road traffic on biodiversity atlas*. Liberec: Evernia, 66 pp. ISBN 978-80-903787-1-1.

ANDĚL, P., GORČICOVÁ, I., PETRŽILKA, L., BELKOVÁ, H., 2010. Landscape fragmentation caused by traffic in the Czech Republic: Evolution from the year 1980 and the prognosis till 2040. In *10th International Multidisciplinary Scientific Geoconference and EXPO - Modern Management of Mine Producing, Geology and Environmental Protection, SGEM 2010, vol. 2*. Varna (Bulgaria), 20 – 26 June 2010, pp. 651-656. ISBN: 978-954918181-4. WOS:000288622300090.

ANDĚL, P., 2013. Landscape Fragmentation Caused by Traffic and its Impact on Wildlife Migration. *Životné prostredie*, 2013, vol. 47, is. 2, p. 90-94. ISSN 0044-4863.

ANGELSTAM, P., KHAULYAK, O. YAMELYNETS, T., MOZGERIS, G., NAUMOV, V., CHMIELEWSKI, T.J., ELBAKIDZE, M., MANTON, M., PROTS, B., VALASIUK, S., 2017. Green infrastructure development at European Union's eastern border: Effects of road infrastructure and forest habitat loss. *Journal of Environmental Management*, vol. 193, 300-311. ISSN 0301-4797. https://doi.org/10.1016/j.jenvman.2017.02.017

BARTUŠKA, L., BIBA, V., JEŘÁBEK, K., 2016. Verification of Methodical Procedure for Determining the Traffic Volumes Using Short-term Traffic Surveys. *Procedia Engineering*, 161, p. 275-281. https://doi.org/10.1016/j.proeng.2016.08.553

BÍL, M., KUBEČEK, J., SEDONÍK, J., ANDRÁŠIK, R., 2017. Srazenazver.cz: A system for evidence of animal-vehicle collisions along transportation networks. *Biological Conservation*, 213, pp. 167-174. https://doi.org/10.1016/j.biocon.2017.07.012

DOSTÁL, I., HAVLÍČEK, M., HUZLÍK, J. Evaluation of Transport Impact to the Landscape. In: Adamec, V., Jandová, V. (eds.) *IV Czech-Slovak Scientific Conference* "*Transport, Health and Environment*". Blansko, November 2-3, 2010. Brno: Transport Research Centre, 2010, p. 97-104. ISBN 978-80-7399-141-8. WOS:000392425300013.

GAWLAK, CH., 2001. Unzerschnittene verkehrsarme Räume in Deutschland 1999. *Natur und Landschaft*, 76, Heft 11, 481 - 484.

GRILO, C., FERREIRA, F.Z., REVILLA, E., 2015. No evidence of a threshold in traffic volume affecting road-kill mortality at a large spatio-temporal scale. *Environmental Impact Assessment Review*, 55, pp. 54-58. https://doi.org/10.1016/j.eiar.2015.07.003

IUELL, B., BEKKER, G. J., CUPERUS, R. et al, 2003. *Wildlife and Traffic: A European Handbook for Identifying Conflicts and Designing Solutions*. KNNV Publishers, 2003, Brusel.

KEKEN, Z., KUŠTA, T., LANGER, P., SKALOŠ, J., 2016. Landscape structural changes between 1950 and 2012 and their role in wildlife–vehicle collisions in the Czech Republic. *Land Use Policy*, 59, pp. 543-556. https://doi.org/10.1016/j.landusepol.2016.10.002

MARÁKOVÁ, B., RUSNÁK, M., FALŤAN, V., DRUGA, M., RUŽEK, I., 2016. Evaluation of land cover changes and black locust occurrence in agricultural landscape. Case study: Podolie and Častkovce cadastral areas, Slovakia. *Acta Universitatis Carolinae, Geographica,* 51 (2), pp. 247-260. https://doi.org/10.14712/23361980.2016.20

PÄTRU-STUPARIU, I., STUPARIU, M.-S., TUDOR, C.A., GRÄDINARU, S. R., GAVRILIDIS, A., KIENAST, F., HERSPERGER, A.M., 2005. Landscape fragmentation in Romania's Southern Carpathians: Testing a European assessment with local data. *Landscape and Urban Planning*, vol. 143, 1-8. ISSN 0169-2046. https://doi.org/10.1016/j.landurbplan.2015.06.002

ŘSD, 2016. Celostátní sčítání dopravy 2016. Available online from < http://scitani2016.rsd.cz/pages/informations/default.aspx > (cit. 2017-09-27)

SZUMACHER, I., PABJANEK, P., 2017. Temporal changes in ecosystem services in European cities in the continental biogeographical region in the period from 1990-2012. *Sustainability,* 9 (4), art. no. 665. https://doi.org/10.3390/su9040665

USTAOGLU, E., WILLIAMS, B., 2017. Determinants of Urban Expansion and Agricultural Land Conversion in 25 EU Countries. *Environmental Management,* 60 (4), pp. 717-746. https://doi.org/10.1007/s00267-017-0908-2

Shrnutí

Dopravní infrastruktura je významným faktorem, který ovlivňuje nejen své bezprostřední okolí, ale také krajinu v širším měřítku díky fragmentaci a bariérovému efektu. Původní „Atlas vlivu silniční dopravy na biodiverzitu“ vydaný v roce 2008 představil mapy kontaktů mezi zelenou a dopravní infrastrukturou a mapy míry fragmentace krajiny. Mnohé se však od té doby změnilo. Nové dálnice a rychlostní silnice protnuly krajinu, čímž vytvořily nové bariéry, zvýšila se i celková intenzita dopravy, čímž došlo ke zhoršení celkových podmínek pro migraci volně žijících živočichů. Příležitostí pro aktualizaci této mapové sady se stalo publikování výsledků Celostátního sčítání dopravy 2016. Tento soubor map je vzhledem k míře podrobnosti a měřítku zpracování určen zejména pro využití při strategickém plánování a rozhodování v dopravním sektoru na strategické úrovni. Důležité je také využití během screeningové fáze procesu EIA – určení, je-li daná oblast potenciálně ovlivněná dopravou, a jakou míru rizika lze očekávat. Jiné jejich využití lze hledat při určení míry změn v uplynulých deseti letech na základě porovnání původních a aktualizovaných map.

VISUALIZATION OF TRAFFIC OFFENCES IN THE CITY OF BRNO (CZECH REPUBLIC): ACHIEVING 3D THEMATIC CARTOGRAPHY THROUGH OPEN SOURCE AND OPEN DATA

Lukáš Herman, Jan Russnák, Radim Stuchlík, Jiří Hladík

Masaryk University, Faculty of Science, Department of Geography, Kotlářská 2, 611 37 Brno, Czech Republic

herman.lu@mail.muni.cz, russnak@mail.muni.cz, radim.stuchlik@mail.muni.cz, hladikjiri@mail.muni.cz

Abstract: This paper examines 3D visualization of traffic offences based on open data sources at the city level. Most of the existing studies and applications focus on 3D visualization of qualitative data. For this reason, this paper concentrates on 3D visualization methods for quantitative data. The possibilities of creating 3D dot maps, statistical surfaces, graduated 3D symbols and prism maps and their effective use was studied. A pilot web application visualizing crime statistics was developed for verifying the applicability of selected 3D cartographic methods and the feasibility of open source technologies for crime mapping. 3D visualizations of selected traffic offences registered and solved by municipal police (different traffic offences types) are available in a pilot application for the city of Brno (Czech Republic). The design and implementation of map components, interactive functionality, limitations and opportunities for future development are also discussed.

Key words: 3D crime mapping, 3D visualizations, open data, open source thematic cartography, Three.js, traffic offence

INTRODUCTION

The 3D visualization of geospatial data is used in many fields and for numerous applications but it depends on the expansion of hardware devices and software tools enabling 3D geovisualization. 3D geovisualizations include a broad spectrum of instances from photorealistic visualizations to abstract depictions of attribute data. Exploration of the applicability or possible modification of traditional cartographic visualization methods in 3D is, therefore, a progressive topic. The feasibility of 3D visualization of crime as an example of quantitative data, purely based on open technologies and available open data, is the primary aim of this paper. Open technologies and open data were solely used for this purpose in the case study area (Brno, Czech Republic).

3D CARTOGRAPHIC VISUALIZATION

The principles of 3D cartographic visualization have been relatively rarely investigated in the past apart from, for example, Jobst and Germanchis (2007), Bleisch (2011), Gede (2016), Hájek et al. (2016), or Sieber et al. (2016).

Most of these studies focus on cartographic methods for visualizing qualitative data, especially in designing and applying 3D point symbols or textures on surfaces and objects. This paper, however, explores visualization methods for quantitative data, namely about traffic offences. The potential use of these methods and practical aspects of their creation are described. Papers with a similar focus have been published, for example, by Zsoldi (2011) or Gede (2016).

Advantages, limitations, and applications

The general and main advantages of using 3D variants of cartographic visualization methods are more space for displaying additional data variables, resolving issues related to hidden symbols, or a more familiar view of spaces (Shepherd, 2008). Traffic offences or accidents are often clustered, so it is advisable to utilize more space for visualization (for instance third dimension) and to solve the problem of overlapping symbols. The usability problems of 3D thematic maps were identified by Jobst and Germanchis (2007) and Shepherd (2008):

- occlusion of objects in a 3D scene;
- perspective distortion;
- countless scales within one view;
- incomparable geometries of objects.

3D visualization of quantitative data (thematic information) has many uses, such as in digital atlas cartography (Sieber et al., 2016), visualizing demographic and economic data (Horák et al., 2003, Ourednik, 2017), air pollution (Calvillo et al., 2008), disease (Marek et al., 2015), traffic noise (Herman and Řezník, 2013), erosion and land use changes (Svatoňová and Rybanský, 2014), results of geographical analysis in general (Lin et al., 2015) or for teaching geography (Niedomysl et al., 2013; Juřík and Šašinka, 2016). 3D thematic cartography has already been employed to visualize statistics on crime and crime mapping (Lodha and Verma, 1999; Wolff and Asche, 2009; McCune, 2010). But there are no fixed guidelines for making crime maps or even their 3D variants. And it is still not enough known about how 3D visualizations can be used effectively and appropriately in these areas. User studies are therefore very important. User testing of 3D visualizations has been described by several authors, for example Niedomysl et al. (2013), Popelka and Dědková (2014), Špriňarová et al. (2015), or Juřík et al. (2017).

3D variants of cartographic methods

Most traditional (2D) cartographic methods have 3D variants. This paper focuses on visualization of crime statistics as outlined above, working with:

- 3D dot maps;
- statistical surfaces (fishnet maps);
- prism maps;
- graduated 3D symbols (3D diagram maps).

A 3D dot map is mainly used to express spatial distribution, especially of discrete phenomena. The distribution of dots on a surface specifies the variable density of objects or phenomena. Dots (of different colour or shape) may also express their quality. 3D visualization also allows vertical spatial patterns to be depicted. Potential of 3D dot map for visualizing traffic offences is relatively small, unlike the 2D variant, because the height (Z axis) can be hardly used effectively. Probably the only suitable application is in space-time cube, where the Z axis represents time.

A 3D variant of an isopleth map is usually referred as a statistical surface. Statistical surfaces can be graphically represented by a regular square grid with variable height at its nodes. This representation is called a fishnet map. For instance, Wolff and Asche (2009) and McCune (2010) used this method to crime and safety mapping. Its disadvantage is superficial representation and difficulty in reading values displaying phenomenon as an expression of characteristics through height (Kraak and Ormeling, 2003; Slocum et al., 2005). Quantitative characteristics can not only be expressed as height. Colour can be used in a similar manner as it is on original (2D) variants of isopleth maps. 3D isopleth map is used only extraordinarily, but 2D isopleth maps or heat maps are used quite often. So, a surface model can be similarly coloured and the dependence of visualized phenomenon on altitude, for example, can be studied.

Prism maps show quantity by extruding the base of the polygonal area. The height of extrusion is not affected by classification; it displays raw data (Kraak and Ormeling, 2003; Slocum et al., 2005). The readability of prism maps can be affected negatively by the distribution of values, where low values may be covered by higher values. Kaňok (1999) further states that the main application for prism maps is the popularization of cartography. Prism maps are often combined with a colour scheme. The same values expressed by height can be represented by colour, or colour can represent another attribute. This second example may then be used to compare the relationship between two attributes. Colour can be expressed as a quantitative characteristic (population density) or a qualitative (administrative units). It is suitable to use this method for traffic offences visualization if they are linked to some spatial units (e.g. towed cars, penalties for bad parking). Relevant spatial units may be, for example, police districts.

Kaňok (1999) divides point and non-localized diagrams (graduated symbols), based on the number of attributes they represent on single-parameter and multi-parameter diagrams. 3D single-parameter diagrams express the characteristics of the phenomenon by its volume. The most usually employed shapes are a cube, sphere, or cone. The disadvantage of this method is that volumetric size is generally perceived as more difficult to represent than planar size (Kaňok, 1999). Multi-parameter 3D diagrams change size in different dimensions (e.g. height and width) individually. 3D diagrams may represent two or three characteristics and therefore have two or three parameters. It is suitable to use this method for traffic offences visualization if they are linked to spot-like objects (e.g. junctions – red riding), smaller sites (towed cars or penalties for parking on selected car parks) or if the offences are naturally clustered (exceeded speed limits – speed measurements points).

PILOT STUDY

The methods described above were verified in the example of the city of Brno, Czech Republic.

Input data

The following thematic data were used as input data to create 3D models:

- List of traffic offences stored as an XLS file. From this file, traffic offences of cyclists, pedestrians, and exceeded speed limits were selected.
- List of towed cars also stored as an XLS file.

Both datasets relate to the year 2015 and are catalogued according to time, place, punishment, offence. These data were provided by the Municipal Police of Brno in response to a request for information. This data is published by the City of Brno on the web (https://old.datahub.io/organization/statutarni-mesto-brno).

The following, underlying data were also used:

- City districts from the Registry of Territorial Identification, Addresses and Real Estate (RUIAN), available online as a WFS (Web Feature Service) or as off-the-shelf GML (Geography Markup Language) files. Data are compressed with the GZIP algorithm.
- Digital Landscape Model 1:25 000 (DMU 25), available as WMS (Web Map Service) by the Czech national geoportal INSPIRE
- DATA 200, available as a WMS service by the Czech Office for Surveying, Mapping, and Cadastre (CUZK).

Open data processing

These input data were processed in QGIS software (version 2.12). In this pilot study, the Qgis2threejs plug-in to create visualization in a web browser was used. Qgis2threejs exports terrain data, map canvas images, and vector data to a web browser supporting WebGL. This plug-in uses the Three.js library and so final visualization in this study was implemented through this library. Three.js is a cross-browser JavaScript library allowing 3D computer graphics to be displayed in a web browser.

Thematic data was downloaded in XLS format, and the first part of processing was therefore done in MS Excel. Specifically, it means selection by offence type, georeferencing through the Excel Geocoding Tool (http://excelgeocodingtool.com), and conversion to CSV (Comma-Separated Values*)* files. All data were then loaded into QGIS (CSV, GML files and WMS services). The QGIS program itself permits important functions for 3D data pre-processing (i.e. interpolation and other statistical surfaces creation techniques). Additional layer settings (e.g. colour scales) can be set through QGIS. Other final visualization parameters, such as final web page templates, controls, and individual layer parameters (e.g. exaggeration, display of labels, transparency, background colour, raster resampling) are defined in the Qgis2threejs plug-in.

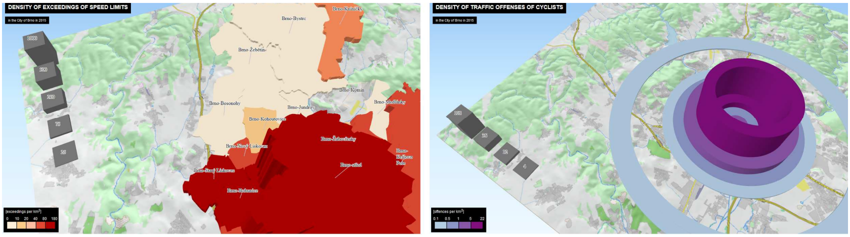


Fig. 1. Examples of prism maps (left – city districts; right - belts of distance from the city center).

RESULTS

Examples of 3D thematic maps are shown in Fig. 1, 2, 3 and 4; all interactive 3D maps are available online at http://web3dvis.esy.es/3d_traffic_offences. Three.js in final 3D visualization enables the basic functionality usually available in web map portals. Users can switch between layers or set their own transparency. Transparency avoids the occlusion of features or layers. The attributes of a selected feature (e.g. a city district) are available after clicking on it in the pop-up window (see Fig. 3 – right). The coordinates of the selected point may also be displayed.

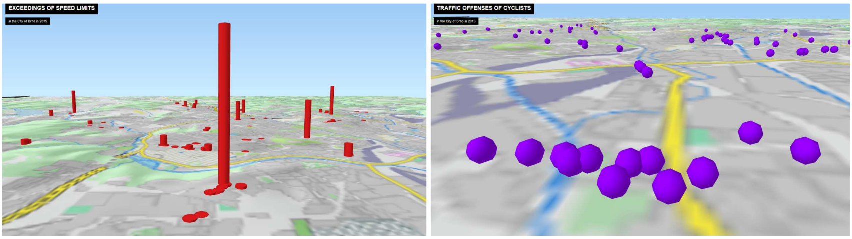


Fig. 2. 3D diagram map (left) and 3D dot map (right).

Users can also create their own *cutting plane* (Fig. 3 – left). A *cutting plane* allows easier comparison between map features (their heights) or with a 3D legend. A north arrow and labels facilitate orientation in the 3D scene. How labels are depicted can be set in the Qgis2threejs plug-in. Names of city districts were used in this case. A north arrow was created manually as a new layer (Shapefile) and extruded at a fixed value. Two different methods to implement a legend were used. A legend for the colour scale was created with HTML (see Fig. 4 – left), while legends located directly in 3D scenes were used to explain the heights of map features or the scales of map diagrams (see Fig. 4 – right).

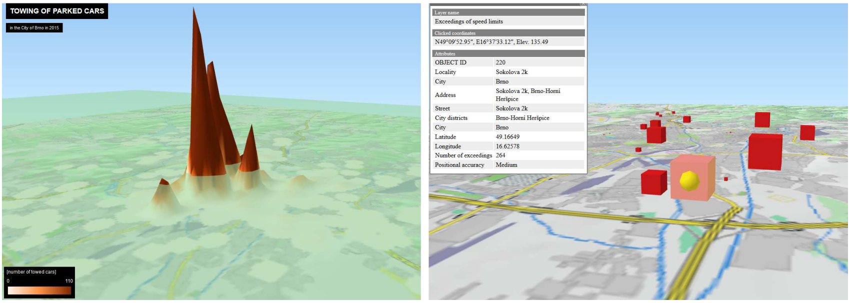


Fig. 3. Statistical surface with cutting plane and 3D diagram map with displayed attributes in pop-up window.

DISCUSSION

3D visualization, in general, has significant potential for application, but it is affected by its properties, for example the cartographic visualization method or the UI (*User Interface*). In terms of cartographic visualization, the approach in this study is not directly dependent on the visualization(s) of underlying data. In this case, cartographic visualization is not directly redistributable since it is stored in the Three.js code. Cartographic visualization should be designed, developed, and ideally also verified by user testing for each application separately.

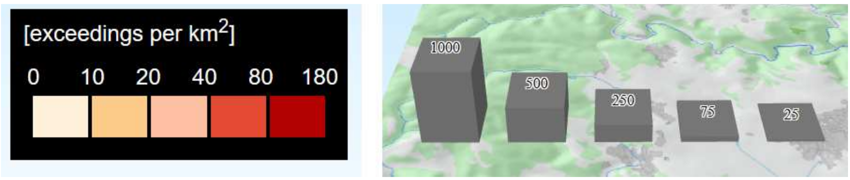


Fig. 4. Map legend variants (left – 2D, right – 3D).

The usability aspects of the UI and effective 3D map design are therefore important topics for future research. This research could also be demanded legislatively or be the subject of standardization (Řezník, 2013). Some authors, for example (Voženílek, 2001), argue that 3D visualization can present geospatial data to wider audiences, including those with little or no cartographical or GIS experience. On the other hand, the results of other previous studies (Herman and Stachoň, 2016; Juřík et al., 2017 or Kubíček et al., 2017) suggest that interactive 3D visualization would be more useful to users with previous 3D visualization experience and for complex tasks particularly. It would be appropriate to validate a created application with user testing.

CONCLUSIONS AND FUTURE WORK

The presented proof-of-concept application was created to demonstrate the possibility of open web-based 3D visualization. It should be emphasized that its open source relies on the data and software used, as well as its final application. The proof-of-concept application is freely available to interested persons under a BSD license.

To summarize, the following major advantages of 3D visualization based on open data and the Three.js library were identified:

- it represents (in this pilot study) an example of an open data application usable in crime analysis;
- it enables user-friendly interactive 3D visualization which is accessible to a broad spectrum of users (from the general public to experts);
- it does not need any new software or plug-ins installed on the client or server sides;
- it shows that cartographic methods common in classic (2D) cartography may also be transferred to 3D visualizations;

We also identified some limitations in the procedures and technologies used. Much of a 3D thematic map's creation process takes place within the Qgis2threejs plug-in interface. Additional modifications to the UI (such as creating a legend or map title) require either new data layers in QGIS to be created or the HTML code of the final visualization to be edited. Optimizing a 3D thematic map's design is, in general, primarily based on modifying HTML code and CSS templates. Final visualizations are not yet completely responsive (optimized for display on mobile devices).

Our outputs are comparable to those of other free and open source tools (Thematicmapping.org) and commercial software (ESRI ArcScene). Thematicmapping.org creates prism maps and graduated 3D symbols, but they are placed on the Google Earth virtual globe, and comparing the height of objects is rather difficult (Popelka and Doležalová, 2016). ESRI ArcScene permits all four of the tested methods to be created (3D dot maps, statistical surfaces, prism maps, and graduated 3D symbols), but export to 3D format VRML (Virtual Reality Modelling Language), which is supported on the Web, is problematic (Herman and Řezník, 2015). Only prism maps can be exported correctly.

Our Three.js-based solution will be further modified and extended in the future. We want to implement the main principles of application of adaptive visualization and visual seeking as it is described by Štampach et al. (2015), especially map view adaptation. It may also be possible to perform advanced spatial analysis during input data processing and then present the results using 3D visualization. Russnák et al. (2016), for example, discusses the possibilities of clustering the data of traffic offences committed by cyclists or aggregating traffic offences into street segments. The different methods of 3D thematic cartography presented in this paper can be also combined into one 3D scene. However, it is necessary to consider the potential problems mentioned by Shepherd (2008), where the Z-axis is used to illustrate different variables and visualization loses clarity. Despite all these extensions and modifications, the 3D thematic cartographic methods described (3D dot maps, statistical surfaces, prism maps, and graduated 3D symbols) can be relatively quickly and easily created and subsequently used. However, it is necessary to take into account the spatial character of the offences and to consider both the dimensionality of visualization and the cartographic visualization method.

Acknowledgements: This research was created in scope projects "Influence of cartographic visualization methods on the success of solving practical and educational spatial tasks" (Grant No. MUNI/M/0846/2015) and "Dynamic mapping methods focused on disaster and risk management in the era of big data" (Grant No. LTACH-17002) and funded by project "Integrated research on environmental changes in the landscape sphere of Earth III" (Grant No. MUNI/A/1251/2017).

REFERENCES

BLEISCH, S. Towards Appropriate Representations of Quantitative Data in Virtual Environments. *Cartographica*. 2011, 46(4), 252–261. ISSN 0317-7173. https://doi.org/10.3138/carto.46.4.252

CALVILLO, N., et al. *In the Air* [online]. ©2008 [cit. 6th October 2017]. Available from: http://intheair.es/

GEDE, M. Thematic Mapping with Cesium. In: *Proceedings, 6th International Conference on Cartography and GIS*. Albena: Bulgarian Cartographic Association, 2016, pp. 280-286. ISSN 1314-0604.

HÁJEK, P., et al. Principles of Cartographic Design for 3D Maps Focused on Urban Areas. In: *Proceedings, 6th International Conference on Cartography and GIS*. Albena: Bulgarian Cartographic Association, 2016, pp. 297-307. ISSN 1314-0604.

HERMAN, L., ŘEZNÍK, T. Web 3D Visualization of Noise Mapping for Extended INSPIRE Buildings Model. In: *Environmental Software Systems. Fostering Information Sharing.* Berlin: Springer, 2013, pp. 414-424. ISBN 978-3-642-41150-2.

HERMAN, L., ŘEZNÍK, T. 3D Web Visualization of Environmental Information – Integration of Heterogeneous Data Sources when Providing Navigation and Interaction. In: *ISPRS Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences, vol. XL-3/W3*. La Grande Motte: Copernicus GmbH, 2015, pp. 479-485. ISSN 1682-1750.

HERMAN, L., STACHOŇ, Z. Comparison of User Performance with Interactive and Static 3D Visualization – Pilot Study. In: *ISPRS Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences, vol. XLI-B2*. Prague: Copernicus GmbH, 2016, pp. 655-661. ISSN 1682-1750.

HORÁK, J., et al. Exploitation of Geoinformation Technology in the Framework of Labour Market Analysis (Využívání geoinformačních technologií při analýzách trhu práce). In: Růžička, J. *GI/GIT teorie a praxe ruku v ruce - sborník konference*. Ostrava: VŠB - TUO, 2003. ISSN 1213-239X.

JOBST, M., GERMANCHIS, T. The Employment of 3D in Cartography — An Overview. In: Cartwright W., et al. *Multimedia Cartography*. Berlin: Springer, 2007, pp. 217-228. ISBN 978-3-540-36650-8.

JUŘÍK, V., ŠAŠINKA, Č. Learning in Virtual 3D Environments: All about Immersive 3D Interfaces. In: *EDULEARN16 Proceedings*. Barcelona: IATED, 2016, pp. 7868-7881. ISBN 978-84-608-8860-4.

JUŘÍK, V., et al. When the Display Matters: A Multifaceted Perspective on 3D Geovisualizations. *Open Geosciences*. 2017, 9(1), 89-100. ISSN 2391-5447.

KAŇOK, J.: *Thematic cartography (Tematická kartografie)*. 1st ed. Ostrava: Ostravská univerzita, 1999. 318 p. ISBN 80-7042-781-7.

KUBÍČEK, P., et al. Identification of Altitude Profiles in 3D Geovisualizations: The Role of Interaction and Spatial Abilities. *International Journal of Digital Earth*. 2017 [in print]. ISS 1753-8947.
https://doi.org/10.1080/17538947.2017.1382581

KRAAK, M.-J., ORMELING, F. Cartography: Visualisation of Geospatial Data. 2st ed. Harlow: Prentice Hall, 2003. 205 p. ISBN 0-130-88890-7.

LIN, H., et al. Virtual Environments Begin to Embrace Process-based Geographic Analysis. *Transactions in GIS*. 2015, 19(4), 493-498. ISSN 1361-1682. https://doi.org/10.1111/tgis.12167

LODHA, S. K., VERMA, A. Animations of Crime Maps Using Virtual Reality Modeling Language. *Western Criminology Review*. 1999, 1(2) [online]. ISSN 1096-4886.

MAREK, L., et al. Using Geovisual Analytics in Google Earth to Understand Disease Distribution: a Case Study of Campylobacteriosis in the Czech Republic (2008–2012). *International Journal of Health Geographics.* 2015, 14(7), 1-13. ISSN 1476-072X.

MCCUNE, D. *If San Francisco Crime were Elevation* [online]. ©2011 [cit. 7th October 2017]. Available from: http://dougmccune.com/blog/2010/06/05/if-san-francisco-crime-was-elevation/

NIEDOMYSL, T., et al. Learning Benefits of Using 2D Versus 3D Maps: Evidence from a Randomized Controlled Experiment. *Journal of Geography.* 2013, 112(3), 87-96. ISSN 0022-1341.
https://doi.org/10.1080/00221341.2012.709876

OUREDNIK, A. The Third Dimension of Political Mapping: Exploiting Map Interactivity for a Better Understanding of Election and Referendum Results. *Cartography and Geographic Information Science*. 2017, 44(4), 284-295. ISSN 1523-0406.

POPELKA, S., DĚDKOVÁ, P. Extinct Village 3D Visualization and Its Evaluation with Eye-Movement Recording. In: *Computational Science and Its Applications – ICCSA 2014, pt. 1, vol. 8579*. pp. 786-795. Heidelberg: Springer, 2014, pp. 786-795. ISBN 978-3-319-09143-3.

POPELKA, S., DOLEŽALOVÁ, J. Differences between 2D map and virtual globe containing point symbols – an eye-tracking study. In: *SGEM2016 Conference Proceedings*, Sofia: STEF92 Technology Ltd., 2016, pp. 175-182. ISBN 978-619-7105-60-5.

RUSSNÁK, J., et al. Visualization and Spatial Analysis of Police Open Data as a Part of Community Policing in the City of Pardubice (Czech Republic). *Annals of GIS*. 2016, 22 (3), 187-201. ISSN 1947-5683.

ŘEZNÍK, T. Geographic Information in the Age of the INSPIRE Directive: Discovery, Download and Use for Geographical Research (Geografická informace v době směrnice INSPIRE: Nalezení, získání a využití dat pro geografický výzkum). *Geografie*. 2013, 118 (1), 77-93. ISSN 1212-0014.

SANDVIK, B. *Using KML for Thematic Mapping*. Diploma Thesis. 2008. University of Edinburgh. School of GeoSciences. Institute for Geography. Supervisor: Bruce Gittings.

SLOCUM, T., et al. Thematic cartography and geographic visualization. 2nd ed. Upper Saddle River: Pearson Prentice Hall, 2005. 518 p. ISBN 0-13-035123-7.

SHEPHERD, I. Travails in the Third Dimension: A Critical Evaluation of Three-dimensional Geographical Visualization. In: Dodge, M., et al. *Geographic Visualization: Concepts, Tools and Applications*. Chichester: Wiley, 2008, pp. 199-222. ISBN 978-0-470-51511-2.

SIEBER, R., et al. Atlas of Switzerland Goes Online and 3D—Concept, Architecture and Visualization Methods. In: Gartner, G., et al. *Progress in Cartography*. Cham: Springer, 2016, pp. 171-184. ISBN 978-3-319-19601-5.

SVATOŇOVÁ, H., RYBANSKÝ, M. Visualization of landscape changes and threatening environmental processes using a digital landscape model. In: *8th International Symposium of the Digital Earth (ISDE8)*. Bristol: IOP Publishing Ltd., 2014, pp. 1–6. ISSN 1755-1307.

ŠPRIŇAROVÁ, K., et al. Human-computer Interaction in Real 3D and Pseudo-3D Cartographic Visualization: A Comparative Study. In: *Cartography - Maps Connecting the World: 27th International Cartographic Conference 2015 - ICC2015.* Cham: Springer, 2015, pp 59-73. ISBN 978-3-319-17737-3.

ŠTAMPACH, R., et al. Dynamic Visualization of Sensor Measurements: Context Based Approach. *Quaestiones Geographicae*. 2015, 34 (3), 117-128. ISSN 0137-477X. https://doi.org/10.1515/quageo-2015-0020

VOŽENÍLEK, V. *Cartography for GIS: Geovisualization and Map Communication*. 1st ed. Olomouc: Univerzita Palackého, 2005. 142 p. ISBN 80-244-1047-8.

WOLFF, M, ASCHE, H. A 3D Geovisalization Approach to Crime Mapping. In: *Proceedings of the 24th International Cartographic Conference*. Santiago de Chile: ICA, 2009.

ZSOLDI, K. 3D Methods in Cartography. In: *14th IAMG Conference - Mathematical Geosciences at the Crossroads of Theory and Practice*. Salzburg, 2011, pp. 1471-1478.

Shrnutí

Příspěvek se věnuje 3D vizualizaci prostorových dat o dopravních přestupcích, které jsou dostupné jako otevřená data v měřítku města. Většina existujících studií se zaměřuje na trojrozměrnou vizualizaci kvalitativních dat. Z tohoto důvodu se chceme v tomto příspěvku zaměřit na 3D kartografické metody pro znázornění kvantitativních (statistických) dat, jakými jsou například data o kriminalitě či právě o rozložení dopravních přestupků. Analyzovali jsme možnosti tvorby a efektivního použití 3D variant tečkové metody, izopletových map, kartodiagramů a metody objemových kartogramů. Byla vytvořena pilotní webová aplikace pro praktické ověření výše popsaných kartografických metod a možností aplikace open source technologií při mapování a vizualizaci dopravních přestupků. Vizualizovány jsou dopravní přestupky zaznamenané a řešené městskou policí v městě Brně (konkrétně přestupky chodců, cyklistů, překročení povolené rychlosti a odtahy zaparkovaných vozidel). V závěru jsou diskutovány různé aspekty návrhu a implementace jednotlivých kompozičních prvků (např. legendy 3D map), interaktivní funkcionality, jejich limitů a možností dalších úprav a rozvoje.

DEPENDENCE OF OCCURRENCE OF FOREST FIRES IN VYSOČINA REGION ON TEMPERATURE AND ITS SPATIAL DISTRIBUTION

Martin Hubacek[1], Sarka Hoskova-Mayerova[2], David Sladek[3], Karel Dejmal[1], Katerina Simkova[1]

[1] Department of Military Geography and Meteorology, University of Defence, [2] Department of Mathematics and Physics, University of Defence, Kounicova 65, Brno, Czech Republic

name.surname@unob.cz

[3] Military Geographic and Hydrometeorologic Office, Čs. odboje 676, Dobruska, Czech Republic

david.sladek@vghur.army.cz

The occurrence of forest fires is dependent on a number of phenomena. In addition to human activity, natural phenomena, including the weather and the spatial arrangement of the landscape, belong into these phenomena. In recent years there have been significant fluctuations in the weather and it is possible to observe periods with the occurrence of higher temperatures and minimum precipitation in the Czech Republic. This was reflected in the occurrence of forest fires. In the research, data series of firefighter's intervention during forest fire for the period 2005 - 2015 was analysed in the Vysočina region. The influence of temperature on the occurrence of fires in the region was monitored. Based on the findings, testing for the potential occurrence of clusters of air temperature and the identification of areas with a potentially higher probability of occurrence of fires at higher temperatures were performed. Despite the fact that the influence of the temperature was examined separately, no matter the other meteorological phenomena, the initial hypothesis on the influence of temperature on the occurrence of forest fires was confirmed. Based on these results, spatial dependence and localization of areas with a higher probability of forest fires were modelled.

Key words: forest fires; temperature; statistical analysis; spatial modelling, GIS

INTRODUCTION

Forest fires are very dangerous due to their capability to spread at great speed. They cause considerable material damage but can also endanger human lives. Moreover, the behaviour of the fire in the forest is often unpredictable and the fire can spread even underground. Due to the difficult terrain it is very complicated to extinguish fires. The reason is mainly problematic orientation in the terrain [1] and troubles in driving vehicles outside and off ordinary roads. [2, 3].

Man is in most cases a cause of fire. Francl [4] writes that all of all forest fires that occurred in the Czech Republic between 2000 and 2007, 58.7% were negligent and 8.3% intentional. Natural phenomenon (lightning) proves to have caused only 1.1% of all fires. Even though natural phenomena are not a usual cause of fires, they secondarily participate on their amount and spread rate. The greatest influence, depending on the species composition of the forest, plays climatic and meteorological conditions. Fires are very common in the summer, when higher temperatures cause bigger evaporation that leads to landscape draying. In Europe, extensive forest fires occur mainly in the Mediterranean and during dry seasons even in the moderate and cold areas. In the future, more frequent weather fluctuations (longer droughts, storm winds, high temperatures, …) and more frequent forest fires will occur in most parts of the world in the context of global climate change [5, 6, 7]. The Czech Republic will also not avoid these changes. In recent years some of mentioned phenomena could be observed [8, 9]. Data from the database of the firefighting rescue service (SPOJAR application from RSC) show higher amount of firefighter's deployments to forest fires in recent years (Figure 1).

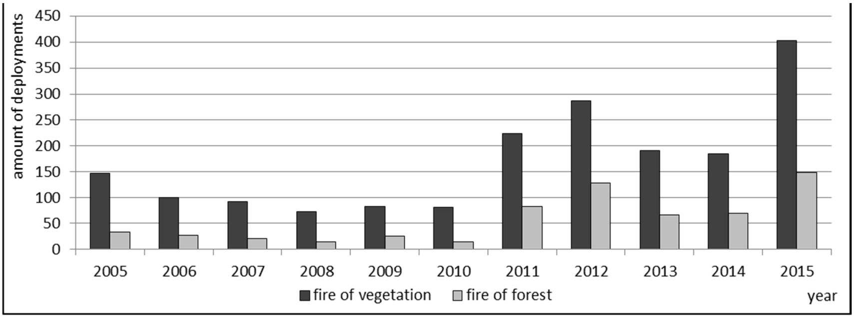


Fig. 1. Graph of all vegetation and forest fires.
Source: data from the SPOJAR database

With the expectation of more frequent occurrence of dry periods, it is possible to make a hypothesis about higher occurrence of forest fires in connection with weather changes due to climate changes. The data series of HZS actions caused by forest fires in Vysočina Region from 2005 – 2015 has been chosen for the verification. The air temperature has been picked as an examined phenomenon that influences the occurrence of fires. It has one of the decisive effects on the amount of forest fires [10]. Air temperature values for the analysis were obtained from the data in the SYNOP reports from the meteorological stations located within and around the Vysočina Region.

PREPARATION OF THE USED DATA

As a basic data source, a database of deployments of HZS containing information on all deployments in the period 2005 - 2015 was used. Deployments are classified according to the type of intervention. The information about the location and the time of occurrence (reporting) of the event is also included in the record. Only fire types with vegetation fire subtype were selected from all records (Table 1). These records were then spatially limited to the territory of the region under examination. Because forest fires are not primarily recorded in the database, the spatial overlay feature with forested areas was used to identify them. With the use of GIS tools and spatial geodatabase DMU 25, only fires whose location is within the forest or in the immediate forest vicinity, have been selected.

Tab. 1: The amount of deployment in the reference period

Event	Amount	Percentage
Fire	6758	100%
Vegetation fire	1868	27,6%
Forest fire	631	9,3%

Source: data from the SPOJAR database

The second used data source is meteorological reports SYNOP. The SYNOP report is an encoded message from ground-based observations from meteorological stations. In the Czech Republic, it is being usually issued at both military and civilian stations operated in automatic mode or with human service. The report contains data on the previous or current weather on the station (e. g. precipitation). It also includes, for example, data on temperature, dew point temperature, air pressure, direction and speed of wind, and other variables and phenomena. In total, eight meteorological stations were used (Table 2).

In the first phase, meteorological data was sorted out by the location. The shortest distance between the fire and the closest meteorological station was calculated using the geographical coordinates of the event location and the meteorological stations. This divided the area into districts belonging to particular meteorological stations with respect to the shortest distance. For the air temperature, one of the simpler or more complex interpolation methods could be used to assign air temperature values. However, the distribution of air temperatures, unlike precipitation or other meteorological phenomena, is quite stable and therefore this method has been chosen. Geographic influences, such as altitude and orientation (aspect), are only local and due to the insufficient density of meteorological stations they cannot be considered and therefore they were neglected.

Tab. 2: Meteorological stations selected for data processing

ID	WMO	Name	E (WGS84/UTM)	N (WGS84/UTM)
1	11624	Čáslav	527553	5532557
2	11628	Košetice	508287	5489620
3	11636	Kostelní Myslová	530950	5443836
4	11659	Přibyslav	555216	5492542
5	11683	Svratouch	574868	5508555
6	11692	Náměšť nad Oslavou	583092	5447257
7	11693	Dukovany	583967	5437566
8	11698	Kuchařov	579599	5414808

Source: Sladek [11]

In the second step, it was necessary to assign specific SYNOP messages to individual time-based deployments. SYNOP messages are encoded at UTC time (Coordinated Universal Time), events in the database of deployments are at CET time (Central European Time). Therefore, it was necessary to convert both databases into a single time system. The CET time was chosen as the more suitable for further processing, and the times in the SYNOP messages were transferred into it. The monitored deployments were assigned the temperatures corresponding to the SYNOP message issued at the hour of the event.

ANALYSIS OF FOREST FIRE OCCURRENCES

After the data was prepared as described above, a file containing all the necessary information for further processing was available. These were, in particular, the type of event, location information, date and time. This dataset was used to confirm or refute the hypothesis about the influence of air temperature on the amount of forest fires and for analysing the spatial distribution in the Vysočina Region.

Time and space distribution of forest fires

The first step, which was undertaken, was the basic spatial-temporal analysis of the monitored phenomena in the region during the monitored period. By simply comparing the density of vegetation fires in the area with the density of the settlement based on the data of the Czech Statistical Office (CSO), it is possible to trace the effect of human activity on the amount of fires at first sight (Figure 2).

The time analysis was done by time intervals (year, month, day of the week, hour). From the distribution of fires in individual years (Figure 1), it is possible to see a significant increase in forest fires since 2011. In particular, 2015 is highly above the average. Comparing the temperatures in individual years in the monitored period 2010 – 2015, there are no significant differences compared to the long-term average of the years 1961 – 1990 [12]. On the other hand, more significant differences may be observed in precipitation. These have been particularly evident since 2011, either in the lower total rainfall (2011, 2012 and 2015) or, above all, in fewer rainfall days.

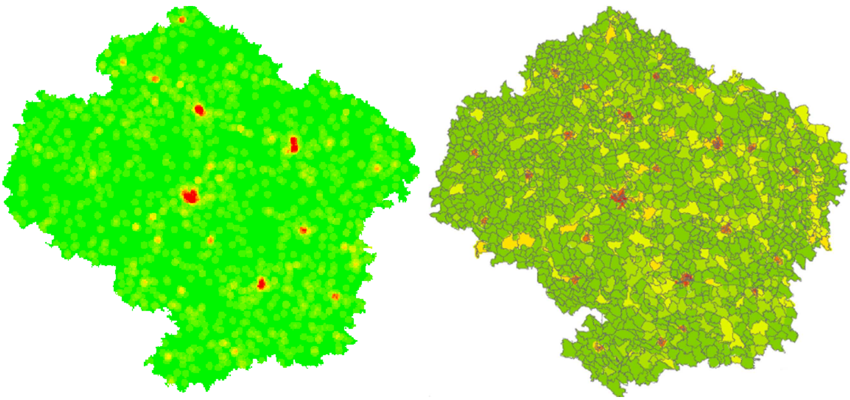


Fig. 2. Comparison of density of actions based on vegetation actions (left) and population density.
Source: data from the SPOJAR and CSO database, compiled by Sladek [11]

When analysing the occurrence of vegetation fires in individual months, regardless of the year of fire, two peaks can be observed (Figure 3). The first is in April with the start of the previous month and the second stronger peak is visible in the summer months with the peak in August. The spring maximum is likely to be related to weather changes and higher human activity (burning grass, burning pliers ...).

Regarding the maximum values for the deployments caused by vegetation fires within individual months, July and August 2015 appear to be extreme. According to monthly reports from the Czech Hydrometeorological Institute [12] from available stations, July and August 2015 were significantly above average (up to 5 °C compared to the average 1961-1990) and precipitation slightly below average. This can be considered as a factor contributing significantly to the occurrence and spread of forest fires.

From the analysis of the occurrence of the fire from the point of view of the hours during the day, there is an obvious tendency to rise from 8AM to a maximum around 3PM. After eight o'clock in the evening and during the night hours, the number of fires is minimal. This trend can be observed both in the group of vegetation fires in general and among forest fires. At the time of maximum occurrence of fires, the maximum daily temperatures occur and this phenomenon can be considered as a possible connection between the occurrence of forest fires and temperatures.

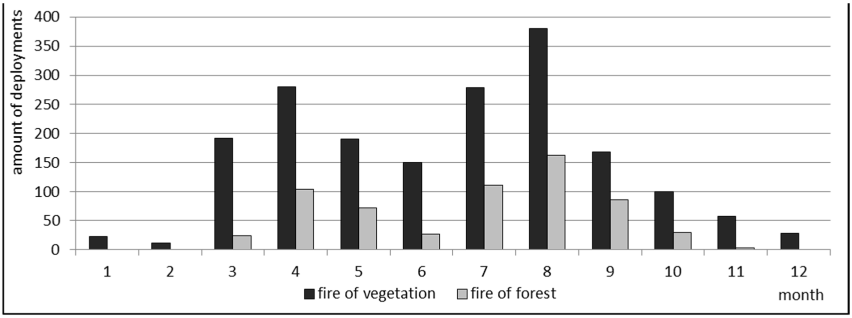


Fig. 3. The occurrence of vegetation fires in individual months, regardless of the year of fire.
Source: data from the SPOJAR database

Analysis of temperature distribution

Based on the assignment of data from meteorological stations to individual deployments, it is possible to compare the measured temperatures at the hours of firefighters operations and the common daily flow. Since complete data from meteorological stations is available, it is possible to compare the distribution of event temperatures with the distribution of all measured temperatures at hourly intervals, which will later help understand forest fire behaviour. Depending on distribution of air temperatures frequency measured during fires, it is obvious that the firefighters most often went out to fires at temperatures around 20 °C.

It can be seen from Figure 4 that the distribution of all measured air temperatures at hourly intervals in the years 2005-2015 is very close to the normal (Gaussian) distribution (red line). The distribution of temperatures measured during fires of vegetation (4a) and forest (4b) (blue line) is much more complicated. The peak is shifted to the higher temperature range, although there are several fires that broke out at temperatures below freezing. The graphs in Figure 4 show a higher probability of fire at higher temperatures, but this phenomenon is clearly evident from Figure 5. The graph in this figure shows the probability of occurrence of forest fires at a given temperature based on the total number of hours in the years 2005-2015, when this temperature was measured. From this graph it is possible to clearly assess the significant influence of temperature on the occurrence of fires.

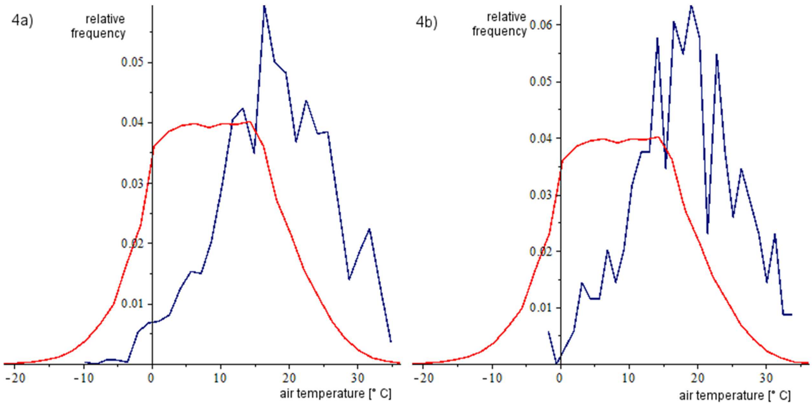


Fig. 4. Graph of distribution of temperatures measured during fires of vegetation (4a) and forest (4b).
Source: Sladek [11]

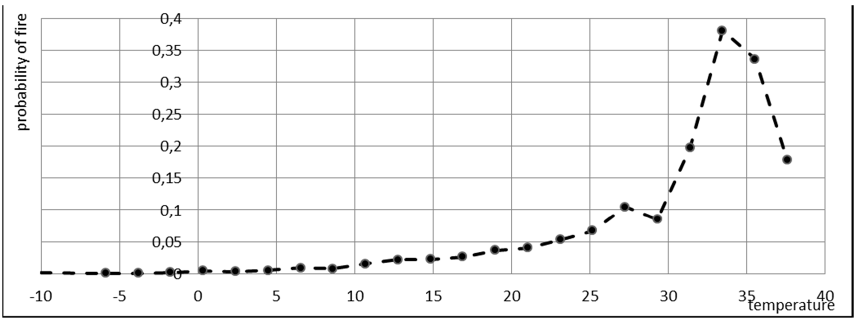


Fig. 5. The probability of occurrence of forest fires at a given air temperature.
Source: own compilation

Cluster analysis

It is clear from the previous analysis that there is dependence between the occurrence of forest fires and high temperatures, although temperature is not the only factor affecting the occurrence of forest fires and is not even their cause. In order to model the probability of occurrence of fires in the region it is also necessary to know their spatial arrangements. Even though at first glance trends in clustering are evident from a simple analysis (Figure 2), they cannot be objectively described or excluded from their randomness. To determine cluster properties, autocorrelation tests are used for spatial modelling. Depending on the spatial extent, global and local autocorrelation can be chosen [13]. These tests can be successfully performed, for example, in ArcGIS [14].

In order to verify whether the fires in the region are predisposed to clustering, Moran's autocorrelation test was used. This determines the tendency for clustering, random or regular distribution of elements in the space [15, 16]. The result of this test on the dataset is the following:

- Moran's Index: 1.405
- z-score: 21.235
- p-value: 0.000001

The high value of the Z parameter indicates that with a probability of less than 1%, clustering is the result of coincidence. The result of the test confirmed the tendency of forest fires to cluster. The exact locations and properties of the clusters can only be found through the so-called local indicator spatial association (LISA). Representatives of the LISA methods are, for example, the Local Moran Index or Getis-Ord GI* analysis [15, 17, 18]. Moran's local index identifies statistically significant outbreaks and remote locations. The Getis-Ord GI * analysis calculates the spatial aggregation with low or high values based on the probability and standard deviation of the individual points.

Both methods were used to find clusters of forest fires. The result was two raster layers with a pixel size 500 x 500 meters, containing information on clusters of fires. Comparing both layers shows that their results are very similar. The clusters in both layers show the same position and similar significance. The resulting clusters can be considered reliable. The most significant areas in terms of the occurrence of forest fires can be found southeast of the town Ždár nad Sázavou and northeast of the town Náměšť nad Oslavou.

The cloud analysis results have shown a high probability of forest fires to cluster. Individual clusters may point to locations with a higher fire risk in the forest. However, it is not possible to demonstrate the relationship to temperature by means of clustering.

MODELLING OF THE POSSIBLE FIRE

The analysis of the occurrence of forest fires has shown a connection between their quantity and high temperatures. Autocorrelation tests showed a tendency of observed phenomena to cluster, and two significant locations with a high risk of forest fires were found. Autocorrelation tests have failed to demonstrate the spatial association of forest fires and temperature. For this reason, more or less suitable GIS tools were used to model the occurrence of forest fires in summer depending on the air temperature. Data input from the data set containing the summer months (June, July, August) from 2005–2015 with the exception of 2012 was used as the input data. The data from 2012 was then used to verify the reliability of each model. This year was chosen because the location of the fires is relatively uniform throughout the region, and in terms of the number of fires it appears to be average. The used methods were:

- IDW (Inverse Distance Weighting) with different configuration,
- Spline,
- Thiessen polygons,
- Natural Neighbour,
- Kriging.

After the individual models were created, the corresponding model values were assigned to the 2012 real records and the following characteristics were calculated:

- $\overline{T^*}$ - average modelled air temperature,
- $\overline{\Delta T^*}$- average difference of the modelled and real measured air temperature,
- ΔT_{max}- maximal difference of the modelled and real measured air temperature,
- ΔT_{min}- minimal difference of the modelled and real measured air temperature,
- $\sigma_{\Delta T}$- standard deviation of the modelled and real air temperature differences,
- σ_{T^*}- standard deviation f modelled air temperatures,
- σ_T- standard deviation of real air temperatures ($\sigma_T = 5.638$).

The values in Table 3 show that the smallest value of the average difference of the modelled and measured temperature (ΔT^*)̅ is registered for the IDW method with manually set parameters. However, from the point of view of the reliability of the results, it is necessary to draw attention to the unsatisfactorily high values of maximum deviations of measured and modelled temperatures. The best result of the maximum error value was obtained in the experiment with high parameter β for the IDW method. However, in such a high exponent, there is a considerable distortion of visualization due to the so-called bull eye effect. Generally, the values obtained indicate that the IDW method could be the most appropriate method, although its results may be inadequately accurate.

Tab. 3: The precision characteristics of the individual methods used to test data set from summer 2012

	$\overline{T^*}$	$\overline{\Delta T^*}$	ΔT_{max}	ΔT_{min}	$\sigma_{\Delta T}$	σ_{T^*}
Spline ten.[1]	23.0	9.4	24.0	1.0	6.41	7.96
Spline reg.[1]	22.1	20.9	88.4	2.2	22.57	28.06
Thiessen	25.3	7.5	17.0	0.9	5.63	22.56
NN	25.4	5.6	16.4	0.3	4.80	1.99
Kriging	24.5	4.9	14.0	0.03	4.13	0.32
IDW GA[2]	24.4	4.3	13.5	0.6	4.28	1.64
IDW β =0,5	25.3	5.7	16.4	0.2	5.14	2.35
IDW β =1	24.9	4.7	15.2	0.6	4.63	1.35
IDW β = 3	25.6	6.1	16.5	0.3	5.27	2.78
IDW β = 2	25.3	5.6	16.5	0.3	5.08	1.92
IDW β = 8	23.6	4.8	12.8	0.7	3.77	2.11

Notes: [1] reg./ten. (type of splinu – regularized/ tension); [2] Created in Geostatistical Analyst - subjectively chosen parameters
Source: Sladek [11]

When applying the method of modelling results using the IDW method to a forest layer, it is possible to obtain information at which temperatures a fire is more likely to occur in a particular forest polygon (Figure 6). Due to the proven connection between the air temperature and the higher probability of a fire, it is necessary to draw attention to the darker areas passing through the whole region in the southeast-northwest direction. In the forests of these areas, the probability of forest fires is higher at higher temperatures despite the lower reliability of the model. From the geographic point of view, the south-eastern part of the region is connected to the Dyje-Svratka Valley with lower altitude and relatively small terrain fragmentation. At the same time, in recent years, the area has a significantly lower volume of soil moisture in the summer months [19]. In the north-western part of the Vysočina Region there are several larger settlements, otherwise this part do not differ significantly from other parts of the region. The connection between the higher probability of fires at higher air temperatures, can be in a higher concentration of the population and probably their more frequent stays in the nature during the summer. For a small location in the north of the Vysočina Region no explanation was found. The pronounced conclusions have not yet been verified and will be part of the next work as well as the possibility of linking modelling and clustering results.

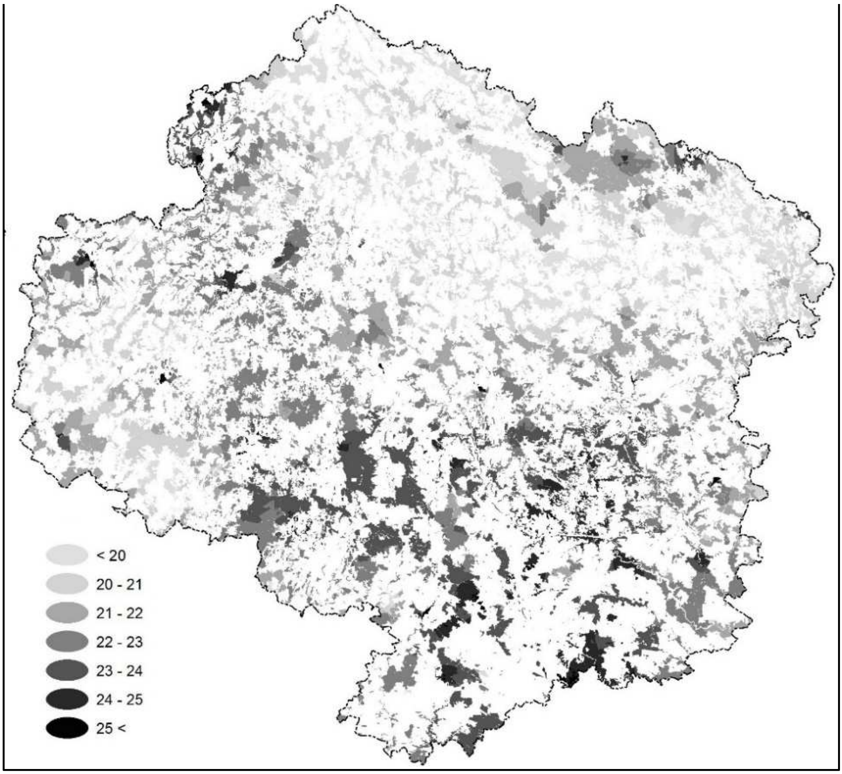


Fig. 6. The results of the IDW method showing the most likely air temperatures for the occurrence of a fire.
Source: own compilation

DISCUSSION AND CONCLUSION

As already mentioned in the introduction of this paper, forest fires are currently a serious problem. The problem is especially connected with the inaccessibility of terrain for the fire-fighting equipment, in the difficult supply of water for fire-fighting. The big problem is that the fire can spread uncontrollably even under the surface. In addition, forest fire has a major impact on the environment.

Based on available data from the Vysočina Region, the following data were processed:

1. Time-space analysis of observed phenomena.
2. Time analysis – distribution of fire in years, in individual months regardless of year, in daily times.

3. Analysis of the distribution of events air temperatures with the distribution of all measured values at hourly intervals. It has been found that there is dependence between the occurrence of forest fires and high air temperatures, although the air temperature is not their cause.
4. The cluster analysis was used to model the probability of fire occurrence in the region.

Cluster analysis has shown that there is a tendency for clustering. Two raster layers with a pixel size 500 x 500 meters were also created, containing information on clusters of fire. Applied LISA methods have shown that the likelihood of cluster formation is high in forest fires.

The cluster analysis did not prove the spatial relation of forest fires and temperatures in places of existing clusters. However, because the objective was to identify spatial dependence (i.e. to locate places where fires at high temperatures are more likely to occur), GIS modelling tools were used. From the whole data series (except 2012 - which was chosen for verification), models of probability of occurrence of fire at certain temperatures were calculated and the results of these models were verified on data from 2012. To make the final model the most accurate seems (despite the large standard deviation) IDW method. Its result was applied to the vegetation layer in the Vysočina region. This layer assigns to each forest unit of DMU 25 a temperature at which the probability of fire will be highest.

For each forest polygon, it has been calculated at what temperatures the greatest probability of fire is. Given that this probability increases significantly at temperatures above 25 ° C, see Figure 5, it is possible to identify areas with a high risk of fire at high temperatures. However, this finding cannot rule out the possibility of a fire in other locations. It is therefore necessary to continuously remind and apply fire protection regulations and to observe preventive measures to reduce the risk of forest fires. Nevertheless, in risky locations, it is advisable to carry out more rigorous control activities at high air temperatures and thus to minimize risks.

REFERENCES

[1] KONEČNÝ, Milan, et al. The usability of selected base maps for crises management – users' perspectives. *Applied geomatics*, 2011, 3(4) 189-198.

[2] HUBACEK, M. et al. Analysis of vehicle movement possibilities in terrain covered by vegetation. In: *International Conference on Military Technologies (ICMT) 2015*. Brno: IEEE, 2015, 301-305.

[3] RYBANSKY, M. and VALA, M. Cartographic visualization of relief impact on transport during crisis situations. *Moravian Geographical Reports*. 2009, 17(3): 19-26.

[4] FRANCL, R. Forest fires in the Czech Republic from the point of view of firefighters (in Czech). *Lesnická práce: Časopis pro lesní vědu a praxi* [online]. 2007, 86(8). [2017-10-12].: http://www.lesprace.cz/casopis-lesnicka-prace-archiv/rocnik-86-2007/lesnicka-prace-c-08-07/lesni-pozary-v-ceske-republice-z-pohledu-hasicu

[5] FLANNIGAN, M. D., STOCKS, B. J., and WOTTON, B. M. Climate change and forest fires. *Science of the total environment*, 2000, 262(3): 221-229.

[6] FLANNIGAN, M. D., et al. Forest fires and climate change in the 21 st century. *Mitigation and adaptation strategies for global change*, 2006, 11(4): 847-859. https://doi.org/10.1007/s11027-005-9020-7
[7] LINDNER, M., et al. Climate change impacts, adaptive capacity, and vulnerability of European forest ecosystems. *Forest ecology and management*, 2010, 259(4): 698-709. https://doi.org/10.1016/j.foreco.2009.09.023
[8] PRETEL, J., et al. *Clarification of existing estimates of impacts of climate change in the water, agriculture and forestry sectors and proposals for adaptation measures* (in Czech). Praha, Ministry of Environment, 2007.
[9] KOLAR, P., (2017): Changes and variability of spring-summer air temperature in Czechia during the past 300 years: comparison of instrumental, documentary and natural proxy data (in Czech). *Geografie*, 122(2): 190–212.
[10] KOUTSIAS, N., et al. On the relationships between forest fires and weather conditions in Greece from long-term national observations (1894–2010). *International Journal of Wildland Fire*, 2013, 22(4): 493-507.
[11] SLADEK, D. *Modeling of natural processes to the needs of the IRS* (in Czech). Brno, University of Defence, 2017. Diploma thesis.
[12] Monthly station data. *Czech Hydrometeorological Institut* [online]. Praha: CHMI, 2017 [2017-11-12]. From: http://portal.chmi.cz/historicka-data/pocasi/mesicni-data?l=en
[13] PFEIFFER, D., et al. *Spatial analysis in epidemiology*. New York, NY, USA: Oxford University Press, 2008.
[14] MAREK, L. *Spatial and multidimensional statistical analyzes of epidemiological data* (in Czech). Olomouc, University of Palacky, 2016. Dissertation.
[15] SPURNA, P. Spatial autocorrelation-ubiquitous phenomenon in spatial data analysis? (in Czech). *Czech Sociological Review*, 2008, 44(4): 767-788.
[16] TOBLER, W. R. A computer movie simulating urban growth in the Detroit region. *Economic geography*, 1970, 46(1): 234-240. https://doi.org/10.2307/143141
[17] ANSELIN, L. Local indicators of spatial association – LISA. *Geographical analysis*, 1995, 27(2): 93-115. https://doi.org/10.1111/j.1538-4632.1995.tb00338.x
[18] GETIS, A. and ORD, J. K. The analysis of spatial association by use of distance statistics. *Geographical analysis*, 1992, 24(3): 189-206. https://doi.org/10.1111/j.1538-4632.1992.tb00261.x
[19] INTERSUCHO [online]. Brno: Ústav výzkumu globální změny AV ČR, 2017 [2017-10-18]: http://www.intersucho.cz/en/

Shrnutí

Výskyt lesních požárů je závislý na řadě jevů. Kromě činnosti člověka jsou to i jevy přírodní, mezi které patří zejména počasí a prostorové uspořádání krajiny. V posledních letech dochází k výrazným výkyvům počasí a na území České republiky je možné pozorovat období s výskytem vyšších teplot a minimem srážek. To se projevilo i ve výskytu lesních požárů. V rámci výzkumu byla analyzována datová řada výjezdů hasičů k lesním požárům

za období let 2005 – 2015 na území kraje Vysočina. Byl sledován vliv teploty vzduchu na výskyt požárů na území kraje. Na základě zjištěných výsledků proběhlo testování na potenciální výskyt shluků míst s potenciálně vyšší pravděpodobností výskytu požárů v období vyšších teplot vzduchu. I přesto, že vliv teploty vzduchu byl zkoumán samostatně, bez ohledu na další meteorologické jevy, se potvrdily výchozí hypotézy o vlivu teploty vzduchu na výskyt lesních požárů. Na základě těchto výsledků bylo provedeno modelování prostorové závislosti a vyhledání lokalit s větší pravděpodobností vzniku lesních požárů.

INTERACTION PRIMITIVES IN 3D GEOVISUALIZATIONS

Vojtěch Juřík, Lukáš Herman, Čeněk Šašinka

Masaryk University, Faculty of Arts, HUME Lab, Arna Nováka 1, 602 00 Brno, Czech Republic

jurik.vojtech@mail.muni.cz, herman.lu@mail.muni.cz, cenek.sasinka@mail.muni.cz

Abstract: Virtual reality (VR) offers wide range of possibilities regarding not only representation of real world phenomena, but also their dynamic modification and customization. A typical representation of the geographical space is geovisualization, which is widely used in practice, namely in education and teaching, but also in such an area as scientific research for revealing human cognitive processes. Interaction with such VR products consists of many specific types of action, however currently there is no uniform taxonomy for the basic units of interaction. With the growing number of VR products we need to summarize existing taxonomies to better understand and design next generations of geovisualizations. The concept of interaction primitives can offer basic framework for understanding dynamic interaction with virtual cartographic products. In this paper, we outline an issue of interaction primitives with respect to interactive 3D geovisualizations and suggest their specific application in the VR research and development.

Key words: 3Dgeovisualization, interaction primitives, virtual reality

INTRODUCTION

Information representation takes many different forms. The development of information technologies opens wide new possibilities for the representation of information with respect to their cognitive processing and understanding by humans. Visualization in general (not solely the virtual one) is a graphical form of external representation of specific information (Ware, 2004). As such, visualization should be effective regarding its purpose and visualized data should also be presented in the most understandable way possible. The specific visualization type actively affects e.g. problem solving strategies, as demonstrated in previous studies (Bauer and Johnson-Laird, 1993). Virtual reality (VR) made huge progress in last couple of years and it is still more often used as an effective instrument for simulation of various environments. VR allows us to modify virtual content easily and it can be quickly customized for specific purposes. Furthermore, VR also offers effective ways of measuring behavioral activity of a user, who works/interacts with virtual content. The most typical representation of the space in VR is 3D geovisualization (GV). Modern technologies offer a lot of opportunities to convert geospatial data into VR in particular forms of GVs, which match users' needs as much as possible. GVs offer possibilities of e.g. *map-driven reasoning* (MacEachren and Monmonier, 1992).

Various forms of GVs differ in their features, their setting and content, but also in interactivity options. GVs can be static or dynamically interactive when displaying a specific terrain. Although two different maps can be informationally equivalent according to Larkin and Simon's concept (1987), they can differ in ways, how they can be manipulated by a user, e.g. how a user can control them (rotating or zooming), but also in the options of information display and offered choices. This feature can be labelled as *interaction equivalence.* This term represents comparability of various visualizations in their interactivity (options of interaction). Interaction non-equivalency of two different GVs (e.g. static vs interactive) results in different processing of displayed content by a reader/user due to different actions performed by the user. Regarding human psyche, the very nature of every single GV should stand in the middle of research and design focus, because misinterpretation of displayed information can bring huge safety threats in applied fields (i.e. Rierson, 2013). Specific nature of visualization should be always emphasized in design process, because as such it can strongly affect cognitive processing of displayed information (Ware, 2012). And it is the nature of the interaction with VR which can be expressed with the use of so called *interaction primitives* (*IPs*) (Roth, 2012), where IPs represent basic elements describing the interaction with interactive 3D GVs.

CARTOGRAPHIC INTERACTION

The suggestions for establishment of so called *interaction science* were based on previous knowledge in the fields of information visualization or visual analysis, nevertheless also on the contribution of GIScience as well as cartography needs. Some authors emphasize the elementary division of information visualization into two basic parts - (1) *representation* and (2) *interaction* (resp. interactivity) (Buja et al., 1996). When creating geovisualization, we can analogically observe cartographic representation on one hand and cartographic interactivity on the other.

Cartographic representation means graphic, acoustic, haptic and other parameters of the map, which represent geographical information itself (Roth, 2012). This part has been studied intensively during past years, especially with respect to human perception (how s/he sees the map), cognition (how s/he understands the map) and semiotics (what does the map visualization mean to a specific person) (MacEachren, 1995). Cartographic interactivity stands on the other side representing a specific dialog between a user and a map. Edsall (2003) sees interaction exchange as a partial sequence defined in a framework of conversation between the user and the map (sequence question → answer). The process in whole is then called an *interaction session*. Such a dialog is mediated via specific technology (or rather interface).

The user and information visualization are both interaction agents in the process of "map reading" and they affect each other. When the user looks for and reaches information leading him to his targets via interaction with the interface, he actively modifies/manipulates/changes his current preview of the visualization (primarily on the perception level). Such changes lead him to a different interpretation of the visualization, because with every change his cognitive scheme has also been modified - according to Neisser's principle (1976). If this change is desirable, the user hits his target. If not, more interaction with the visualization is needed. In this process, a computation device serves as a dialog mediator between the user and the visualization, which allows dynamic exchange of information in real time (MacEachren and Monmonier, 1992). The nature of such interaction is built on the example of a conversation metaphor, which is emphasized especially in a human-computer interaction (HCI) approach, information visualization and visual analysis (Yi et al., 2007). In general, the process of cartographic interaction can be defined by three parts: a user, a map and a computation device (Roth, 2012).

The best way to demonstrate interaction of the user with specific interface is with the use of Norman's Seven Stages of Action model (Norman, 1988), see (Fig. 1). His model reflects the process of the general interaction of human with a device. In this framework we will discuss the issue of IPs.

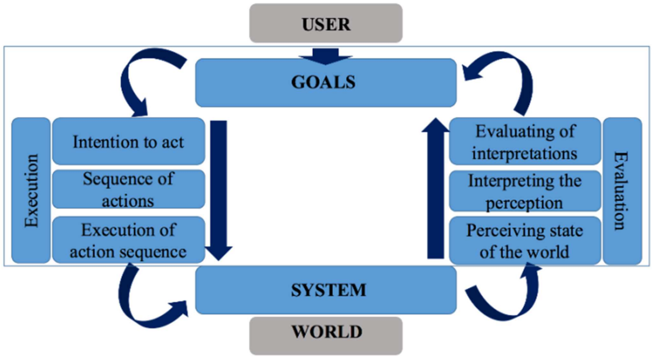


Fig. 1. Seven Stages of Action model (Norman, 1988).

Currently we can find more than one system/taxonomy describing IPs within frameworks mentioned above (MacEachren et al., 1999; Crampton, 2002; Yi et al., 2007). Their definitions partially overlap each other, still there is no unified taxonomy. As Roth suggested (2012), construction of such a unified taxonomy is considered to be a grand challenge of interaction. Roth (2012) finds useful to incorporate and interpret IPs within the Norman's model framework (Fig. 2). In this framework we will discuss the issue of IPs. In the process of interaction, the user is led by his particular goal, this goal transforms into the intention leading to the specific action. This action has effect, which can be reflected backwards by the user and further interpreted and evaluated. Evaluation and interpretation of the current state compared to the original goal leads to another action or to modification of the goals (Fig. 2).

Each stage in the Norman's model represent various ways, by which user can interact with the physical, resp. virtual objects (so called *"operands"*). The user interacts with operands via different IPs, which means that on every level of the model we speak about series of different user's actions. Roth (2012) himself divides interaction into three main categories according to their belonging to the stage within Norman's model. He speaks about three recommended approaches to parsing exchanges into IPs, calling it three O's of cartographic interaction: (1) an objective-based approach, (2) an operator-based approach and (3) an operand-based approach.

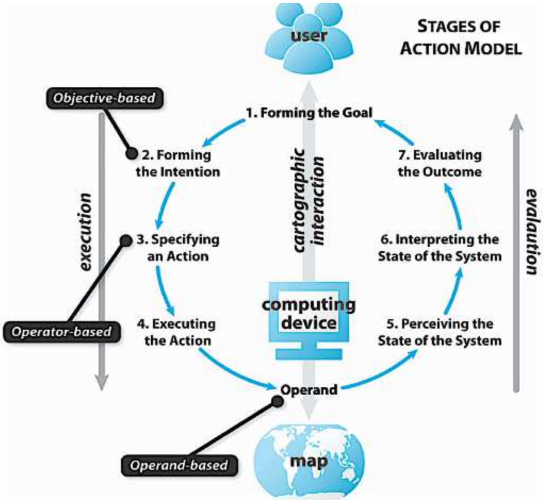


Fig. 2. The Stages of Action Model and the Three O's of Cartographic Interaction (Roth, 2012).

INTERACTION PRIMITIVES FOR CARTOGRAPHIC INTERACTION

Objective-based approach

IPs included in an *objective-based* taxonomy represent the interaction on the "forming the intention" level (see Fig. 2). These IPs define specific goals of the user interaction/working with UI (User Interface). There are many different existing lists of primitives assigned into Objective-based taxonomies according to different authors. However, in general we can understand primitives on the Objective-based level as "task purpose" or "task assignment" primitives. A couple of examples are listed below to illustrate variability in the IPs taxonomy in a better way. Roth (2012) summarizes, that in spite of considerable variability, primitives "*identify*" (also "*explore*" or "*examine*") and "*compare*", are consistently represented across different authors (see Tab. 1).

Tab. 1: Objective-based taxonomies

MacEachren et al. (1999)	Meta-operations	(1) identify, (2) compare, (3) interpret
Crampton (2002)	Interactivity Tasks	(1) examine, (2) compare, (3) (re)order/(re)sort, (4) extract/suppress, (5) cause/effect
Yi et al. (2007)	User Intents	(1) select, (2) explore, (3) reconfigure, (4) encode, (5) abstract/elaborate, (6) filter, (7) connect

Operator-based approaches

An *Operator-based* approach covers primitives engaged in to the process of a specifying action (Specifying an Action level in Fig. 2). These primitives relate to options of visualization manipulation. They can be seen as the "interaction menu" for various acts, by which the user can perform a goal-focused action, but they still do not represent the action itself. On this level in general we speak rather about a setting of UI for an upcoming real interaction. Roth (2012) finds similarities across the existing labels of these acts, especially for so called "*brushing*", which is described as "highly interactive technique for directly selecting groups of information items in a display" (Roth, 2012; Štampach et al., 2015). Further, on this level we can speak about primitives like "*focusing"* and "*linking*".

Tab. 2: Operator-based taxonomies

MacEachren et al. (1999)	Interaction Forms	(1) assignment, (2) brushing, (3) focusing, (4) colourmap manipulation, (5) viewpoint manipulation, (6) sequencing
Ward and Yang (2003)	Interaction Operators	(1) navigation, (2) selection, (3) distortion
Edsall et al. (2008)	Interaction Forms	(1) zooming, (2) panning/re-centering, (3) re-projecting, (4) accessing exact data, (5) focusing, (6) altering representation type, (7) altering symbolisation, (8) posing queries, (9) toggling visibility, (10) brushing and linking, (11) conditioning

Operand-based approach

An *Operand-based* taxonomy covers IPs laying on the borderline of Norman's *action* and *evaluation* part - namely between Executing the Action level and Perceiving the State of the System level (Fig. 2). In this case, the object of interest is a real or virtual *operand*, which can be e.g. specific type of data, structure or an object. Roth (2012) further distinguishes these primitives on *type centric and state centric.* Primitives on this level have great variability and are usually connected to the specific context.

Tab. 3: Operand-based taxonomies

Crampton (2002)	Interactivity Types	1) data, (2) representation, (3) temporal dimension, (4) contextualizing interaction
Keim (2002)	Data Types	(1) one-dimensional, (2) two-dimensional, (3) multi-dimensional, (4) text and hypertext, (5) hierarchies and graphs, (6) algorithms and software
Ward and Yang (2003)	Interaction Operands and Spaces	(1) screen, (2) data, (3) data structure, (4) attribute, (5) object, (6) visualization structure

INTERACTION PRIMITIVES FOR EMPIRICAL RESEARCH OF 3D GEOVISUALIZATION

Taking into account the mentioned approaches, we strive for a taxonomy which can be used to set a ground plane in the empirical research of interaction with interactive 3D GVs. We suggest a taxonomy of IPs usable particularly for an empirical research and optimization of interactive 3D GVs. The suggested taxonomy is in its very nature based on an elementary classification created by Laha et al. (2015) and it represents an example of an objective-based taxonomy. Examples of the tasks that we have added into the individual categories were selected from our previous studies reflecting the usability testing of interactive 3D GVs (Špriňarová et al., 2015; Herman et al., 2016; Herman et al., 2017; Juřík et al., 20017; Kubíček et al., 2017). This classification covers main categories of tasks, which can be done on the 3D GVs.

Tab. 4: Suggested taxonomy of interaction primitives for empirical research

1	**search**	
1.1	**self-localization**	**Where am I?**
1.2	**presence/absence**	**Is there a lake?**
1.3	**counting**	**How many buildings are there?**
2	**pattern recognition**	
2.1	**trend**	**Is there a global trend in the heights of buildings?**
2.2	**repetition**	**Is there any specific pattern in the terrain shape?**
3	**spatial understanding**	
3.1	**absolute comparison**	**Which hill/top is in the highest place?**
3.2	**relative comparison**	**Is the trigonometric point “A” higher than the trigonometric point “B”?**
3.3	**comparison with different type of visualization**	**Which of the terrain profiles is displayed as a 2D graph?**
4	**quantitative estimation**	
4.1	**absolute estimation**	**What is the slope of the road?**
4.2	**relative estimation (binary)**	**Do the heights of trees depend on altitude?**
4.3	**relative estimation (quantitative)**	**How many times higher is the building “A” than the building “B”?**
5	**shape description**	**How would you describe the shape of the terrain?**
6	**combined tasks**	**Find all the buildings in the terrain and determine which one is the highest one.**
7	**planning**	**Determine a specific place where it would be suitable to place a lookout to see all of the landmarks.**

DISCUSSION

The benefits of the discussed efforts to sort basic elements of interaction are undeniable. Although there is a considerable diversity in researchers' perception of IPs, many similarities can be found among them and their fundamental parts can be used for development and research purposes of many visualization products. With respect to the previously mentioned diversity in IPs taxonomies, we newly suggested a consolidating taxonomy, which can be applied as a solid starting point for the empirical research of virtual 3D GVs. This suggested taxonomy was based on a classification created by Laha et al. (2015) and completed with the use of our research findings acquired within the research of interactive 3D GVs.

Purpose of the taxonomy was verified also with respect to its empirical grounding, where e.g. Roth (2013) strongly highlights applicability for practical tasks. In HCI and human factors research, interactive GVs represent a valuable asset for looking for answers in case of human behaviour and human possible failures in real environment (e.g. human error). Elsewhere Roth (2012) summarizes, that IPs taxonomy represents a complex lexicon for education and practice and as such - besides the applied field - the IPs taxonomy fulfils didactic purposes. However in general, the suggested taxonomy creates essential theoretical background for design and development of virtual cartographical products with interactive parameters. We can compare our suggested taxonomy with other existing examples, which are commonly used for classification of IPs. Both of them (Kjellin et al., 2010; Rautenbach et al., 2014) are used in researches dealing with empirical testing of 3D GVs. Compared to both taxonomies mentioned above, our taxonomy is the most robust one, especially because it takes into account advanced types of tasks (see tab. 5. - categories 6 and 7). We also consider its hierarchical form (composed from two levels) to be advantageous for finding similarities or differences when classifying user tasks.

Tab. 5: Examples of other existing taxonomies of IPs

		User operations – Koua et al. (2006) in Kjellin et al. (2010)	**Map reading tasks** – Morrison (1978) in Rautenbach et al. (2014)
1	**search**	locate	search, locate, identify, count
2	**pattern recognition**	distribution, cluster	delimit
3	**spatial understanding**	locate, rank, compare	compare or contrast, verify
4	**quantitative estimation**	identify, distinguish, categorize, correlate, associate	measurement, direct estimation, indirect estimation
5	**shape description**		identity
6	**combined tasks**		
7	**planning**		

Comparison of various UI settings became a crucial issue in the field of human factors, where different options of interaction can have a huge impact on safety. In consonance with this, in upcoming research there should be more emphasized testing of interaction equivalence within interfaces design and development, because interaction became an immanent part of visualization in its very nature. Every type of user's action performed within the UI (including control actions) may hugely influence the process of user's perception, evaluation, interpretation, and decision-making in the problems being solved. Such aspects should be subjected to a deep analysis and discussion.

CONCLUSIONS AND FUTURE WORK

In this paper we discussed the existence of various approaches in the issue of IPs – i.e. basic building blocks of interaction with GVs. The exact setting of IPs taxonomy seems to be necessary especially from didactical point of view, because such taxonomy is considered to be starting point for description and further development of virtual interactive maps, for their classification and evaluation of their functionality. Also, the necessity of better evaluation and specifying user issues is grounded in legislative demands (Řezník, 2013).

We find Objective-based approaches and Operator-based approaches consolidating IPs useful primarily for the design and optimization of the interactive GVs (not only three-dimensional ones). With respect to many existing approaches in the issue of IPs, we summarized the types of interaction used in practice and suggested a new conclusive taxonomy of IPs, which can serve as a solid ground plane for design, development and research of interactive 3D GVs. The suggested taxonomy offers a comprehensive typology of ecologically relevant tasks for comparison of the different types of UIs, e.g. 3D GVs with various types of control devices (e.g. Špriňarová et al., 2015). It can also be used for the assessment of cognitive skills/competences when dealing with information content in specific a GV. Last but not least, the suggested taxonomy can represent a methodological alphabet for interaction equivalence testing in the issue of various UI settings.

To conclude, suggested taxonomy offers instruments for evaluation and comparison of different interfaces. Currently we have the methodology, which can decide whether two different visualizations are information equivalent or not, however the interaction aspect of visualizations still remains quite an unexplored issue. This suggested taxonomy will be used as a starting point in our upcoming research projects in the field of cognitive cartography.

Acknowledgements. This research has been supported by funding from the project of Masaryk University under the grant agreement No. MUNI/M/0846/2015, which is called "Influence of cartographic visualization methods on the success of solving practical and educational spatial tasks".

REFERENCES

BAUER, M., JOHNSON-LAIRD, P. How diagrams can improve reasoning. *Psychological Science.* 1993, 4(6), 372-378. ISSN 0956-7976. https://doi.org/10.1111/j.1467-9280.1993.tb00584.x

BUJA, A., et al. Interactive high-dimension data visualization. *Journal of Computational and Graphical Statistics.* 1996, 5(1), 78-99. ISSN 1061-8600.

CRAMPTON, J.W. Interactivity types in geographic visualization. *Cartography and Geographic Information Science*. 2002, 29(2), 85-98. ISSN 1523-0406.

EDSALL, R.M. Design and usability of an enhanced geographic information system for exploration of multivariate health statistics. *The Professional Geographer*. 2003, 55(2), 146-160. ISSN 1467-9272.

HERMAN, L., et al. Touch Interaction with 3D Geographical Visualization on Web: Selected Technological and User Issues. In: *ISPRS Archives of the*

Photogrammetry, Remote Sensing and Spatial Information Sciences, vol. XLII-2/W2. Athens: Copernicus GmbH, 2016, pp. 33-40. ISSN 1682-1750.

HERMAN, L., et al. Eye-tracking Analysis of Interactive 3D Geovisualizations. *Journal of Eye Movement Research*. 2017, 10(3), 1-15. ISSN 1995-8692.

JUŘÍK, V., et al. When the Display Matters: A Multifaceted Perspective on 3D Geovisualizations. *Open Geosciences*. 2017, 9(1), 89-100. ISSN 2391-5447.

KEIM, D. A. Information visualization and visual data mining. *Transactions on Visualization and Computer Graphics*. 2002, 8 (1), 100-107. ISSN 1077-2626

KJELLIN et al. Evaluating 2D and 3D visualizations of spatiotemporal information. *ACM Transactions on Applied Perception*. 2010, 7(3), 1-23. ISSN 1544-3558. https://doi.org/10.1145/1773965.1773970

KUBÍČEK, P., et al. Identification of Altitude Profiles in 3D Geovisualizations: The Role of Interaction and Spatial Abilities. *International Journal of Digital Earth*. 2017 [in print]. ISSN 1753-8947. https://doi.org/10.1080/17538947.2017.1382581

LAHA, B., et al. A Classification of User Tasks in Visual Analysis of Volume Data. In: *IEEE Scientific Visualization Conference 2015*. Chicago: IEEE, 2015, pp. 1-8. ISBN 978-1-4673-9785-8.

LARKIN, J.H., SIMON, H.A. Why a diagram is (sometimes) worth ten thousand words. *Cognitive science*, 1987, 11(1), 65-100. ISSN 1551-6709. https://doi.org/10.1111/j.1551-6708.1987.tb00863.x

MACEACHREN, A.M. *How Maps Work*. 1st ed. New York: The Guilford Press, 1995. 513 p. ISBN 978-1572300408.

MACEACHREN, A.M., MONMONIER, M. Geographic Visualization – Introduction. *Cartography and Geographic Information Science*. 1992, 19(4), 197-200. ISSN 1523-0406.

MACEACHREN, A.M., et al. Constructing knowledge from multivariate spatiotemporal data: Integrating geographical visualization with knowledge discovery in database methods. *International Journal of Geographical Information Science*.1999, 13(4), 311-334. ISSN 1362-3087. https://doi.org/10.1080/136588199241229

NEISSER, U. *Cognition and Reality: Principles and Implications of Cognitive Psychology*. New York: W. H. Freeman & Co Ltd, 1976. 230 p. ISBN 978-0716704782.

NORMAN, D.A. The Design of Everyday Things. 1st ed. Cambridge: MIT Press, 1988. 368 p. ISBN 978-0-465-06710-7.

RAUTENBACH, V., et al. Towards evaluating the map literacy of planners in 2D maps and 3D models in South Africa. In: AfricaGEO 2014, Cape Town, 2014, pp. 1-12.

RIERSON, L. *Developing Safety-critical Software: A Practical Guide for Aviation Software and DO-178C Compliance*. 1st ed. New York: CRC Press, 2013, 566 p. ISBN 978-1439813683

ROTH, R. Cartographic Interaction Primitives: Framework and Synthesis. *Cartographic Journal*. 2012, 49(4), 376-395. ISSN 0008-7041. https://doi.org/10.1179/1743277412Y.0000000019

ROTH, R. An Empirically-Derived Taxonomy of Interaction Primitives for Interactive Cartography and Geovisualization. *IEEE Transactions On Visualization And Computer Graphics.* 2013, 19(12), 2356-2365. ISSN 1077-2626. https://doi.org/10.1109/TVCG.2013.130

ŘEZNÍK, T. Geographic Information in the Age of the INSPIRE Directive: Discovery, Download and Use for Geographical Research (Geografická informace v době směrnice INSPIRE: Nalezení, získání a využití dat pro geografický výzkum). *Geografie*. 2013, 118 (1), 77-93. ISSN 1212-0014.

ŠPRIŇAROVÁ, K., et al. Human-computer Interaction in Real 3D and Pseudo-3D Cartographic Visualization: A Comparative Study. In: *Cartography - Maps Connecting the World: 27th International Cartographic Conference 2015 - ICC2015.* Cham: Springer, 2015, pp. 59-73. ISBN 978-3-319-17737-3.

ŠTAMPACH, R., et al. Dynamic Visualization of Sensor Measurements: Context Based Approach. *Quaestiones Geographicae*. 2015, 34(3), 117-128. ISSN 0137-477X. https://doi.org/10.1515/quageo-2015-0020

WARD, M., YANG, J. Interaction spaces in data and information visualization. In: *Joint Eurographics/IEEE TCVG Symposium on Visualization*. Konstanz: Eurographics, 2004, pp. 137-146. ISBN 1-58113-698-6.

WARE, C. *Information visualization - Perception for Design*. 2nd ed. San Francisco: Morgan Kaufman, 2004, 486 p. ISBN 1558608192.

YI, J., et al. Toward a deeper understanding of the role of interaction in information visualization. *Transactions on Visualization and Computer Graphics.* 2007, 13(2), 1224-1231. ISSN 1077-2626.

Shrnutí

Virtuální realita představuje přirozený posun ve vývoji a výzkumu interaktivních geografických produktů, především map. V tomto článku shrnujeme problematiku interakčních primitiv, tedy elementárních prvků interakce, s jejichž pomocí lze přesně popsat proces práce člověka s virtuálními geografickými vizualizacemi, konkrétně s interaktivními 3D geovizualizacemi. V současnosti neexistuje jednotná taxonomie interakčních primitiv, nicméně na základě předchozích výzkumů lze tyto základní jednotky interakce dělit dle různých autorů do konkrétních podkategorií – objective/operator/operand-based primitives (Roth, 2012). V rámci tohoto článku jsme konsolidovali různá dělení interakčních primitiv (např. jejich dělení v rámci Normanova modelu) a na tomto základě jsme vytvořili vlastní komplexní taxonomii pro pochopení, výzkum a rozvoj interaktivních geovizualizací s ohledem na člověka – uživatele. Navržená taxonomie je vhodná pro posouzení tzv. interakční ekvivalence u různých typů geovizualizací s různým nastavením uživatelského rozhraní a má sloužit jako výchozí bod při dalším testování funkčnosti a optimalizaci interaktivních 3D geovizualizací.

OLD ROADS IN DOLNÍ POMORAVÍ IN THE MIKULČICE AND KOPČANY AREA: HYPOTHESES SUPPORTED BY THE ANALYSIS OF OLD MAPS AND AERIAL IMAGERY

Jaromír Kolejka[1], Martin Boltižiar[2], Matej Vojtek[2]

[1] Department of Geography, Faculty of Education, Masaryk University in Brno, Poříčí 7, 603 00 Brno, Czech Republic

kolejka@ped.muni.cz

[2] Department of Geography and Regional Development, Faculty of Natural Sciences, Constantine the Philosopher University in Nitra, Trieda A. Hlinku 1, 949 74 Nitra, Slovakia

mvojtek@ukf.sk, mboltiziar@ukf.sk

Abstract: The paper deals with a method of integrated analysis of old maps and aerial photographs taken at different periods in order to identify old roads in the region of Dolní Pomoraví. The plain landscape, represented by the floodplain of the Morava River, has undergone numerous changes in the area of Mikulčice and Kopčany in connection with the development of its own floodplain and its use by man from the earliest times to the present. Since it is the inundation area, fluvial processes have led to the formation of typical terrain shapes that have been taken into account when crating the roads. Moreover, the later hydrotechnical interventions into the natural regime of the floodplain also reflected in the creation of roads. Taking into account both natural and anthropogenic conditions in the floodplain, they can therefore be a good starting point for distinguishing old and newer parts of roads. From the knowledge of old road network, it is possible to derive the former property conditions and impact of the settlements and in this case, it is also the approximate course of the centuries-old state border across the floodplain. Integrated analysis of old maps and aerial imagery often brings interesting and unexpected results that can also be found in practical applications and can be helpful in making further spatial analyses leading to new findings. Although the results extend beyond to a rather distant or near undated past, they can be applied in a variety of ways when deciding on the future of the study area which stands for UNESCO registration as a cross-border archeopark.

Key words: old roads, Mikulčice, Kopčany, Morava River

INTRODUCTION

Road creation in a certain area can be described as a relatively conservative landscape property at least in the conditions of Central Europe. It is evidenced by the curved course of today's roads even in a plain landscape where there is no obvious obstacle to their straightforward leading on long stretches. The roads thus probably respect the ancient deployment and boundaries of the fields which have mostly disappeared after joining the fields into large parcels. However, the course of the roads has preserved and leads to the idea that the preservation of the course of roads belongs to the conservative behavior of human society (Faltýnek, Šlezar, 2014). The question remains how long the course of the ancient roads is preserved in the landscape. One can also imagine that radical political and economic changes (and shifts) in the past have led new owners or users of large fields to revise the road network in their domains towards their more efficient and usually shortened variants especially with regard to the local political and economic power center and specific economic intentions (Poláček, 2012). At the same time, it is also possible to anticipate to some extent with the idea that even the major transformation of the road network did not lead to a complete reconstruction. Always at least some parts of road network "resisted" the pressure of changes.

The plain landscape in the Dolní Pomoraví region, represented by the floodplain of the Morava River, has undergone numerous changes in the area of Mikulčice and Kopčany in connection with both the development of its own floodplain and its use by humans from the earliest times to the present (Květ, 1999, Dresler, 2012). Since it is the inundation area of the Morava River, fluvial processes led to the formation of typical terrain shapes which were taken into account by man when creating the roads. Moreover, later hydrotechnical interventions in the natural regime of the floodplain were also reflected in the roads creation. Both natural and anthropogenic conditions in the floodplain can be a good starting point to distinguish ancient and newer parts of roads. Their knowledge can then be another tool to make further spatial analyses leading to new findings. Here, the landscape research partly gets to the boundary of paleogeography in its geographical sense Reconstruction of the landscape for historically not very distant periods may touch, with a high detail, even relatively large areas (Fontes, 2010, Gheyle et al., 2013, Saey et al., 2013). The geographical research of landscape represents a considerable knowledge base for "landscape archeology" whether it is understood in different widths (Gojda, 2004). In its basis, the landscape research of the past thus means to a different extent a successful reconstruction of the natural or cultural landscape in a certain period according to the set of natural, economic, and social indications. (Gojda, 2000).

The paper presents an integrated analysis of old maps and aerial photographs taken in different periods. From the knowledge of the ancient road network, it is possible to derive the former property conditions, the impact of municipalities and in this case even the approximate course of the ancient centuries-old interstate border in the floodplain.

MATERIAL AND METHODS

Study of aerial imagery and map material was focused on the identification of sections of old roads and terrain shapes potentially affecting their localization and course. With some exceptions, detailed geographic study lack allowing to obtain the documents about the territory in the early medieval period of which it would be possible to deduce the territorial structure of local former Great Moravian settlement agglomeration (Culek, Ivan, Kirchner, 1999, Kolejka et al. 2016). The oldest maps of the study area of Morava river floodplain between Mikulčice and Kopčany (approximately trapezoid with the northern edge at Mikulčice - Holíč line and the southern edge on the line Moravská Nová Ves - Kopčany) are available in different quality and resolution from the year 1575 (Fabricius' map of Moravia). The set of old maps includes: Comenius' map of Moravia (1626), Cóvens-Mortier map of Moravia (1742), Seutter's map of Moravia (approx. 1750), map of the First Military Survey (1763-1787), map of the Second Military Survey (1836-1852), maps created by black-and-white and color aerial imagery and recent topographical maps of the Basic Map of the Czech Republic and Slovak Republic after 2000. A field mapping and recent colored orthophoto was used to create the land use map of the study area which serves as a reference basis for visualizing the results of analyzes of the other named materials (fig. 1). This procedure was chosen because for the location of new findings, it is suitable to use such cartographic representation of the territory that best corresponds to the current state of the territory and is well understood by a broad circle of readers.

The first reliable cartographic resource providing information on existing roads is the map of the Second Military Survey. Unlike the previous First Military Survey, they already have a quality geodetic focus which enable to better georeference them into existing coordinate systems and cartographic projections. From georeferenced maps of the Second Military Survey, the road network of that times was digitized using the on-screen method (Vojteková, 2013). The roads were then divided into two categories: 1. Curved roads leading from villages to adjacent fields and forest properties; 2. Straight roads of modern origin accompanying forest crossings, water canals (also modern ones), extensive parcels of arable land and alley roads in the neighborhood of the Holíč Castle. Their color differentiation makes possible to observe (fig. 2) probably older road network in the study area.

Aerial photographs (orthophotos) served to identify the former river side channels in an open landscape with meadows and arable land. In the wooded area, the old riverbeds were surveyed by bioindication which was used to create the forest typographical maps from the company Lesprojekt Brandýs nad Labem and using the quaternary geological maps produced by the Czech Geological Service and State Geological Institute of Dionýz Štúr (Slovakia). The resulted network of ancient riverbeds is not complete since the aerial photographs allowed mapping only part of this network because of the water and vegetation conditions at the time of taking aerial photographs. Geological and forestry mapping resulted in the generalization of field backgrounds to the final scale of 1:10 000 (vegetation) and 1:50 000 (geology). It should be noted, however, that the former riverbeds are to a large extent covered with young sediments and their present visible dimensions (especially width) are substantially smaller than at the time of active water flow.

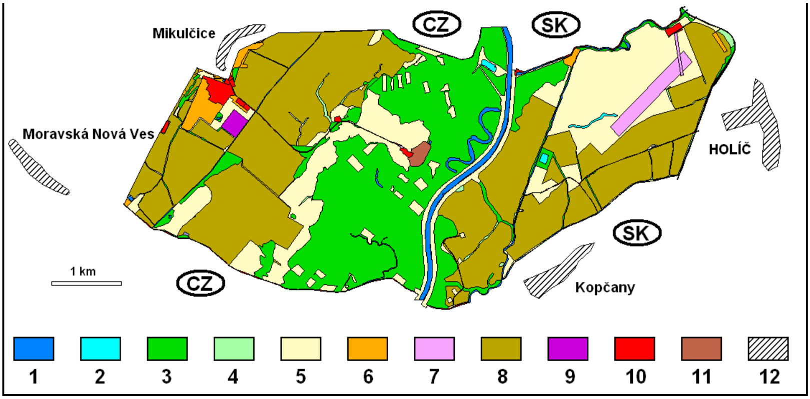


Fig. 1. Land use in the Mikulčice-Kopčany study area in 2016 (Legend: 1 - water bodies, 2 - wetlands, 3 - forests, 4 - scrubs, 5 - meadows, 6 - gardens, 7 - grassy airport, 8- arable land, 9 - solar power station, 10 - built-up area, 11 - Great Moravian fortification, 12 - historical cores of municipalities); Source: own processing.

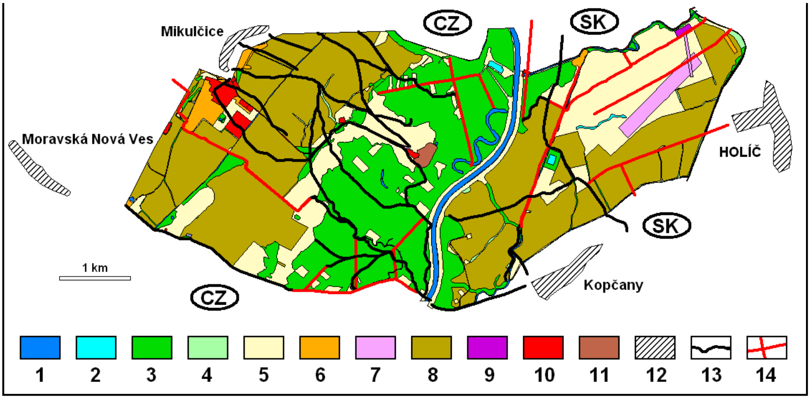


Fig. 2. Road network in the Mikulčice-Kopčany study area identified to the first half of the 19th century according to map of the Second Military Survey. It is combined with the land use map of the study area in 2016 (Legend: 1 - water bodies, 2 - wetlands, 3 - forests, 4 - scrubs, 5 - meadows, 6 - gardens, 7 - grassy airport, 8- arable land, 9 - solar power station, 10 - built-up area, 11 - Great Moravian settlement, 12 - historical cores of municipalities, 13 - curved sections of roads, 14 - straight sections of road); Source: own processing.

Similarly, their differentiated age cannot be distinguished as their sedimentary fillings have not yet been subject to a detailed dating analysis. In the created map (fig. 3), all detected segments of the old riverbeds are thus displayed. It can be assumed that the ancient road network tried to avoid both the flowing and cut-off riverbeds that prevented the construction of roads and their permanent or seasonal use. The roads of that time were therefore (probably) conducted so that the crossings with these riverbeds was used as little as possible (fords, bridges, barrages).

On the contrary, a suitable environment for the conduction of roads were and are the natural elevations of the floodplain - eolian elevations - the sand dunes with the local name “hrúdy”. These were probably created at the turn of the Pleistocene and Holocene by winding from the river sediments during the absence of a continuous vegetation cover. Probably a significant part of them was later subject to changes due to the erosion of the flowing water. The preserved dunes and their remains were not usually flooded. The highest dunes have not been flooded even under the maximum floods and have long been used for safe living. Higher dunes also served as burial grounds and were often used for leading the roads between the settled dunes. Mapping of existing dunes “hrúdy” took place through the visual interpretation of aerial photographs, geological maps, contour maps and using bioindication according to forest typological maps. Since sediments are being deposited during the floods, only portions of the original dunes protrude above the present flat surface of the floodplain. Many lower dunes are probably already covered by younger sediments and the terrain of the floodplain was leveled. Wider area of sand covered by clay can be partially revealed by bioindication. Former and existing dunes connected by the embankments have attracted the inhabitants to the conduction of roads suitable for use especially in periods of increased moisture of the surface of floodplain. It is clear from the comparison of old roads and the occurrence of ancient riverbeds and sand dunes (fig. 3) that the number of crossings of old roads and riverbeds was minimized. The roads near the crossings with riverbeds were bifurcated or connected through the bridges, fords or barrages. If sand dunes fit properly in the linking route of the inhabited places, the conduction of roads used these elevations in this landscape.

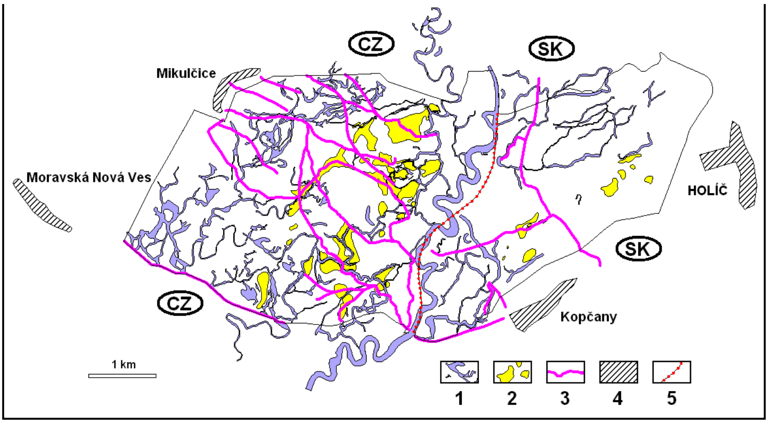


Fig. 3. Conduction of old roads in the floodplain landscape between Mikulčice and Kopčany in the context of selected natural factors (Legend: 1 - found former riverbeds, 2 - sand dunes “hrúdy”, 3 - curved sections of old roads, 4 - historical cores of municipalities, 5 - course of the current international Czech-Slovak border).
Source: own processing

RESULTS OF ANALYSES AND THEIR ASSESSMENT

If a network of existing and ancient water bodies is omitted from the road analysis, it can be seen that two different local road networks and relatively straight road connection between Kopčany and Moravská Nová Ves were created in the study area between Mikulčice and Kopčany. In addition to preserved remnants of this connecting line, this is also indicated by the shape and orientation of the cores of these municipalities. The ground plan of Mikulčice core is also oriented (bends) on the connecting line with Kopčany (fig. 4). The road from Kopčany towards south-west direction crosses the Morava River. Behind it, it is gradually ramified to the north-west direction into the fan-shaped “double-network”. Likewise, the main roads from Mikulčice are ramified leading to the east of the floodplain. They also have a fan-shape after crossing probably the originally main riverbed of meandering stream flowing from north-east to south-west parallel to the western edge of the floodplain below the slope of Mikulčice built-up area (see fig. 3). Although in this part of the study area the arable land is dominant today, in the time of the Second Military Survey in the first half of the 19th century these were meadows and pastures.

According to the oldest Fabricius' map, the great (largest) watercourse was here and formed the western edge of the great river (“Mikulčice”) island. The eastern edge was formed by a meandering stream approximately in the position of the presently artificially straight riverbed of the Morava River. Both watercourses had the same size and they dominated in this landscape according to the Fabricius' map. Depending on the road network from Mikulčice and Kopčany, it can be assumed that the two municipalities divided the island approximately by half. This in practice means that the boundary of both municipalities was at the same time an interstate border of the Lands of Bohemian Crown represented by the Margrave Kingdom of Moravia and Hungary Kingdom. This fact is testified by old maps from Fabricius, Comenius, Cóvens-Mortier, and Seutter. The fundamental changes in the hydrological system of the western part of the study area resulted in the establishment of Nesyt pond at the lower reach of the Kyjovka River, which is the right-sided tributary of the Morava River under Hodonín (into the western side of the Morava River), sometimes after the creation of the Fabricius map. On the Comenius' map, the “western” stream is weaker than the “eastern”. On the later maps until the First Military Survey, the “western” meandering stream still existed although it was weakened. The maps of military surveys show only small streams (in the map of the Second Military Survey the pond is already missing).

After 1750, the international border moved approximately to its present form. The remains of former international border are evidenced by the long-lasting forest edges found by comparing the forest boundaries in maps of the Second Military Survey and current colored orthophoto (fig. 4). To the west of this forest edge, two quite different systems of parcelling of agricultural lands can be seen. Mostly it is the system of narrow parallel parcels which are perpendicular in several belts to the drainage canal from the former Nesyt pond - the current riverbed of the Kyjovka River. It passes through a chain of sand dunes with the current road from the village to the Great Moravia Memorial to chaotic parcelling of lands of various shapes and sizes. This fact is evident both from the current cadastral map of Mikulčice and the black-and-white orthophoto from the 1950s. The former boundary is also suggested by the hooked ends of the old roads which are almost perpendicular to both ramified road networks (see fig. 4).

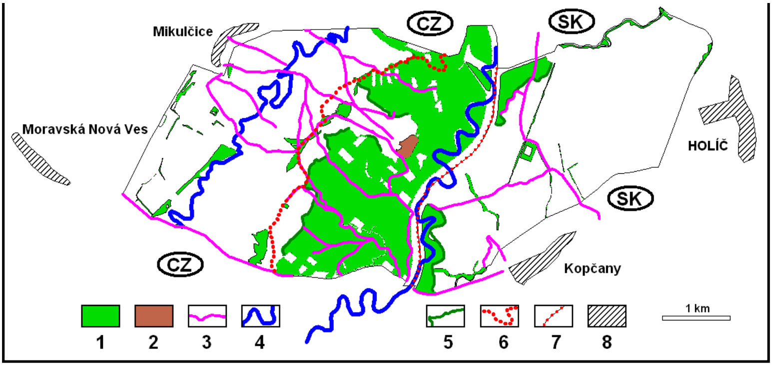


Fig. 4.: Road network in Mikulčice and Kopčany which meets in the former Mikulčice river island of the Morava River (Legend: 1 - forests, 2 - old Slavic fortification, 3 - curved sections of roads of Mikulčice and Kopčany network, 4 - presumed main side channels of the river bounding the Mikulčice river island in the past, 5 - long-lasting stable edges of forest on Mikulčice island, 6 - probable course of the Moravian-Hungarian border by mid 18th century, 7 - current course of the international Czech-Slovak border, 8 - historical cores of settlements).
Source: own processing

CONCLUSION

Integrated analysis of old maps and aerial photographs (orthophotos) often brings interesting and unexpected results that can also have practical applications. The results extend beyond to a rather distant or near undated past, they can be applied in a variety of ways when deciding on the future of the study area, which repeatedly stands for a UNESCO World Heritage List as a cross-border archaeological park. Its key part is on one hand the Great Moravia Memorial represented by the former Slavic fortification called Na Valech in Moravia/Czech Republic. On the other hand, it is the Great Moravian Church of St. Margaret Antioch and other Great Moravian sites near Kopčany in Slovakia.

The study area is covered by a number of other projects with usually practical focus for which these findings can be useful. Questions are raised for the future connection of Mikulčice and Kopčany with a pedestrian bridge crossing the Morava River in a suitable place. This should maximally respect the old road network. The possibility can be seen also in the revitalization of the territory especially the renewal of the meandering stream at the site of the presently drained Kyjovka River.

Acknowledgements: The paper was elaborated within the international project INTERREG V-A SK-CZ/2016/02 "UNESCO World Heritage Sites in the Life of Municipalities, Towns and Regions" by the cooperation of the Faculty of Education, Masaryk University in Brno and Faculty of Natural Sciences, Constantine the Philosopher University in Nitra and grant project VEGA 1/0934/17 "Land-use changes of Slovak cultural landscape over the past 250 years and prediction of its further development".

REFERENCES

CULEK, M., IVAN, A., KIRCHNER, K. 1999. Geomorphologie der Talaue der March zwischen der Napajedla-Pforte und dem Zusammenfluss mit der Thaya (Zum Naturmilieu in der Umgebung von Mikulčice und Staré Město). In: Poláček L., Dvorská J. (eds.): *Probleme der mitteleuropäischen Dendrochronologie und naturwissenschaftliche Beiträge zur Talaue der March. Internationale Tagungen in Mikulčice. Band V*. Brno: Archäologisches Institut der Akademie der Wissenschaften der Tschechischen Republik, pp. 199-221, 1999.

DRESLER, P. Cesty okolo Pohanska u Břeclavi nejen za Velké Moravy. In: Martínek J., Šmeral J. (eds.): *Výzkum historických cest v environmentálním kontextu*. Brno: Centrum dopravního výzkumu, pp. 11-18, 2012.

FALTÝNEK, K., ŠLEZAR, P. Archeologické doklady pozůstatků komunikací a dopravních staveb v Litovli. In: Martínek J. (ed.): *Výzkum historických cest v environmentálním kontextu II*. Brno: Centrum dopravního výzkumu, pp. 24-28, 2014.

FONTES, L. Mountain Landscapes and Landscape Archaeology in Northwest Portugal. In: *Living Landscapes. The European Landscape Convention in Research Perspective*, 18-19 October, Florence, Conference Materials, Volume I, Bandeccho and Vivaldi/UNISCAPE, Pontedevs/Firenze, pp. 204-226, 2010.

GHEYLE, W., DOSSCHE, R., BOURGEOIS, J., STICHELBAUT, B., EETVELDE, V. V. Integrating Archaeology and Landscape Analysis for the Cultural Heritage Management of a World War I Militarised Landscape: The German Field Defenses in Antwerp. *Landscape Research*, vol. 39, no. 6, pp. 502-522, 2013. https://doi.org/10.1080/01426397.2012.754854

GOJDA, M. *Archeologie krajiny*. Praha: Academia, 2000. 238 p.

GOJDA, M. Landscape Archaeology. In: *Knowledge for Sustainable Development. An Insight into the Encyclopedia of Life Support Systems*. Volume 1. Oxford: UNESCO Publishing – Eolss Publishers, pp. 723-741, 2004.

KOLEJKA, M., BOLTIŽIAR, M., SVATOŇOVÁ, H., VOJTEK, M., OLÁHOVÁ, J. Possible interpretations of old and thematic maps and aerial photographs for identification of conserved elements of the cultural landscape of Great Moravia in Mikulčice and Kopčany surroundings. In: Lněnička, L. (ed.): *Central Europe Area in View of Current Geography*. Brno: PF MU v Brne, pp. 41-49. 2016

KVĚT, R. Alte Wege im Marchtal von dem Engpass bei Napajedla bis zum Zusammenfluss mit der Thaya. In: Poláček L., Dvorská J. (eds.): *Probleme der mitteleuropäischen Dendrochronologie und naturwissenschaftliche Beiträge zur Talaue der March. Internationale Tagungen in Mikulčice. Band V*. Brno:

Archäologisches Institut der Akademie der Wissenschaften der Tschechischen Republik, pp. 223-226, 1999.

POLÁČEK, L. *Mosty a říční archeologie v Mikulčicích (teze)*. Přehled výzkumů 53, no. 2, Brno: Archeologický ústav AV ČR, pp. 23-38, 2012.

SAEY, T., STICHELBAUT, B., BOURGEOI J., EETVELDE, V. V. MEIRVENNE, M. V. An Interdisciplinary Non-invasive Approach to Landscape Archaeology of the Great War. *Archaeological Prospection*, vol. 20, no. 1, pp. 39-44, 2013.

VOJTEKOVÁ, J. *Trendy vývoja banskej krajiny na hornom Ponitrí [Trends in Development of Mining Landscape in the Upper Nitra Region]*. Nitra: UKF v Nitre, 2013. 152 p.

Shrnutí

Předkládaný příspěvek nabízí jeden z možných přístupů rekonstrukce starých cest využitím integrované analýzy starých map a leteckých snímků pořízených v různých obdobích několika let na příkladu dolního Pomoraví v okolí Mikulčic a Kopčan. Ze znalosti dávné cestní sítě lze odvozovat i dřívější majetkové poměry a dosah vlivu obcí, v daném případě dokonce přibližný průběh dávné staleté mezistátní hranice v rovině nivy. Vedení cest v území lze označit za poměrně konzervativní vlastnost krajiny, alespoň v podmínkách střední Evropy. Svědčí o tom klikatý průběh dnešních silnic, a to i v rovinaté krajině, kde není zřetelná překážka pro jejich přímočaré vedení na dlouhých úsecích. Cesty tak pravděpodobně respektují dávné rozmístění a hranice polností, které povětšině po spojení políček do velkých parcel již zaniklo. Průběh cest se však zachoval a vede k představě, že uchování průběhu cest patří ke konzervativnímu chování lidské společnosti. Otázkou zůstává, po jak dlouhou dobu se vedení dávných cest v krajině uchovává. Lze si totiž rovněž představit, že radikální politické a hospodářské změny (a přesuny) v minulosti, vedly nové vlastníky, resp. uživatele velkých polností k revizi cestní sítě ve svých doménách směrem k jejich efektivnějšímu a zpravidla zkrácenému provedení zejména s ohledem na místní centrum politické a hospodářské moci a konkrétní ekonomické záměry. Současně lze rovněž do jisté míry počítat s představou, že ani zásadní přeměna cestní sítě nevedla k její úplné přestavbě. Vždy alespoň některé úseky cestní sítě tlaku změn „odolaly“.

Rovinatá krajina v dolním Pomoraví, reprezentovaná nivou řeky Moravy, prodělala v okolí Mikulčic a Kopčan četné změny v souvislosti jak s vývojem vlastní nivy, tak jejím využíváním člověkem od nejstarších dob po současnost. Vzhledem k tomu, že jde o inundační území řeky Moravy, fluviální procesy vedly ke vzniku typických tvarů reliéfu, které byly člověkem zohledněny při vedení cest. Také pozdější hydrotechnické zásahy do přírodního režimu nivy se rovněž odrazily ve vedení cest. Zohlednění jak přírodních, tak antropogenních podmínek působících v nivě mohou být vhodným východiskem k odlišení dávných a novějších úseků cest. Jejich znalost pak může být další pomůckou k realizaci dalších prostorových analýz vedoucích k novým zjištěním.

Integrovaná analýza starých map a leteckého snímkového materiálu tak přináší mnohdy zajímavé a neočekávané výsledky, které mohou nalézt také i praktické uplatnění. Výše demonstrované výsledky sice přesahují svým obsahem spíše do vzdálené, či blízké nedatované minulosti, avšak se mohou rozmanitým způsobem uplatnit při rozhodování o budoucnosti zájmového

území. To opakovaně kandiduje na zápis do seznamu Světového přírodního a kulturního dědictví UNESCO jako přeshraniční archeopark. Jeho klíčovou součásti je jak Památník Velké Moravy bývalého slovanského hradiště Na Valech na Moravě/Česká republika, tak stojící velkomoravský kostelík sv. Margity Antiochijské v sousedství dalších velkomoravských nalezišť u Kopčan na Slovensku.

ANALYSES OF AVAILABILITY USING GIS TAKING INTO CONSIDERATION OF REAL TERRAIN

Matej Močko, Martina Zigová, Michal Ševčík, Imrich Jakab

Constantine the Philosopher University in Nitra, Tr. A. Hlinku č. 1, 949 74 Nitra

matej.mocko@ukf.sk, martina.zigova@ukf.sk, michal.sevcik@ukf.sk, ijakab@ukf.sk

Abstract: Term “availability” is most often understood as easiness of achieving a site or a services from other places which can be measured as e. g. distance, travel costs or time duration. Despite of broad usage, distance calculating is often methodically incorrect because it takes place in two-dimensional environment. This causes distortion of results which are in fact three-dimensional.

In our paper we focus on calculating real spatial and time distance with considering a fact that real world is not two-dimensional and terrain has often many characteristics and terrain roughness. Calculations are made on road network and hiking trails in High Tatras Mountains by use of our own tool which uses functions of GRASS GIS software. Final map layers are described and overlaid with services, tourist places of interest and phenomena of High Tatras Mountains.

Key words: cumulative availability, GIS, 3D dimension, tourism, High Tatras

INTRODUCTION

One of the basic definitions of the term “availability” is “Availability is most often understood as the ease of site or services achieving from other places, which can be measured as a distance, travel costs or time duration”, formulated by Clark (1990). Availability is an important indicator, which enables measuring of an accessibility of a certain locality. It improves the quality of life by facilitating access to various options, commodities, services, as well as a participation in social and cultural events.

The method of availability determination was evolving simultaneously with its importance. For this purpose, indicators of availability are used. Thoroughgoing research and analyses of availability may improve the localization of objects of interest and lead to more rational spatial organization of human society, mainly of the infrastructure (Tolmáči, 1998).

An overview of various ways and approaches of availability measuring and applications to different issues, are described in many papers, such as Tolmáči (1998, 2002), Geurs & Ritsema van Eck (2001), Spiekermann & Neubauer (2002), Geurs & van Wee (2004), Scheurer & Curtis (2007), Gutiérrez (2009).

One of the first approaches for availability measurement were index methods, e.g. Fatigue index by Hůrský (1969). These methods have evolved over some time. It was, in the first place, caused by radical development in transport sphere connected with economic progress and, in the second place, by emergence of new computer technologies, which make the measurement of availability significantly simpler, and at the same time, more complex and sophisticated (Ludwig, 2016). Križan & Gurňák (2008) and Tolmáči (2002) attach the formation of new availability research directions to development and expansion of analysis tools, especially in the field of geographic information systems (GIS).

Analyses of availability can be performed in the GIS using either vector or raster-based representation. In general, depending on the grid resolution, raster and vector networks are capable of performing the same spatial operations and analyses. In both cases the flow of movement, either from node to node in a network, or from cell to neighbouring cell of a raster, is subject to resistence determining the direction and speed of flow. The way this resistance is modelled differs from vector to raster (Husdal, 1999).

The most basic way to measure spatial availability is a use of a buffer zone, defined by a radius of the maximal set Euclidean distance around an object of interest (Nicholls, 2001; Ford et al., 2015). This method was mainly used in earlier research (Hansen, 1959; Lowry, 1964). However, this approach deals with several problems. Availability is expressed approximately only as a straight air-line distance or movement, but this is, in fact, not possible. The movement is beforehand predefined by the infrastructure, traffic rules and necessity of avoiding obstacles, what causes an increase of the actual length of a route (Nicholls, 2001).

In either raster or vector representations, similar pathfinding algorithms are used (Husdal, 1999). From many algorithms that exists (A*, Bellman–Ford, Floyd–Warshall, etc.), the most commonly used is the Dijkstra's algorithm (Dijkstra, 1959). Dijkstra's algorithm has a lot of variants, but in general it is tree-based method of finding shothest path in weighted oriented graphs.

In the most of scientific literature is availability often measured as a physical distance or a travel duration (Sotoudehnia & Comber, 2011). However, despite the widespread use, the distance computations are oftentimes methodically incorrect. They are performed in a 2-D environment and there is no consideration of properties and altitude of a terrain.

This has the distortion effect on final results, because in the real world the route has a three-dimensional character. This fact has a great impact particularly in mountainous or alpine environments, where the differences between 2D and 3D distances (expressed in meters or in time unit) can be greatly significant.

MATERIALS AND METHODS

Aim of our paper is to demonstrate innovative option of the availability computation on a practical example, which is based on cumulative computation using entire transport network in a three-dimensional environment.

Instead of commonly used vector representation, for the availability analyses raster data modeling was used. Working with the network as a 3D object provides considerable advantages and raster representation also simplifies network complexity. The main advantage of raster representation are the fixed, implicitly saved relations between individual cells, allowing us to easily obtain amount of needed data. To obtain a three-dimensional availability, is necessary to include transport network slopes into the computation. This data can be acquired by basic geomorphological analyses of a digital terrain model. Based on the set terrain attributes, it is now possible to compute the real distance using a trigonometry and map algebra. The output is the real distance of each cell that must be travelled. This information is saved in every single cell of entire transport network. This network uses the Dijkstra's algorithm as an input for computing minimum cumulative costs layer. The identification of the shortest real distance from initial to final coordinates is possible by selecting a route with the lowest value of distance. This value is simply calculated as a sum of distance values of all cells in each of the possible routes.

In our paper we implement, on a practical example, our suggested approach to the availability analysis. The example is situated in the central part of the High Tatras. The selection of objects of interest was inspired by the TANAP national park press release from 03.08.2017 (State Forests of TANAP, 2017). From this press we have selected 6 the most frequently visited places by hikers in the High Tatras (without use of cableways and rack railway):

1. Popradské pleso (tarn),
2. Hrebienok (mountain),
3. Rysy (mountain),
4. The chalet at the Zelené pleso tarn,
5. The mountain hotel Sliezsky dom,
6. Kriváň (peak).

The availability of these objects of interest was computed and expressed in a relation to 15 railway stations located in near neighborhood.

For the availability analyzes, procession and visualization of geospatial data, the GRASS GIS system (Geographical Resources Analysis Support System) was used. GRASS GIS represents a complex GIS solution with raster, topological vector, image processing and graphics production functions (GRASS Development Team, 2017).

Following input map layers were used:

• Vector layer of the transport network (OpenStreetMap, 2017),

• Digital terrain model (DTM) with 25 m spatial resolution (European Digital Elevation Model, 2017).

Based on DTM parameters, the spatial resolution of 25 m was used for the cumulative availability computation, as well as the production of output maps.

RESULTS

The primary output is a map of cumulative availability computed in a 3D environment (Fig. 1). Every pixel of this output raster map carries its own information about its metric availability from the initial point within the network. On the map, the metric availability can be exactly defined for any part of the network. It is thus possible to apply it to different objects and phenomena located near any part of the transport network.

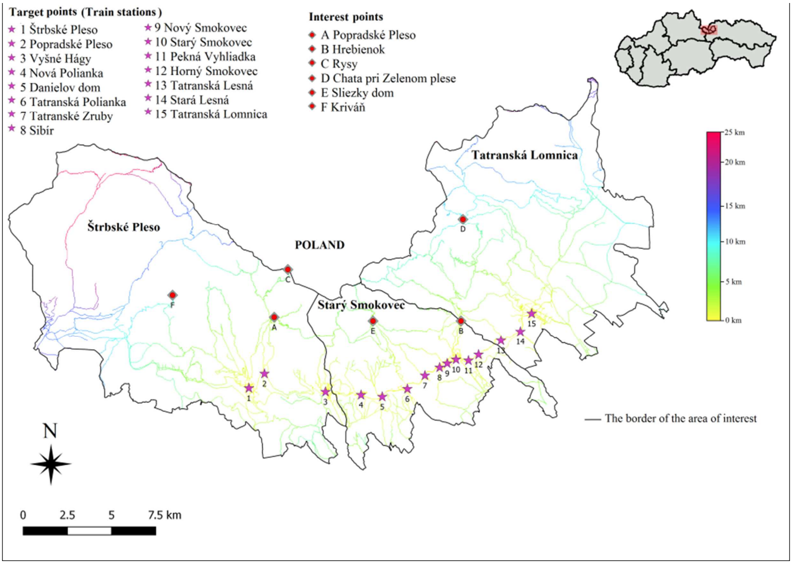


Fig. 1. Cumulative availability map in 3D environment.

The availability was computed from selected railway stations to six of the most tourists visited allurements of the High Tatras.

Identical cumulative availability maps were computed individually from every railway station. Afterwards, we have created a Table 1, in which is possible to identify distances from every railway station to all objects of interest representing the most visited places in High Tatras.

Tab. 1: Distances of objects of interest from railway stations

		Popradské Pleso	Hrebienok	Rysy	Chata pri Zelenom plese	Sliezsky dom	Kriváň
Štrbské pleso	2D distance (in m)	4800,80	17680,64	8629,45	24845,72	13085,69	9524,54
	3D distance (in m)	5175,78	19454,42	15809,39	24861,01	13111,43	11298,14
Popradské pleso	2D distance (in m)	3692,19	16516,77	7520,84	23737,12	11977,09	11467,37
	3D distance (in m)	3980,58	18173,80	13778,39	23751,72	12000,64	13602,75
Vyšné Hágy	2D distance (in m)	8778,82	11027,84	12769,19	19633,89	8281,33	16115,43
	3D distance (in m)	9464,52	12134,19	23393,51	19645,97	8297,62	19116,35
Nová Polianka	2D distance (in m)	11067,98	8712,18	15058,35	17318,23	7536,11	18404,60
	3D distance (in m)	11932,49	9586,22	27587,32	17328,89	7550,94	21831,79
Danielov Dom	2D distance (in m)	12352,73	7422,65	16343,10	16028,70	6246,58	19689,34
	3D distance (in m)	13317,58	8167,31	29941,01	16038,56	6258,87	23355,77
Tatranská Polianka	2D distance (in m)	12065,90	5867,86	16295,59	14473,92	4793,58	21319,41
	3D distance (in m)	13008,35	6456,55	29853,98	14482,82	4803,01	25289,38
Tatranské Zruby	2D distance (in m)	12887,61	4378,16	17117,31	12984,22	4601,43	22743,08
	3D distance (in m)	13894,25	4817,40	31359,39	12992,21	4610,48	26978,15
Sibír	2D distance (in m)	13885,35	3303,52	18115,05	11909,57	5599,17	23821,85
	3D distance (in m)	14969,92	3634,94	33187,28	11916,90	5610,19	28257,81
Nový Smokovec	2D distance (in m)	13922,79	2818,10	18152,48	11424,15	5636,61	24354,18
	3D distance (in m)	15010,28	3100,82	33255,86	11431,18	5647,70	28889,27
Starý Smokovec	2D distance (in m)	14478,54	2476,11	18708,24	11082,17	6192,37	24911,22
	3D distance (in m)	15609,44	2724,53	34274,02	11088,99	6204,55	29550,03
Pekná Vyhliadka	2D distance (in m)	15301,00	3142,57	19530,69	11748,62	7014,82	25733,67
	3D distance (in m)	16496,14	3457,84	35780,77	11755,85	7028,61	30525,64
Horný Smokovec	2D distance (in m)	16023,61	3865,18	20253,31	12471,24	7737,43	26456,29
	3D distance (in m)	17275,19	4252,95	37104,63	12478,91	7752,65	31382,81
Tatranská Lesná	2D distance (in m)	17676,21	4113,68	21905,90	11588,58	9390,03	28108,88
	3D distance (in m)	19056,87	4526,38	40132,22	11595,71	9408,50	33343,14
Stará Lesná	2D distance (in m)	18942,15	4950,86	23171,84	10336,97	10655,97	29374,83
	3D distance (in m)	20421,69	5447,55	42451,47	10343,33	10676,93	34844,82
Tatranská Lomnica	2D distance (in m)	20399,94	6402,85	24629,64	9678,70	12113,76	30832,62
	3D distance (in m)	21993,35	7045,21	45122,18	9684,66	12137,59	36574,08

Based on this, data recorded in Table 1, is possible to determine the degree of suitability for use of the individual stations to visit selected objects of interest. In this case, availability is expressed only as the travelled distance without consideration of time, which is needed for overcoming the elevation. As the most suitable starting station for visiting all the most visited places of the High Tatras appears to be Popradské pleso station, because the sum of all distances between this station and all objects of interest is 121.41 km. The worst localization has Tatranská Lomnica station with the sum of distances 132.6 km.

The 2-D availability of objects of interest from all individual stations is recorded in Table 2. The biggest differences between two-dimensional and three-dimensional availability computation were showed on case of Rysy mountain availability from Tatranská Lomnica station, where the difference is 20.5 kilometers. That means, that 45.5% of route length is not projected on common two-dimensional maps (Fig. 2). Vice versa, the smallest difference was shown on the availability of the chalet at the Zelené pleso tarn from Tatranská Lomnica station. In this case, 2-D map projection causes only 6 meters loss (0.06%) of the route.

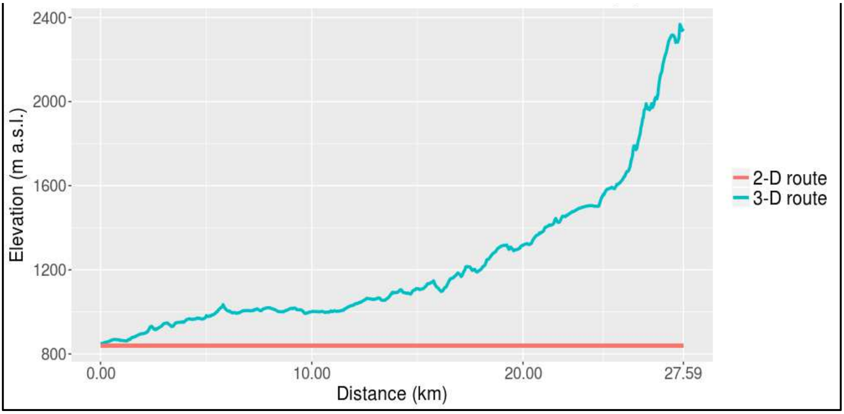


Fig. 2. Profile of 2-D and 3-D route from Tatranská Lomnica station to Rysy.

The next step of our research was a time availability computation (Fig. 3). Also in this case, results of 2D and 3D availability were compared. For 3-D time availability computation, time penalties were added to all pixels of cumulative map. These penalties correspond to differences between real 3D and distorted 2D distances. This conversion gives us more accurate time availability results computed on real lengths of hiking trails in 3D environment. The results and their comparison with 2D environment are recorded in Table 2.

Analogous to distances results, time availability differences were the greatest at the availability of Rysy from Tatranská Lomnica station. Time availability difference was 3 h and 47 min. (45,5%). The smallest difference was in availability of Hrebienok mountain from Starý Smokovec station – 7 min. (11,1%).

Based on time availability data, recorded in Table 2, it is also possible to determine the degree of suitability for use of the individual stations to visit all objects of interest, but from the point of view of time duration. The most suitable starting station is Popradské pleso station, which is the same as in case of distances results with the sum of time duration 33 h and 43 min. The worst localization has also the same station – Tatranská Lomnica station with the sum of 43 h and 36 min.

Tab. 2: Time cumulative availability of objects of interest from railway stations

		Popradské Pleso	Hrebienok	Rysy	Chata pri Zelenom plese	Sliezsky dom	Kriváň
Štrbské pleso	2D time (in min)	89	246	235	466	272	235
	3D time (in min)	109	290	412	548	346	361
Popradské pleso	2D time (in min)	71	234	216	453	259	266
	3D time (in min)	83	280	386	539	336	399
Vyšné Hágy	2D time (in min)	165	160	310	380	186	349
	3D time (in min)	206	179	509	438	235	500
Nová Polianka	2D time (in min)	200	132	346	352	157	384
	3D time (in min)	244	148	547	407	205	538
Danielov Dom	2D time (in min)	221	118	367	338	144	406
	3D time (in min)	269	131	572	390	188	563
Tatranská Polianka	2D time (in min)	243	100	389	319	127	428
	3D time (in min)	293	111	596	369	169	587
Tatranské Zruby	2D time (in min)	260	79	406	298	123	445
	3D time (in min)	312	87	615	346	164	606
Sibir	2D time (in min)	275	65	421	284	136	460
	3D time (in min)	328	72	631	331	179	622
Nový Smokovec	2D time (in min)	282	59	428	278	136	466
	3D time (in min)	335	66	638	323	185	629
Starý Smokovec	2D time (in min)	289	55	435	270	143	473
	3D time (in min)	343	61	646	316	193	637
Pekná Vyhliadka	2D time (in min)	302	65	448	259	157	487
	3D time (in min)	360	76	663	301	210	654
Horný Smokovec	2D time (in min)	313	76	459	251	168	498
	3D time (in min)	373	89	676	291	223	667
Tatranská Lesná	2D time (in min)	338	83	484	231	192	523
	3D time (in min)	402	95	705	266	252	696
Stará Lesná	2D time (in min)	360	99	505	217	214	544
	3D time (in min)	428	117	731	247	278	722
Tatranská Lomnica	2D time (in min)	380	119	526	201	235	565
	3D time (in min)	450	139	753	230	300	744

The advantage of cumulative time availability map is that it allows the quantification of availability for any location on the entire transport network, which may have convenient and practical use. In addition, if we use simple interpolation methods, we are able to visualize the availability expressed across the board in the immediate vicinity of communication. If settlements are located near the communications, with an overlay of map layers we can define the degree of availability for every part of a settlement. In our case, we have used the layer of services, specifically layer of chalets, instead of settlements layer (Fig. 3).

If we overlay this layer of availability with a layer of any services located in area of interest, we can easily an exactly express the availability of these services from railway stations.

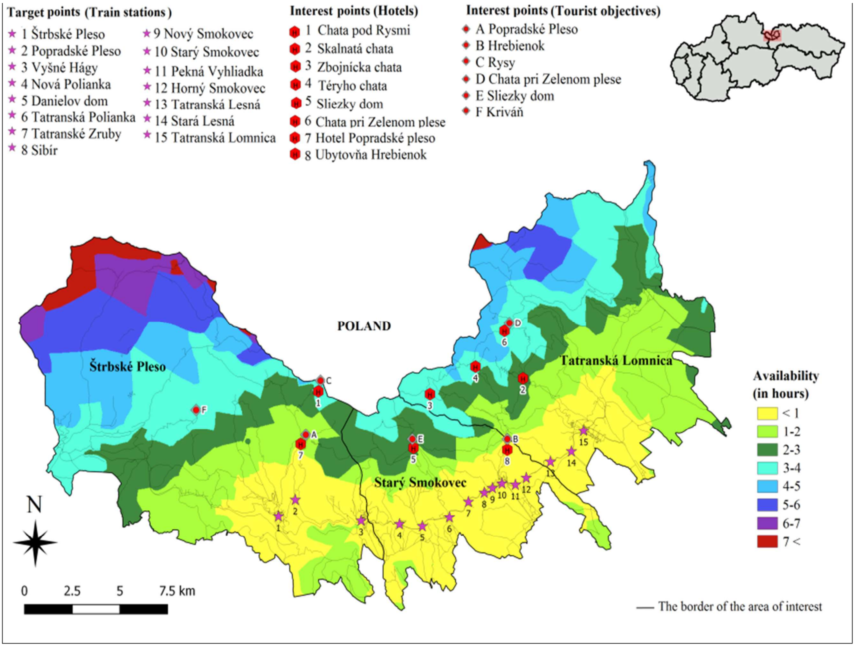


Fig. 3. Availability of objects of interest from railway stations.

DISCUSSION

Our approach is based on multiple interlocked specifics. The first is, that the computation works with cumulative availability indicators. Cumulative availability, according to Tolmáči (1998), is one of the basic availability indicators, which is used in many scientific papers. This indicator expresses a position of selected settlement (node) against the other by a sum of qualitative characteristics. These are expressed as a time interval, a distance in kilometers, travel costs etc., between all settlements.

In practice, graph theory is currently mostly used for the availability analyses purpose. In much of cases, it is the availability computation for a single node in relation to the network. Our approach allows cumulative availability computation for every part of the network, independent on its size. That means, that it's possible to identify degree of cumulative availability for any part of the network in relation to a selected node. In our case, we use raster data models in GIS for computation. From this perspective, it is more convenient to replace the term "node" with the term "point" or "feature". However, this point may consist of more other points, lines or polygons. An example can be a city park. The availability is then solved as a distance to the city park as a geo-object, but not as a point, or a node.

Our approach to the cumulative availability computation for the entire transport network was inspired by authors Bugya, Szabó & Kiss (2011). They have developed a tool for the computation of health care availability in two-dimensional environment. Cumulative availability results for the whole network allow its quick categorization, according to required levels, and simple reusability, if the final points are changed. The biggest disadvantage, following from the graph theory, is the fact, that this method simplifies the network to a two-dimensional object and works with it in that way. However, the real network is subordinated to terrain attributes. Terrain is, in many cases, considerably curvy and this may cause in several spheres (e.g. hiking in mountainous terrain), distortion and significant undervaluation of the final results.

Our approach is aimed directly on this issue and we work with the transport network as a three-dimensional object. For this purpose, is necessary to have, besides the network and the initial and final coordinates, also terrain elevation, slope size and slope length data for all potential routes or the entire network.

Based on the requirements of the cumulative availability computation for the whole network, which is presented as 3D object, much easier for us was to use the raster data modeling instead of common vector representation. The basic input layer is the DTM and just simple geomorphological analyses are required to acquire needed data, which are implicitly saved in cells.

However, raster representation also has several issues. The widespread disadvantage of raster analyses is, that the quality of outputs heavy depends on the DTM resolution quality. Therefore, for the high-quality outputs is necessary to use raster with high resolution, which demands greater technical requirements and increases the processing time. For the computation of time availability, with use of raster data models, we use GIS tools, which compute anisotropic cumulative cost of moving between different geographic locations. The input is an elevation raster map layer, whose cell category values represent elevation data, combined with an input raster map layer and the cell values represent friction cost. Our availability computing method assumes use of hiking trails. Therefore, the time penalties caused by passing through the difficult terrain (e.g. bodies of water) are not necessary to account. Instead of that, to express the difference between the real three-dimensional and distorted two-dimensional distances, we use a friction cost parameter, which represents the time penalties. This conversion will give us a more accurate time availability computed on the real lengths of the hiking trails in a three-dimensional environment.

CONCLUSION

Availability analysis, with the use of GIS, can find application anywhere the distance or time component of availability plays the role. As we tried to point out to our example, the utilization of the availability analysis can have considerable importance for tourism.

Tourism is one of the fastest developing business sectors in the world, with indisputable economic benefits for its country. It is closely connected with the offer of recreational, historical and cultural relaxation, which a certain area offers. Besides the offering of services, it must also be available for visitors. Location of activities in the vicinity of the transport infrastructure can save time and travel costs of visitors, and in this way, attract their attention (Štefancová, 2016). Exactly in this part of tourism development process is necessary to broach the issue of the availability of certain region or specific area of interest.

However, we can also find direct use of availability in areas related to the administration of the country, in urban planning, evaluation of ecosystem services and, overall, in the fields of logistics, transport etc.

The added value of our approach on cumulative distances expression is distance computing on a three-dimensional transport network. The terrain curvature is also considered, which in the mountain and alpine environment significantly increases the distances of the transport networks. Based on this, computation of availability is more accurate and closer to reality than the two-dimensional map projection.

Acknowledgements: The work was supported by the projects VEGA 1/0608/16 and KEGA 025UKF-4/2015.

REFERENCES

BUGYA, T.; SZABÓ, G.; KISS, K. *Ambulance* [software] [access. 26. 09. 2011].

CLARK, A. N. *The Penguin Dictionary of Geography*. Harmondsworth: Penguin, 1990.

DIJKSTRA, E. (1959). A note on two problems in connexion with graphs. *Numerische Mathematik*, 1 (1), 269-271 https://doi.org/10.1007/BF01386390

European Digital Elevation Model, 2017 [online]. [access. 15. 07. 2017] <http:// www.eea.europa.eu/data-and-maps/data/eu-dem#tab-gis-data/>

FORD, ALISTAIR C., BARR, STUART L.; DAWSON, RICHARD J.; JAMES, PHILIP. Transport Accessibility Analysis Using GIS: Assessing Sustainable Transport in London*. ISPRS International Journal of Geo-Information*, 2015, 4.1: 124-149.

GEURS, K. T.; RITSEMA VAN ECK, JAN R. *Accessibility Measures: Review and Applications.* Evaluation of accessibility impacts of land-use transportation scenarios and related social and economic impact. 2001.

GEURS, KARST T.; VAN WEE, B. Accessibility Evaluation of Land-use and Transport Strategies: Review and Research Directions. *Journal of Transport geography*, 2004, 12.2: 127-140.

GRASS Development Team, 2017 [online]. [access. 22. 09. 2017] <http:// grass.osgeo.org/grass72/manuals/>

GUTIÉRREZ, J. *Transport and Accessibility.* International encyclopedia of human geography, 2009, 1: 410-417.

HANSEN, W. G. How Accessibility Shapes Land Use*. Journal of the American Institute of planners*, 1959, 25.2: 73-76.

HUSDAL, J. *Network analysis – network versus vector – A comparison study*. Unpublished course paper for the MSc in GIS. University of Leicester, UK, 1999.

HŮRSKÝ, J. *Methods of Graphic Representation of Commuting to Work*. Academia, 1969. ČSAV discussions, series of mathematical and nature sciences, 79 (3), Academia, Praha.

KRIŽAN, F., GURŇÁK, D. Selected Cartographic and Graphic Methods of Availability Representation. *Acta Facultatis rerum naturalium Universitatis Comenianae Geographica*, 2008, 51.

LOWRY, I. S. *A Model of Metropolis*. Santa Monica, CA: Rand Corporation, 1964.

LUDWIG, M. *Transport Availability of Tourist Attractions in Czech-Liepzig Region.* Banská Bystrica, Diploma thesis. University of Matej Bel in Banská Bystrica. Department of tourism and hospitality. 2016.

NICHOLLS, S. *Measuring the accessibility and equity of public parks: A case study using GIS.* Managing leisure, 2001, 6.4: 201-219.

Openstreetmap, 2017 [online]. [access. 02. 09. 2017] <http://www.openstreetmap.org/>

SCHREURER, J., CURTIS, C. *Accessibility Measures: Overview and Practical Applications.* Department of Urban and Regional Planning, Curtin University, 2007, 52.

SOTOUDEHNIA, F., COMBER, L. *Measuring Perceived Accessibility to Urban GreenSpace: An Integration of GIS and Participatory Map*. Paper presented at the AGILE, April 18-22, 2011.

SPIEKERMANN, K., NEUBAUER, J. *European accessibility and peripherality: Concepts, models and indicators*. Nordregio, 2002.

ŠTEFANCOVÁ, K. *Availability of Selected Turist Attractions in Stredné Považie Region.* Bratislava, 2016. Bachelor thesis. Comenius University in Bratislava. PriF PriF. KRGOPK.

State Forests of TANAP. *Nearly 20 000 Tourists were Counted* [online]. [access. 26. 09. 2017] <http://www.lesytanap.sk/sk/tlacovespravy/sprava/naratali-takmer-dvadsattisic-turistov/>

TOLMÁČI, L. Measures of Availability, Conception of Term and Theoretical Basis. *Acta Facultatis Rerum Naturalium Universitatis Comenianae, Geographica*, 1998, 41: 175-191.

TOLMÁČI, L. *Availability of Slovak Towns and Cities.* Mapa Slovakia Škola, 2002.

Shrnutí

Účelom príspevku je prostredníctvom praktického príkladu poukázať na možnosti inovatívneho prístupu k výpočtom analýz dostupnosti. Inovatívnosť nášho prístupu je založená na niekoľkých na seba nadväzujúcich špecifikách.

Prvým je skutočnosť že počítame s kumulatívnymi ukazovateľmi dostupnosti. Nami používaný prístup umožňuje výpočet kumulatívnej dostupnosti pre každú časť siete nezávisle od jej veľkosti. To znamená, že pre ľubovoľnú časť siete vieme identifikovať mieru jej kumulatívnej dostupnosti vo vzťahu k vybranému miestu. Ďalším špecifikom je počítanie so skutočnými

vzdialenosťami v 3D priestore. Pre zjednodušenie komplexnosti dopravných sieti a pre značné výhody práce so sieťou ako s 3D objektom, sme pre analýzy dostupnosti, miesto bežne používanej vektorovej reprezentácie, použili rastrové dátové modelovanie. Hlavnou výhodou rastrovej reprezentácie sú hlavne nemenné implicitne uložené vzťahy medzi jednotlivými bunkami, čo nám umožňuje ľahko získať množstvo potrebných údajov. Pre získanie 3-D vzdialenosti do výpočtu zarátavame aj sklony danej dopravnej siete získané základnými geomorfologickými analýzami digitálneho modelu reliefu. Do výpočtov konečnej časovej dostupnosti teda vstupujú reálne vzdialenosti čím sa výpočet dostupností stáva presnejším a bližším k realite v porovnaní so zobrazeniami, ktoré ponákajú dvojrozmerné výpočty a dvojrozmerné mapy.

V článku implementujeme nami navrhovaný prístup analýzy dostupností do konkrétneho praktického príkladu situovaného do centrálnej časti Vysokých Tatier. Inšpiráciou pre výber záujmových lokalít bola tlačová správa TANAPu, v ktorej bolo vyčlenených 6 turistami najnavštevovanejších miest Vysokých Tatier: Popradské pleso, Hrebienok, Rysy, Chata pri Zelenom Plese, Sliezky dom a Kriváň. Dostupnosť týchto záujmových lokalít sme počítali a vyjadrovali vo vzťahu k 15 železničným staniciam situovaných v blízkom okolí. Pre analýzy dostupnosti, ako aj pre spracovávanie a vizualizáciu geopriestorových dát bol použitý systém GRASS GIS. Výsledky poukazujú na významný rozdiel pri počítaní dostupností v trojrozmernom prostredí oproti pôvodným 2D postupom. Najväčší rozdiel sa prejavil pri dostupnosti Rysov od železničnej stanice Tatranská Lomnica, kde rozdiel medzi 2D a 3D výpočtom predstavuje až 20,5 km. V percentuálnom vyjadrení to znamená že 45,5% dĺžky trasy nie je zobrazených na tradičných dvojrozmerných mapách. Táto skutočnosť sa premietla aj do výpočtov časovej dostupnosti kde nám vyšiel rovnaký 45,5% rozdiel oproti pôvodným 2D výpočtom. Nami navrhovaný postup dostupnosti môže upresniť výpočty časovej dostupnosti, najmä v horskom a vysokohorskom prostredí, ktoré je špecifické vysokými hodnotami sklonov reliéfu.

THE COMPUTATION OF REAL AREA USING GIS DEMONSTRATED ON MANAGEMENT OF INVASIVE PLANTS

Michal Ševčík, Petra Gašparovičová, Martina Zigová, Tomáš Rusňák, Imrich Jakab

Constantine the Philosopher University in Nitra, Tr. A. Hlinku č. 1, 949 74 Nitra

michal.sevcik@ukf.sk, petra.gasparovicova@ukf.sk, martina.zigova@ukf.sk, tomas.rusnak@ukf.sk, ijakab@ukf.sk

Abstract: Area size information belong among the most basic spatial data attributes. They are not only a part of most geographical studies, but also many documents, conceptions, plans, strategies or activities connected with conservation and protection of the environment. In the most cases, area is computed as 2-D surface without consideration of terrain roughness, which is not equal to reality and this may cause significant distortion of real state. The aim of our study is to compute the real 3-D area using raster analysis on digital terrain model (DTM) and to demonstrate the difference between conventional approaches used. Practical possibilities of use of this approach are demonstrated on the real examples of management of invasive plant species.

Key words: the real area, three-dimensional area, invasive plants, geographic information systems, digital terrain model

INTRODUCTION

Area size information belong among the most basic spatial data attributes. In present, almost every GIS software (QGIS, ArcGIS, Grass GIS, Saga GIS etc.) provides options for area size computation. The major problem lays in fact that commonly used tools work with the area as a 2-D object. The real world is three-dimensional, where every surface has its own specific character and attributes. However, this is not taken into consideration and final results are becoming distorted.

Area size information take place in a plenty of documentations, conceptions, plans, strategies and activities connected with conservation and protection of the environment or any kind of activities related to a land-use. The area information also enters the land adjustment, exploring of the landscape structure, spatial statistics, trends of development and land-use planning or the management of invasive plants in theoretical and practical level as well.

The management of these plant species is not only time-consuming, but also requires huge amount of material resources and financial funds. In the most cases, sources of these finances are the State budget, donations of sponsors, foreign projects, etc. (Cvachová & Gojdičová, 2003). The European Union spends about 12 billion EUR annually for invasive species control and elimination of the damage they have done. This amount of funds continues to grow every year. Based on The State Nature Conservancy of the Slovak Republic data, the number of sites with the presence of these species arises every year (www.sopsr.sk). Their expansive spreading is observed especially on disused or disturbed sites and along highways and watercourses. As other linear elements in the landscape, rivers represent important spreading corridor for invasive plants (Pieretet et al., 2008). They provide a suitable habitat, soil seed bank and support their spreading especially for long distances, what is the key process of biotic invasions (Parendes & Jones, 2000; Kowarik & Säumel, 2008). Also, human-made relief forms, e.g. slopes of dikes and dams, represent an important factor in a river inundation (Liendo et al., 2015) Invasive plants and their cover can, especially on slopes (banks, dams, etc.), cause erosion process.

The presence of invasive plants near watercourses poses a serious health, ecological and economic threat. For this reason, their management requires specific attention (Warren et al., 2015), and the most accurate data as actual as possible.

MATERIALS AND METHODS

To demonstrate the real area computation, our research is located on a part of Handlovka river in the cadastre of Chrenovec-Brusno (Prievidza district, Slovakia). Selection of appropriate area of interest was affected by several phytocoenological papers aimed on the riparian vegetation of Handlovka river (Bencová, 2015; Bencová et al., 2016). The conclusions of these papers show a significantly high cover-range and frequent contiguous stands presence of invasive plant species at several parts of the river. Besides the presence of contiguous stands, this part of the river was selected also for its terrain heterogeneity (changes of the width and length of slopes, varying elevation), therefore it has a character of appropriate representative sample.

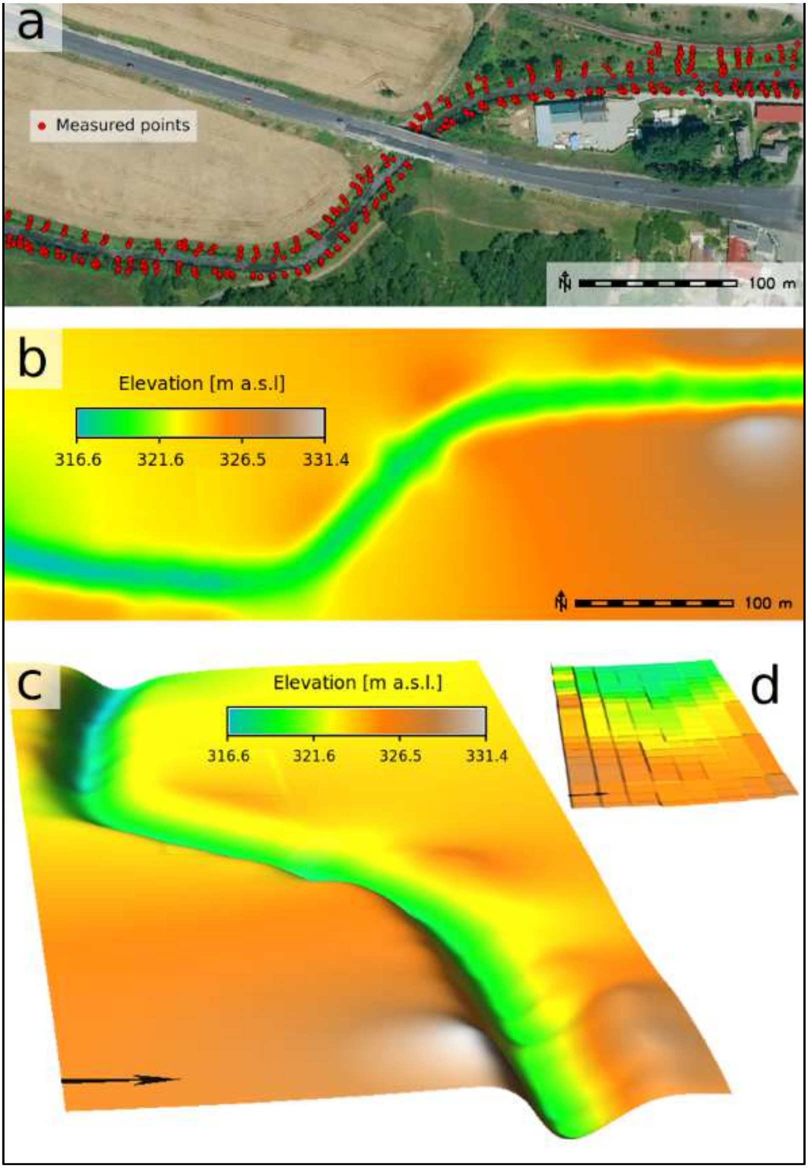


Fig. 1. a) Orthophotograph of the Handlovka river and our measured points; b) Interpolated DTM (2-D); c) Interpolated DTM (2.5-D); d) 2.5-D model of the Handlovka river using free available EU DEM with 25x25m resolution.

As with most of the analyses, as well as the computation of the real area, the quality of the input data plays a key role, mainly the quality of digital terrain model (DTM).

Due to the spatial resolution of the currently available DTMs (e.g. EU, 2013 with the 25x25 m resolution) (Fig. 1d) and the specific characteristics of our area of interest, and streams generally (relatively narrow computing area), for obtaining the most accurate results, we have decided to map our area of interest and create our own DTM.

Elevation data for DTM was obtained by RTK (Real Time Kinematic) method using Topcon GRS-1 fully integrated dual-frequency GNSS receiver with < 1 cm accuracy. Mean deviation of accuracy during whole measurement of points was 8mm (horizontal), 13mm (vertical). Using this receiver, totally 568 points were measured on approximately 577 meters long river section (Fig. 1a). The points were measured in the distance around 10 - 15 meters and at the parts with the rapid slope change (change of the river bank size, terrain changes, sediments etc.). Based on that, we were able to digitalize another 1952 auxiliary points from originally measured points. Each auxiliary point was localized in a middle of two original points with a new value (elevation) calculated as an arithmetic mean of their elevations.

For a creation of DTM, we use open-source software GRASS GIS, which offers many options of deterministic (Inverse Distance Squared Weighting, Splines, etc.) and geostatistical interpolation techniques (Kriging). After parameterization of several models, we got the most realistic results with bicubic spline interpolation with Tykhonov regularization (v.surf.bspline). For length of spline step in the east-west and north-south direction was used average minimum distance between all points (1.5 m). The value of *lambda_i* parameter (Tykhonov regularization smoothing parameter) was chosen using installed "leave-one-out" cross validation method (lambda_i=0.01). This small lambda parameter ensures that interpolated surface closely follows observation points, so new values won't rise above or fall below measured values. Because of this suitable parametrization, specific character of our data (relative dense point cloud capturing all rapid slope changes) and fact that spline-based methods fit a minimum-curvature surface through the input points and ensure preservation of trend in the sample data along with rapid changes in gradient or slope (Arun, 2013), spline gave us the most accurate model, similar like in research of Pavlova (2017). Considering that our locality has specific character (relatively narrow area with rapid changes in the slopes of terrain) we had to choose a sufficient detailed resolution appropriate to the average distances between individual points. The best results were achieved with 0.25x0.25 m resolution (Fig. 1b, Fig. 1c). The model was validated by comparison with originally measured points and with verification in the field.

As a first step in computation of the real area, it was necessary to find data on the slope of the territory, using a simple geomorphological analysis. After that, using basic trigonometry and map algebra, we are able to compute the (real) area for each cell. In other words, the newly created raster layer has recorded information about the real size of the cell in the real world (based on its slope).

The last step for the computation of the real area is the overlay of this newly created raster layer with the given interest area (in our case, the river slopes) and the sum of the values of the overlapping cells.

We also mapped the occurrence of invasive species according to the list of non-native, invasive and expansive plant species (Gojdičová et al., 2002).

RESULTS

The conceptual difference between the perception of the area of 2D and 3D perspective can be seen in the Figure 2 and Figure 3.

As can be noted, the slope has a crucial role in the computation of the real area size. While conventional 2D way of computation use bird's eye view to compute the area size, the slope, as only one dynamical variable, may, in some parts, increase the quantity of real area of tens of percent.

Tab. 1: Descriptive statistics of the slope-layer of interest area

Min [°]	Max [°]	Range [°]	Mean [°]	SD [°]	CV [%]
3.01	41.10	38.09	18.12	5.29	29.21

SD - Standard deviation; CV - Coefficient of variation

According to the Table 1, the average slope value of the area of the interest is approximately 18.1°. Despite the relative board range of slopes, is the average value close the real state, what also shows the relative narrow standard deviation and the histogram (Fig. 4) representing the number of cells for single slope.

The histogram above shows relatively high river bank slope (12°-20°). Especially these parts are more vulnerable to erosion and soil profile disturbance. This can provide a competitive advantage for the invasive plant species, so they can spread along the river. Moreover, management practice for embankments can cause an explosion of invasive heliophiles that are normally kept under. Forming dense high mats (3-5 m), some of these (for example *Fallopia*) prevent the visual inspection of the slope, what can often distort, not just basically information about the degree of invasion by these species, but also the actual state of river slopes (Evette et al., 2014).

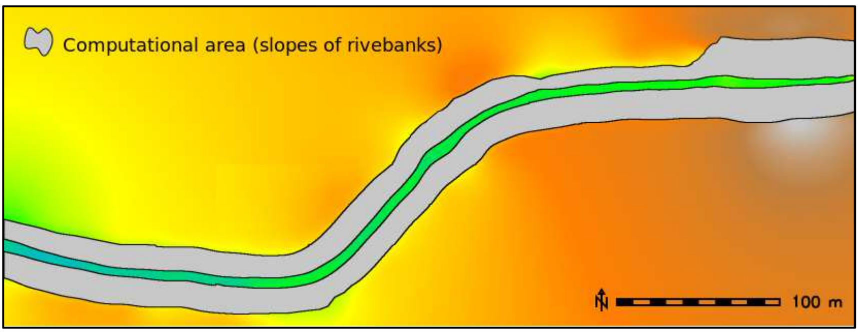


Fig. 2. 2-D view of the Handlovka river with the computational area.

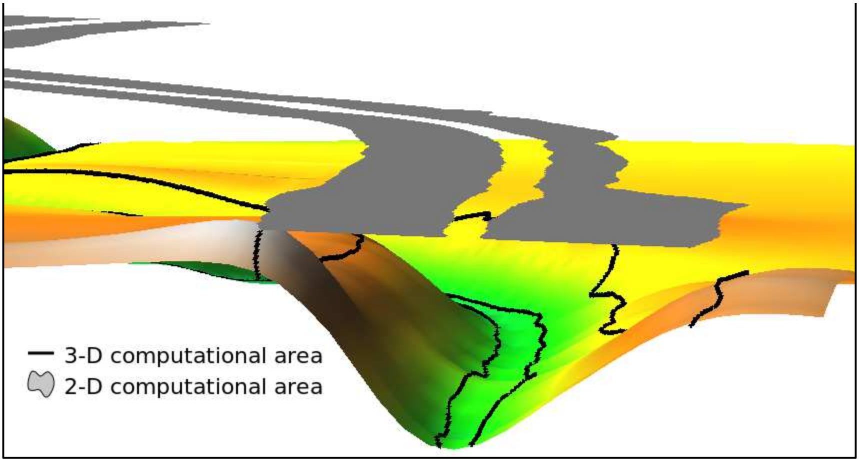


Fig. 3. 2.5-D view of the Handlovka river in 2-D with the computational area and the real boarders.

The difference in the land perception, after adding the third dimension, can be seen at the Figure 5. Substantial number of cells belong to the interval from 3 to 13%, what equals us discovered overall difference (8.684%). This difference makes almost 16 ares (1598.775 m^2) from conventional computed 2D area size of 18410.376 m^2.

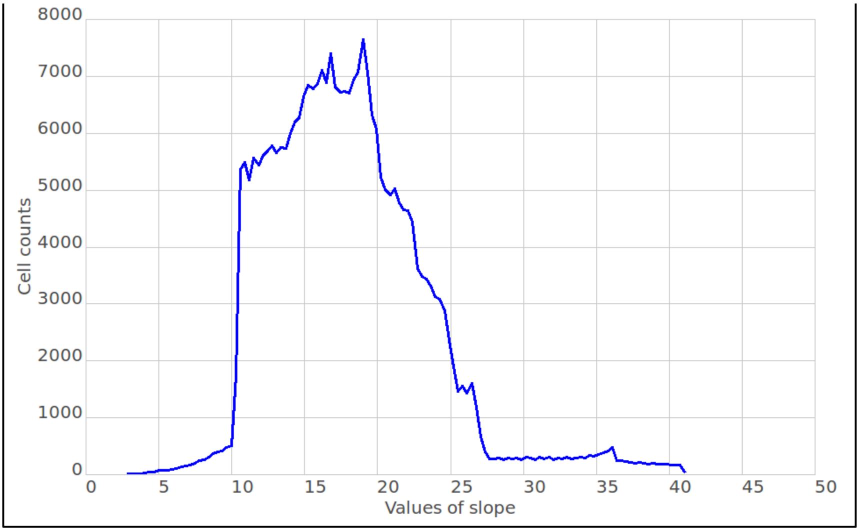


Fig. 4. Histogram of the slope of area of interest.

The same relief effect was reflected in the size of the invasive plant species populations, where the biggest covers was created by *Helianthus tuberosus*, *Aster novi-begii*, *Fallopia xbohemica*, *Solidago canadensis* and *Robinia presudoaccacia*.

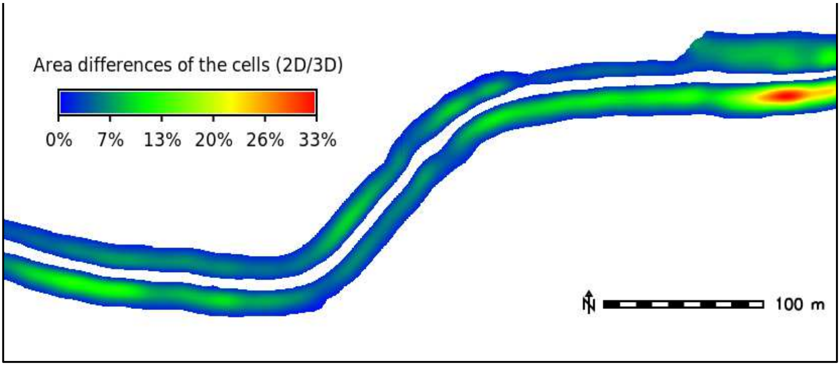


Fig. 5. Percentage difference size of cells between 2D and 3D area.

DISCUSSION

Most of area computation tools uses several basic formulas. In case of raster type data, the number of cells with non-NULL value is multiplied by area of a single cell. Tools working with vector type data mostly use a shoelace formula, also known as the Gauss's area formula, which is a mathematical algorithm that determines the area of a simple polygon, whose vertices are described by ordered pairs in the plane (Szénási & Csiba, 2014).

Options for 3-D area computation are less numerous. Advanced GIS software, as Grass GIS or ArcGis (with 3D Analyst extension), offers tools for 3-D area computation (r.surf.area, surface volume), but these compute area of regular 3-D triangulated points (centres of cells) in current region by adding areas of triangles. Because this computation is based on points, not cells, the area data for the DEM raster are decreased by a half of a cell relative to the area data displayed as a raster image (www.grass.osgeo.org; www.resources.arcgis.com). It's very important to note, that this method of 3-D area computation is performed on the newly created points and not the original data. Because of this, the resulting data are only an estimate, which may increase their inaccuracy.

At present, there are only few papers using one of the options for computing the 3-D area and these are, in the most cases, focused on a specific problem solution (Sanz-Albanedo et al., 2012) or use of a specific technology (Murphy et al., 2008; Gesch, 2009). One of the main reasons may be the fact that this type of computation heavily depends on data resolution (better resolution - more detailed area data). However, the DTM is not always available in sufficient quality to demonstrate significant differences (Tab. 1).

One of the reasons may also be the low level of knowledge about 3-D area computation possibilities. Area size information has been used long time before the origins of information technologies with their broad options. That probably led to a routine perception of area only as a 2-D data.

In our example, we have found 8.684% difference (circa 1598 m^2), between the conventional 2-D computation and the real area computation, which was performed on relatively small part of a river. Although it may not seem very much, it should be noted that if we use the full length of the river for the computation, which is 32 km (assuming its suitability as a representative sample), conventional method causes a loss of approximately 88667 m^2, i.e. 8,87 hectares.

It is also worth mentioning the fact that this situation in not typical only for Handlovka river, but for all types of streams, equally for upland and lowland streams. In the concept of the invasive plants management, this can multiply increase the amount of information about the area, but also the time and funds for their elimination.

CONCLUSION

Area is one of the basic inputs and standards for many activities connected with conservation and protection of the environment, from simply statistic using, such as calculating cadaster area, population density, area of different land-use sites, etc., to dealing with more complicated problems, for example index calculation (Index of Sustainable Economic Welfare, Human Development Index), measuring of ecological footprint, or calculation the costs associated with an environmental accident.

Following our results, the difference between 2D and 3D area is significant especially in the indented relief, so using 3D area in practice is more suitable.

Information about the real area size allows more accurate assessment, even change of the problems approach. Knowledge about the real area size, where invasive plants can be found, is important not just for more efficient management, better estimation of financial means and time needed for their elimination, but also point out the necessity to solve the problem of these plants.

Acknowledgements: The work was supported by the projects VEGA 1/0608/16, KEGA 025UKF-4/2015 and the grant project of the Ministry of Education of the Slovak Republic and the Slovak Academy of Sciences No. 2/0171/16 "Changes in Slovak Landscape Driven by European Union Agricultural Policy".

REFERENCES

ARUN, P. V. A comparative analysis of different DEM interpolation methods. *The Egyptian Journal of Remote Sensing and Space Science.* 16 (2). 2013, 133-139.

BENCOVÁ, M. *Invázne druhy rastlín brehových porastov Handlovky*. Diplomová práca. Nitra: UKF. 2014.

BENCOVÁ, M. Invázne druhy rastlín v riečnej krajine Hornonitrianskej kotliny. *Ekologické štúdie*. Recenzovaný vedecký časopis venovaný aktuálnym problémom ekológie, krajinnej ekológie a príbuzných vedných disciplín. 6(1). 2015, 38-46.

CVACHOVÁ, A., GOJDIČOVÁ, E. *Usmernenie na odstraňovanie inváznych druhov rastlín*. Banská Bystrica: Štátna ochrana prírody SR, Centrum ochrany prírody a krajiny, 2003. 68 s.

Esri, ArcGIS. *Help*, https://resources.arcgis.com/en/help/main/10.1/index.html

#/Surface_Volume/00q900000027000000/ [2017.10.27].

EVETTE, A., ZANETTI, C., CAVAILLÉ, P., DOMMANGET, F., MÉRIAUX, P., & VENNETIER, M. The paradox when managing the riparian zones of rivers with engineered embankments in The French prealps. Safety management or the promotion of biodiversity. *Journal of Alpine Research.* Revue de géographie alpine. 2014,102-4.

GOJDIČOVÁ, E., CVACHOVÁ, A., KARASOVÁ, E. *Zoznam nepôvodných, inváznych a expanzívnych cievnatých rastlín Slovenska 2*. Banská Bystrica: ŠOP SR. 2002. 17 p.

GRASS Development Team, GRASS GIS 7.2.3svn Reference Manual, https://grass.osgeo.org/grass72/manuals/r.surf.area.html [2017.10.27].

GESCH, D. B. Analysis of lidar elevation data for improved identification and delineation of lands vulnerable to sea-level rise. Journal of Coastal Research. 2009, 49-58. https://doi.org/10.2112/SI53-006.1

KOWARIK, I., SÄUMEL, I. Water dispersal as an additional pathway to invasions by the primarily wind-dispersed tree Ailanthus altissima. *Plant Ecology*. 198 (2). 2008, 241-252.

LIENDO, D., BIURRUN, I., CAMPOS, J. A., HERRERA, M., LOIDI, J., GARCÍA-MIJANGOS, I. Invasion patterns in riparian habitats: The role of anthropogenic pressure in temperate streams. *Plant Biosystems.*An International Journal Dealing with all Aspects of Plant Biology. 149(2). 2015, 289-297. https://doi.org/10.1080/11263504.2013.822434

MURPHY, P. N., OGILVIE, J., MENG, F. R., & ARP, P. Stream network modelling using lidar and photogrammetric digital elevation models: a comparison and field verification. *Hydrological Processes*. 22(12). 2008, 1747-1754. https://doi.org/10.1002/hyp.6770

PAVLOVA, A. I. Analysis of elevation interpolation methods for creating digital elevation models. *Optoelectronics, Instrumentation and Data Processing*. 53 (2). 2017, 171-177.

PARENDES, L.A. JONES J.A. Role of light availability and dispersal in exotic plant invasion along roads and streams in the HJ Andrews Experimental Forest, Oregon. *Conservation Biology*. 14(1). 2000, 64-75.

PIERET et al. 6th European Conference on Ecological Restoration, Ecological Restoration : Towards a sustainable future for European ecosystems?, Ghent, Belgium, 2008. 8 p.

SANZ-ABLANEDO, E., CHANDLER, J. & IRVINE-FYNN, T. D. Studying glacial melt processes using sub-centimeter DEM extraction and digital close-range fotogrammetry. *Internation Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences*. Vol. XXXIX-B5, pp. 435-440, International Archives of the Photogrammetry, Remote Sensing and Spatial Information

Science, Melbourne, Australia, 2012. 25.08.2012 conference. https://doi.org/10.5194/isprsarchives-XXXIX-B5-435-2012

SZÉNÁSI, S. CSIBA, P. Clustering Algorithm. Order To Find Accident Black Spots Identified By Gps Coordiantes, *14th Geoconference On Informatics, Geoinformatics And Remote Sensing*, Bulgaria, 17-26. June. 2014, 497-503 pp., Section Geoinformatics.

Štátna ochrana prírody, http://www.sopsr.sk/web/.

WARREN II, R.J., POTTS, D. L., FROTHINGHAM, K. M. Stream Structural Limitations on Invasive Communities in Urban Riparian Areas. *Invasive Plant Science and Management*. 8(3). 2015, 353-362. https://doi.org/10.1614/IPSM-D-14-00081.1

Shrnutí

Informácie o rozlohách patria k základným atribútom priestorových údajov. Sú súčasťou nielen väčšiny geografických výskumov, ale aj mnohých činností a aktivít súvisiacich s tvorbou a ochranou životného prostredia a využívaním krajiny. Problémom je, že bežne využívané nástroje rozlohu daného územia považujú za 2-D objekt a nezohľadňujú fakt, že skutočný svet nie je dvojrozmerný a každý reliéf má svoj špecifický charakter a vlastnosti. To má za následok skreslenie výsledných hodnôt o rozlohách, ktoré majú v skutočnosti trojrozmerný charakter.

V rámci nášho príspevku sa zameriavame na výpočet skutočnej trojrozmernej rozlohy využitím rastrových analýz na digitálnom modely reliéfu a rovnako tak poukazujeme na rozdiel oproti bežne využívanému prístupu. Praktické možnosti využitia tohto prístupu sú demonštrované na reálnom príklade manažmentu inváznych druhov rastlín na svahoch rieky Handlovka. Pre čo najkvalitnejšie výsledky, špecifický charakter územia (úzka plocha) a nedostatočnej presnosti dostupných digitálnych modelov terénu, sme sa rozhodli pre vytvorenie vlastného modelu, pomocou vysoko presného GNSS prístroja a následného interpolovania v GRASS GIS. Z digitálneho modelu sme následne pomocou geomorfologických analýz, základnej trigonometrie a mapovej algebry vyrátali skutočnú rozlohu pre každú bunku.

V súčasnosti je len veľmi málo prác využívajúcich niektorú z existujúcich možností výpočtu 3-D rozlohy, aj napriek tomu, že v niektorých prípadoch môžu byt konečné rozdiely značné. V rámci nášho príkladu sme na relatívne malom úseku rieky zistili medzi konvenčným 2-D spôsobom výpočtu rozlohy a reálnou rozlohou 8.684% rozdiel čo predstavuje približne 1598 m^2. I keď sa to nemusí zdať veľa, je potrebné uvedomiť si, že pri prepočte na celú dĺžku toku, 32 km, sa konvenčným spôsobom stráca približne 88667 m^2, čiže 8.8667 hektárov.

Rozdiel medzi 2-D a 3-D rozlohou môže byť najmä v územiach s členitejším reliéfom podstatný a preto je použitie 3-D reálnej rozlohy pre prax vhodnejšie. Poznanie skutočnej rozlohy územia často krát umožňuje efektívnejší odhad času a potrebných finančných prostriedkov najmä pri mnohých manažmentových činnostiach v krajine.

SELECTED INDICATORS OF COMPUTER LITERACY OF THE POPULATION IN SLOVAKIA

Katarína Vilinová, Gabriela Repaská, Laura Babjaková

Department of Geography and Regional Development, Faculty of Natural Sciences Constantine the Philosopher University in Nitra, Tr. A. Hlinku 1, 949 74, Nitra

kvilinova@ukf.sk, grepaska@ukf.sk, laura.babjakova@student.ukf.sk

Abstract: Due to the rapid growth of scientific knowledge and development of information and communication technologies, significant changes are taking place in individual countries. New technologies are coming to the fore through which there is an increase in country's economy, employment as well as labor productivity. To some extent, this fact is influenced by the ability of basic computer skills. Computer handling is an essential knowledge important to all areas of human life. Computer work is one of the leading characters of an information society. At the same time, this indicator is also important from the viewpoint of regional development of individual regions. The aim of the paper is to characterize selected indicators of computer literacy (work with text and the Internet) in the districts of Slovakia based on the results of the population census in 2011. The methods of analysis, synthesis as well as graphical and cartographic methods will be the main methods used in the paper.

Key words: computer literacy, work with text, work with the Internet, Slovakia, districts

COMPUTER LITERACY OF THE POPULATION

The current 21st century population is often referred to as an information society. This concept is related to the development of information and telecommunication technologies which affect the economies in individual countries of the world as well as their inhabitants.

As a result of the introduction of new technologies and innovations, the countries have to adapt to this trend and maintain the pace of growth. At the same time, considerable disparities in the development in different regions of the world have emerged. Informatization has led to a transition from an industrial society to an informational society which is very closely related to literacy.

Literacy is currently a very broad-spectrum concept that includes several other types (digital, computer, and information). These began to be separated gradually with the development of civilization. The most basic understanding is that it is the ability of a person to write, read and count.

Digital literacy includes the ability to understand information and use it in various formats from various sources presented through modern information and communication technologies (Velšič, 2005). At present, however, it may seem that this term is only a synonym of computer literacy and it is often being interchanged. These two types of literacy have a close connection, but not the same meaning. Digital literacy is a relatively complex phenomenon which can be effectively expressed through a synthesizing indicator - Digital Literacy Index (DLI). According to Svetlík, Bačíková (2015), the level of digital literacy is specific to several aspects whether in terms of gender, educational structure or other factors. Digital literacy includes also computer literacy and complements it with several competencies and capabilities that enable critical, creative and safe procedures to work with digital technologies in all areas of life. The connection to education from primary school is very important from the viewpoint of development of the given literacy (Hosťovecký, Štubňa, 2012, Kramáreková et al., 2016).

In today's society, great emphasis is placed on **information literacy**. Its importance grows gradually and it is important to every individual from the aspect of both personal and professional life. This literacy is an indispensable part of primary, secondary and tertiary education. However, it gradually becomes part of lifelong learning of the population. The information society is defined by several authors e.g. Korcová (2004), Klinec, (2010), etc.

Computer literacy is generally understood as the ability of a person to handle and use a personal computer. This concept is very difficult to precisely define and separate from information or digital literacy. According to Jirák, Wolak (2007), the computer literacy represents a set of knowledge and skills aimed at handling and using the computer in life (work with a text program, tables, graphs, numerical data, acquiring information and communicating via computer, using the Internet, e-mail account, etc.). One aspect of computer literacy is its spatial differentiation. This phenomenon is analyzed in the young population of Serbia by Stojanovic et al. (2017). They point to the differences in both age and gender structure of this population group.

Indicators for the Evaluation of Computer Literacy of the Population in Slovakia

In Slovakia, computer literacy has been paid close attention in recent years since it lags behind the European average regarding the level of individual computer skills. In particular, it is the older generation which has difficulties in adapting to the use of modern technologies. Increase in the level of computer knowledge and skills is also important from the aspect of communication of population and various state institutions. Due to the informatization of society, most of the services of state institutions are being mediated via the Internet (Velšič, 2015).

The population census in Slovakia in 2011 (SODB 2011) included for the first time the survey on the computer knowledge of the population i.e. skills related to the computer literacy. For the first time, the population was surveyed the level of selected computer skills. The census was a part of the global population and housing census program. It was organized in cooperation with Eurostat and coordinated by the United Nations.

The Statistical Office of the Slovak Republic surveyed the ability of the population to handle individual computer skills which they identified as computer literacy. The content of the survey was not to find the level of handling particular skills, but only the fact if the person handles the given skills through self-assessment. The survey included four areas of computer literacy: work with text, tables, e-mail, and the Internet.

During the SODB 2011, Slovakia had 5 397 036 inhabitants. Based on the census data, 49.9% of the population can work with text while 38.8% of them can handle the work with tables. The work with an e-mail was declared by 46.9% of the population and work with the Internet by 53.8% (Table 1).

Different types of skills belonging to computer literacy and which were analyzed require different knowledge and skills. Work with the Internet is one of the most basic skills in order to handle computer work. This skill is currently handled also by preschool children because it does not require any special education. The second highest share can be seen in the work with text. Nowadays, this skill is a necessity in some jobs as well as in education. It is handled by about half of the population in Slovakia. Regarding the work with table editor such as Microsoft Excel, the lowest percentage of population (38.8%) was recorded. This computer skill is mostly used by people with higher education. This type of activity already requires more knowledge and experience. From a gender perspective, we can say that men prevail in all computer skills (Table 1) which means that male gender has a closer relation to these technical skills.

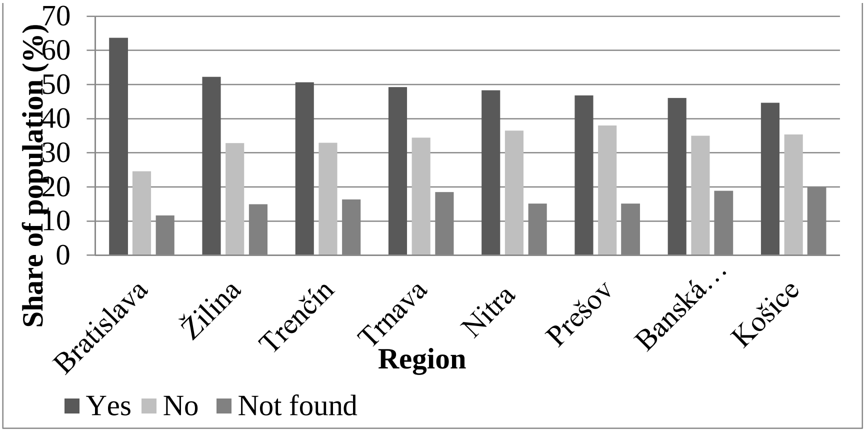
Tab. 1: Computer skills of the population in Slovakia according to gender in 2011

Computer skills	Women		Men		Sum	
	Abs.	%	Abs.	%	Abs.	%
Work with text	1 303 601	24.2	1 387 415	25.7	2 691 016	49.9
Work with tables	1 033 876	19.2	1 062 327	19.7	2 096 203	38.8
Work with e-mail	1 245 998	23.1	1 287 623	23.9	2 533 621	46.9
Work with the Internet	1 445 372	26.8	1 460 002	27.1	2 905 374	53.8

Source: SODB 2011; elaborated by: Babjaková L., 2017

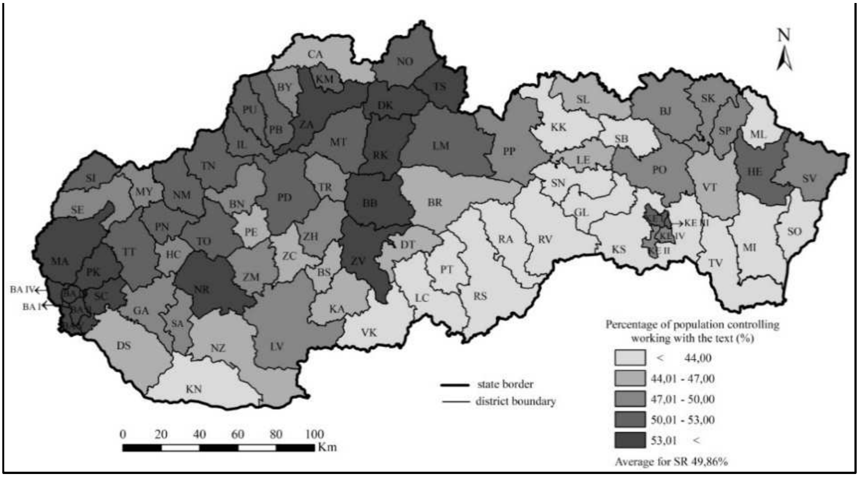
One of the most common activities in the computer work is writing and editing text. **Work with text** usually belongs to the first activities with which the computer beginners start to get familiar. The programs that are needed to create a text are called text editors. There are a number of text editors from different software companies. An example is Microsoft Word which is a part of the most widely used office software called Microsoft Office.

At the regional level, we can see different representation of this skill, which is documented in Graph 1. The highest percentage was recorded in the Bratislava Self-governing Region (63.7%). On the contrary, the Košice Self-governing Region reached the lowest value with 44.7% of the population who can work with text.



Graph 1: Population with the ability to work with text in the regions of Slovakia in 2011
Source: SODB 2011; elaborated by: Babjaková L., 2017

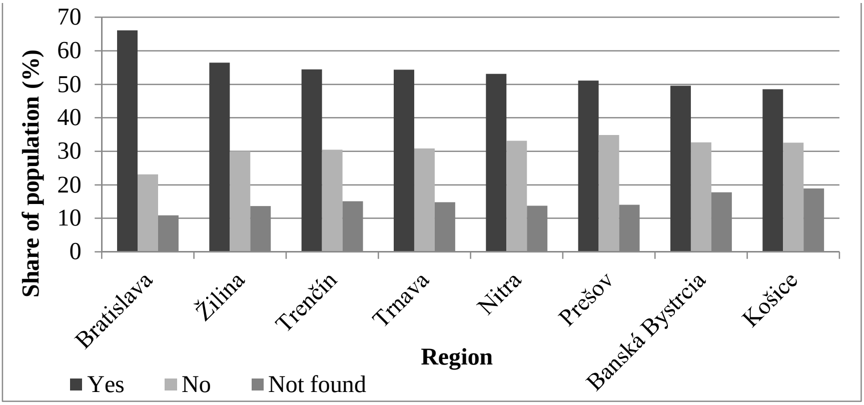
Map 1 documents the studied indicator at the level of districts in Slovakia. Significantly above-average values can be seen especially in the districts located in the Bratislava Self-governing Region. These districts are accompanied by the Nitra District as well as six districts located mainly in the central part of Slovakia. The highest values were reached by the districts of Bratislava V (70.2%) and Bratislava IV (69.2%). Below-average values of handling this skill can be seen in the districts of Southern and Eastern Slovakia with the exception of the districts of Humenné, Košice I, and Košice III.



Map 1: Population with the ability to work with text in the districts of Slovakia in 2011
Source: SODB 2011; elaborated by: Babjaková L., 2017

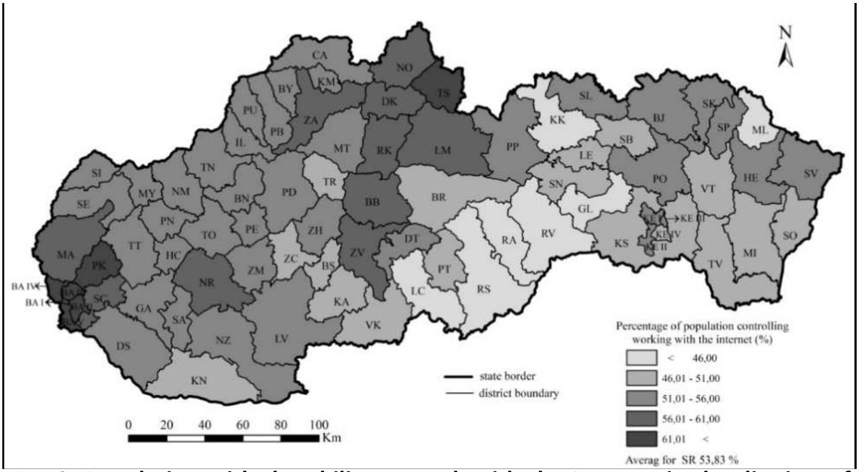
The created disparities between Western and Eastern Slovakia are caused by different educational structure, economic activity of the population and an important role is played in particular by larger representation of the Roma minority in the districts of Southern and Eastern Slovakia. Therefore, the lowest values were reached in the districts of Revúca (37.8%), Rimavská Sobota (38.1%), and Kežmarok (39.3%) which in long-term belong to the least developed districts of Slovakia from the viewpoint of several aspects.

The second studied indicator of computer literacy was the work with the Internet. The Internet is one of the information media that has spread very quickly around the world and it still expands. It is the name for a system for viewing, storing and creating links to documents on the Internet.



Graph 2: Population with the ability to work with the Internet in the regions of Slovakia in 2011
Source: SODB 2011; elaborated by: Babjaková L., 2017

During the census (2011), work with the Internet was the most widely used skill of computer literacy. The highest value at the level of the regions was reached by the Bratislava Self-governing Region (66.1%) and Žilina Self-governing Region (56.4%). Similarly to the previous indicator, the Košice Self-governing Region again maintained its unfavorable position with a share of about 50%. Unlike the previous indicator, the differences in individual regions of Slovakia are less significant (Graph 2).

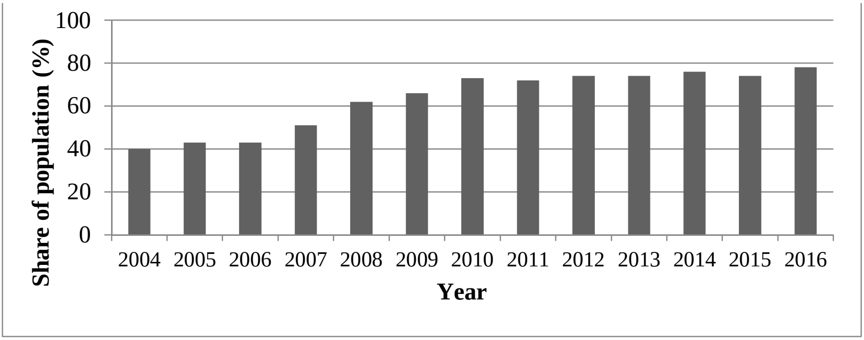


Map 2: Population with the ability to work with the Internet in the districts of Slovakia in 2011
Source: SODB 2011; elaborated by: Babjaková L., 2017

Map 2 documents the ability of inhabitants to work with the Internet in the districts of Slovakia. Similarly to previous indicator, districts of the Bratislava Self-governing Region are dominant. The above-average values were also recorded in these districts: Nitra, Námestovo, Dolný Kubín, Žilina, Ružomberok, Liptovský Mikuláš, Banská Bystrica, and Zvolen. Below-average values were reached by the districts in southern and southeastern part of Slovakia. The lowest share of Internet users was in Revúca (41.4%). This indicator is also affected by the broadband internet connection and its coverage in the regions. The problem is the lack of quality electronic services and the development of access networks. The access networks are built mainly in cities and municipalities with high population density or concentration of business activities. Rural and mountainous areas and economically weak regions remain on the margin of interest. It is these regions where the assistance is directed as a part of the regional development of Slovakia. From the viewpoint of the availability of broadband internet connction, Slovakia clearly belongs to the least developed EU countries despite the dynamic increase in connections.

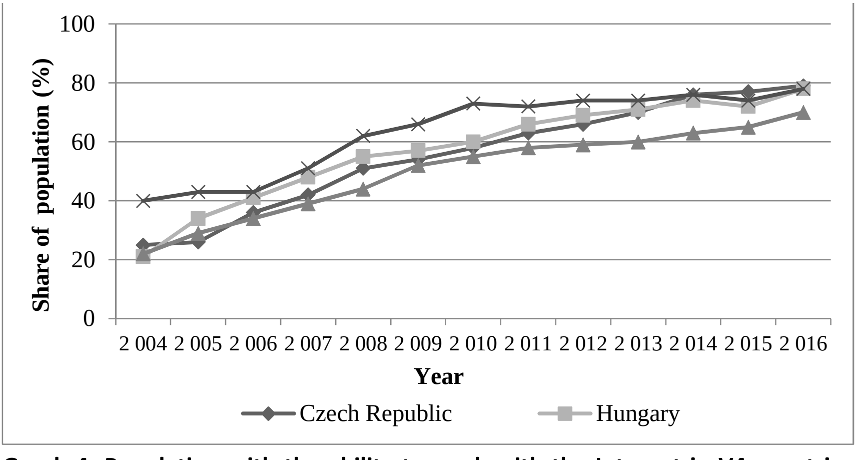
From the viewpoint of the development of Internet usage, we can see a relatively increasing trend in the studied period of 2004 - 2016 (Graph 3). There were no significant fluctuations during the studied period, but the use of the Internet increased by 3.6% on average from year to year. The greatest progress was in 2007 and 2008. By 2007, the share of Internet users increased by 8% to 51% and in 2008 it was by 11% to 62%. The overall increase in Internet usage during this years is also related to the development of broadband internet coverage in Slovakia which the government set in the programming period of 2007 - 2013 as one of the priorities in the field of informatization of the society. The only decrease in the studied period occurred in 2015 when the share of Internet users dropped by two percent to

74%. By 2016, 78% of the population in Slovakia had the ability to work with the Internet.



Graph 3: Population with the ability to work with the Internet in Slovakia during the years 2004-2016
Source: EUROSTAT; elaborated by: Babjaková L., 2017

Graph 4 documents the development of Internet usage among the population of V4 countries from 2004 to 2016. In the context of the comparison of Slovakia with other V4 countries, we can see a relatively favorable development.



Graph 4: Population with the ability to work with the Internet in V4 countries during the years 2004-2016
Source: EUROSTAT; elaborated by: Babjaková L., 2017

The largest share of the population with the ability to work with the Internet between 2004 and 2014 was in Slovakia. Since 2014, Czechia took a leading position while Slovakia and Hungary recorded approximately the same values. In terms of the change index from the first to the last studied year, the greatest progress was recorded in the Slovak population with the value of 51.3%.

CONCLUSION

Computer literacy of the population is a topic that has been paid much attention in recent years. It is an important aspect for the country and points to its development. It is important to know for the society, professionals and institutions how the population acquires the skills to work with new technologies such as computers.

As for the studied indicators of computer skills of the population in Slovakia in 2011, we can see significant differences in the west-east direction. The western part of Slovakia is economically more developed and more educated as a result of which it recorded the highest shares of the population with computer skills. On the contrary, the eastern part of Slovakia is typical for districts that have long been defined as the least developed regions in terms of several indicators. An example is the lower educational level or economic activity of the population. We can also see considerable differences in the north-south direction where there is a clear lagging of the southern part of Slovakia behind the northern part.

In terms of the development and dynamics of the two main indicators of computer work (work with e-mail, work with the Internet), Slovakia has a positive development in comparison with other V4 countries. By the year 2016, 71% of the population in Slovakia was capable of working with the Internet and 78% with an e-mail. Computer literacy is a necessary prerequisite for life in today's modern society. We can assume that along with the increasing living standard of the population the differences in computer knowledge in Slovakia will decrease and the share of inhabitants capable of computer work will increase. We assume that this trend will be confirmed by the census in 2021.

Acknowledgements: This paper was prepared within the grant project VEGA 1/0934/17: Land-use changes of Slovak cultural landscape over the past 250 years and prediction of its further development.

REFERENCES

HOSŤOVECKY, M., STUBNA, J., 2012. Development of digital literacy in technical subjects at primary schools. In: *10th IEEE International Conference on Emerging eLearning Technologies and Applications (ICETA)Location*: Stara Lesna: 2012. pp. 139-141

JIRÁK, J., WOLÁK, R. 2007. *Mediální gramotnost jako dimenze současného člověka.* 1. vyd. Praha: Radioservis, 2007. 152 s. ISBN 978-80-86212-58-6.

KLINEC, J. 2010. *Ekonomická podstata prechodu k informačnej spoločnosti.* Bratislava: Ekonomický ústav SAV, 2010. 38 s. [cit. 2017-06-30]. Dostupné na internete: <http://www.ekonom.sav.sk/uploads/journals/WP26.pdf>. ISSN 1337–5598.

KORCOVÁ, Z. 2004. Informačná spoločnosť a SR. In: Zborník z vedeckej konferencie *„Aktuálne problémy riešené v agrokomplexe“* Nitra: SPU, 2004, s. 545-551. ISBN 80-8069-488-6.

KRAMARÉKOVÁ, H., NEMČÍKOVÁ, M., RAMPAŠEKOVÁ, Z., SVORAD, A., DUBCOVÁ, A., VOJTEK, M. 2016. Cartographic Competence of a Geography Teacher – Current State and Perspective. In: Bandrova, T., Konečný, M. (eds.) *6th International Conference on Cartography & GIS*: vol. 1, 2016. pp. 200-209. ISSN 1314-0604. https://doi.org/10.18421/GP21.01-04

STOJANOVIC, T., PENJISEVIC, I., LUKIC, T., ZIVKOVIC, J. *Computer literacy of young people in Serbia and regional differences*. In: Geographica Pannonica. vol. 21 (1). pp. 43-53. https://doi.org/10.18421/GP21.01-04

SVETLIK, J., BACIKOVA, Z., 2015. Digital natives immigrants and literacy, age and gender differences in Slovakia. In: *International Scientific Conference on Marketing Identity – Digital Life Location*: Smolenice: 2015, pp. 331-342

VELŠIČ, M. 2005. *Digitálna gramotnosť na Slovensku.* Bratislava: Inštitút pre verejné otázky. 2005. 31 s. [cit. 2017-07-10]. Dostupné na internete: <http://www.ivo.sk/buxus/docs//vyskum/subor/Digitalna_gramotnost.pdf>.

VELŠIČ, M. 2015. *Digitálna gramotnosť na Slovensku.* Bratislava: Inštitút pre verejné otázky. 2015. 31 s. [cit. 2017-07-10]. Dostupné na internete: <http://www.ivo.sk/buxus/docs//publikacie/subory/Digitalna_gramotnost_2015.pdf>.

DEMOGRAPHIC DEVELOPMENT IN SLOVAKIA IN 2016

Miloš Bačík

The Catholic University in Ružomberok, Faculty of Education, Department of geography, Hrabovská cesta 1, 034 01 Ružomberok

milos.bacik@ku.sk

Abstract: Demographic development in Slovakia corresponds to the long-term trend which originates in the change of the social system. In the 1990s, it was characterized particularly by a decreasing number of marriages and abortions, increasing divorce rate, a sharp decline in birth and fertility rates, rising unemployment, a low nominal wage and a high price level of goods and services.

This demographic development was reflected in the deterioration of the key synthetic indicators which are in the long term below the threshold of sustainable growth. The age structure of the population was transformed by significant changes in the attitude towards reproduction. The shifts in age groups and the prolongation of human life have led to deepening the process of population ageing.

In the present paper we focused on the brief characteristics of the demographic processes which to a different extent and scope influenced the demographic development in Slovakia in 2016. The concept of the paper is based on the data provided by the Statistical Office of the Slovak Republic, and the classical analysis is used as the main method. Graphical (especially cartographic) outputs in the form of thematic maps are the main contribution of the paper.

Key words: population, demographic processes, age structure, Slovakia

INTRODUCTION

Population development in 2016 is similar to the previous period of a low annual population growth (Table 1). Its origin is associated with changes in the social system, which has led to a “fall” in the whole range of demographic indicators, and to a significant slowdown in the quantitative population growth. Over the five years (1990-1994), for example, the number of live births decreased from 79,989 to 66,370 (Podolák 1996), and in the course of fifteen years (1989-2003), Slovakia moved to the European ranking from the group with the highest fertility rates in the group with the lowest fertility rate (Vaňo 2005).

The age structure has significantly changed. The shifts in age groups and the prolongation of human life have led to deepening the process of population ageing.

In the present paper we focused on the brief characteristics of the demographic processes which to a different extent and scope influenced the demographic development in Slovakia in 2016. The concept of the paper is based on the data provided by the Statistical Office of the Slovak Republic, and the classical analysis is used as the main method. Graphical (especially cartographic) outputs in the form of thematic maps are the main contribution of the paper.

Tab. 1: Demographic development in Slovakia in 1990 - 2016

Year	Population size	Increase / decrease	Growth rate (%)
1990	5 310 711	-	-
1995	5 367 790	57 079	1,07
2000	5 378 783	10 993	0,20
2005	5 389 180	10 397	0,19
2010	5 392 446	3 266	0,06
2015	5 426 252	33 806	0,63
2016	5 435 343	9 091	0,17

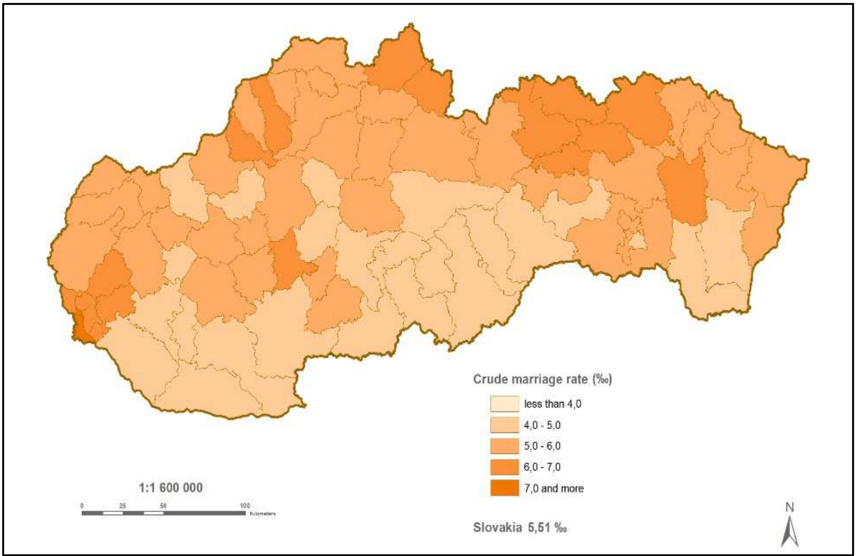
Source: ŠÚ SR

MARRIAGE, DIVORCE AND ABORTION RATES

According to the statistics provided by the Statistical Office of the Slovak Republic (2017), 29,897 couples got married in Slovakia, which was 1122 more than in 2015. Gross marriage rate increased by 0.1 point to 5.5 ‰. The last decade of the timeline is characterized by only a slight fluctuation in the number of new marriages and a low level of the marriage rate in the long term. The rates are affected by the number and age of couples that can potentially get married. For a higher number of people ready for marriage, the most important is the age group 25-29. From this age group, there were 8,937 bridegrooms (29.9%) and 11,340 brides (37.9%) in 2016. The average marriage age was in the age group 29-34, namely 33.6 years in men and 30.7 years in women. Even though the relatively strong generation of young people born in late 1980s entered the marriage age, the trend in marriage rates did not change especially for economic and social reasons. According to the civil status of the partners, new marriages were formed by single bridegrooms (85.6%) and single brides (86.7%), divorced men (13.8%) and divorced women (12.8%), and widowed men (0.6%) and widowed women (0.5%). In the structure of the population according to civil status, there is an increase in the proportion of divorced men and divorced women, and also single men and single women. On the other hand, the proportion of married men and married women declines, and the proportion of widowed men and widowed women remains at about the same level. The credit of the marriage fell, despite the dominant Christian-Catholic value orientation of the population, and some of the population did not consider it necessary for the upbringing of children (Bačík 2016b). The picture of the gross marriage rate according to districts has not changed (Map 1). Traditionally higher marriage intensity is recorded in Northern and Eastern Slovakia, lower in the south of the country. Higher marriage rate was recorded in the capital city. The difference between the highest and the lowest gross marriage rates was 3.72 points in 2016. Favourable figures above 7 ‰ were reported from two districts, Bratislava V and Bratislava I, less favourable at the level of 4 ‰ were reported from the districts of Detva, Turčianske Teplice and Poltár.

In 2016, out of overall 9,800 completed divorce proceedings 9,286 marriages were divorced, which was 482 less than in the previous year. Gross divorce rate declined by 0.1 point to 1.7 ‰. There were 31 divorces per 100 marriages. Of the total number of divorced marriages, 5.4 thousand (57.9%) were married couples with minor children, of which 3.1 thousand with one child, 1.9 thousand with two and 0.4 thousand with three or more children. 35.7% of the marriages were divorced on the man's proposal. The average length of a divorced marriage was 15.6 years. The most common reasons for marriage disruption claimed by men were differences in personalities, opinions and interests (66.1%), other causes (10.1%) and infidelity (9.4%). Women proposed divorce mostly due to differences in personalities, opinions and interests (66.1%), other reasons (12.1%), and in 10.7% of cases the court did not identify the fault. Similarly to the marriage rates, the picture of the gross divorce rate has not changed. A lower level of divorce was recorded in Northern and Eastern Slovakia, a higher level in the south, the southwest and a part of Central Slovakia. The difference between the highest and lowest values of the gross divorce rate was 1.71 points in 2016. Favourable values below 1 ‰ were recorded in the districts of Sabinov, Námestovo, Kežmarok and Stará Ľubovňa, less favourable in Malacky (2.87) and Bánovce nad Bebravou (2.42).

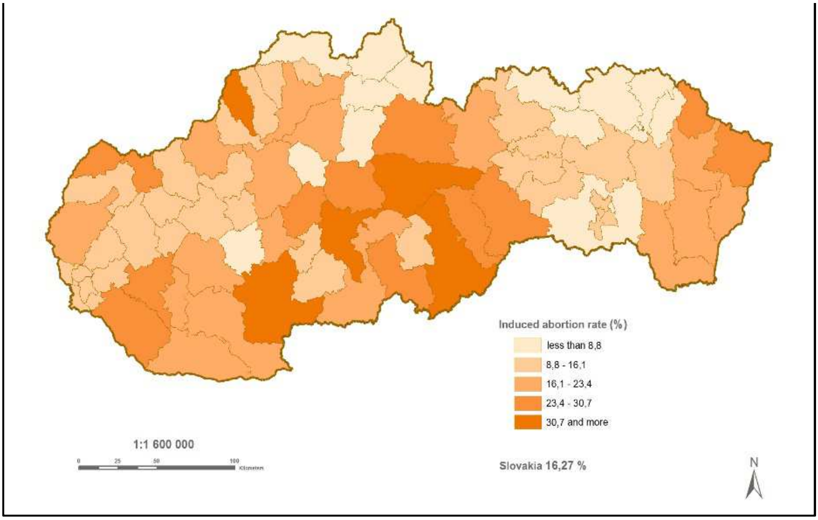
In 2016, abortion ended 15,277 pregnancies, which was 360 less than in the previous year. The gross abortion rate dropped to 2.8 ‰. After a significant increase in abortion in 1988, which followed the adoption of the law of SNR no. 73/1986 Coll., which abolished the interruption commissions and the artificial interruption of pregnancy was practically available to every woman (Halašová 1991), almost to a continuous decrease in the number of abortions (especially artificial). In the 1990s, the number of abortions was reduced by an average of a thousand per year, in the last decade it was by hundreds per year. The reduction of the specific abortion rate in 2007 - 2016 was most significant in age groups 30-34 (by 3.1 points), 20-24 (by 2.5 points) and 25-29 (by 1.9 points). The absolute majority of abortions is associated with the age group of 30-34 year-old women, whereas their number was about 4.7 thousand. Out of the total number, 49.3% abortions were performed to single women and 40.9% to married women. In terms of the number of minors, 31.4% of childless women, 28.4% of mothers with one child and 25.6% of mothers with two children have aborted. In terms of regions (Map 2), a low index of induced abortion rate was recorded in the districts of Sabinov (1.48%) and Námestovo (2.49%). On the contrary, Levice (37.99%) and Púchov (37.01%) reported high values.



Map 1: Crude marriage rate in Slovakia

BIRTH AND FERTILITY RATES

In 2016, 57,557 live children were born, which was 1,955 more than in the previous year. Gross birth rate increased by 0.3 points to 10.6 ‰. The last decade of the timeline is characterized by a moderate fluctuation in the number of newly born children, while the level of the gross birth rate remained low in the long term. The female reproductive period practically ends around the age of 40, and the maximum fertility rate lies currently in age from 27 to 32 years (Figure 1). In 2016, the number of women aged 27-32 reached 244.4 thousand, which was, compared to 2007, less by 32.1 thousand. Despite the fact that the number of women decreased at the given intervals, there was a moderate birth rate increase, as evidenced by the synthetic values of the gross reproduction rate (0.61 or 0.72), net reproduction rates (0.6 or 0.71) and total fertility rates (1.25 or 1.48). The net reproduction rate is in a long term (since 1989) below the level of "1" (Tirpak - Adamica 1995) and this trend continued in the monitored year. The above figure, 0.71, tells us that during one generation of women, while keeping the current level of their fertility and mortality, the number of potential mothers decreased by $^1/_3$.



Map 2: Induced abortion rate in Slovakia

Out of the total number of live births, 34,421 (59.8%) children were born to married couples and 23,136 (40.2%) were born to unmarried couples. Over the last decade, the proportion of unmarried people has increased by more than 11 points. The structure of live-born children according to the birth order did not change much. In the first order, 46.4% of children were born, which was less by 0.8 points compared to 2007, the share of children born as the second rose slightly (from 32.0 to 34.2%) and the third order remained at the same level. The proportion of children born in higher orders declined. A decisive part of children was born to women from age groups 30-34 (31.0%) and 25-29 (29.9%). Higher specific fertility rate (84.1 ‰ or 87.6 ‰) is characteristic for the above intervals. A major increase in fertility compared to 2007 was mainly in age groups 30-34 (by almost 19 points) and 35-39 (by more than 14 points). From the point of view of individual districts, higher gross birth rates (above 15 ‰) were characteristic for the districts of Námestovo and Sabinov. The lowest birth rate (7.37) was in the district of Banská Štiavnica, a low birth rate (just below 8 ‰) in the districts of Humenné, Turčianske Teplice and Medzilaborce.

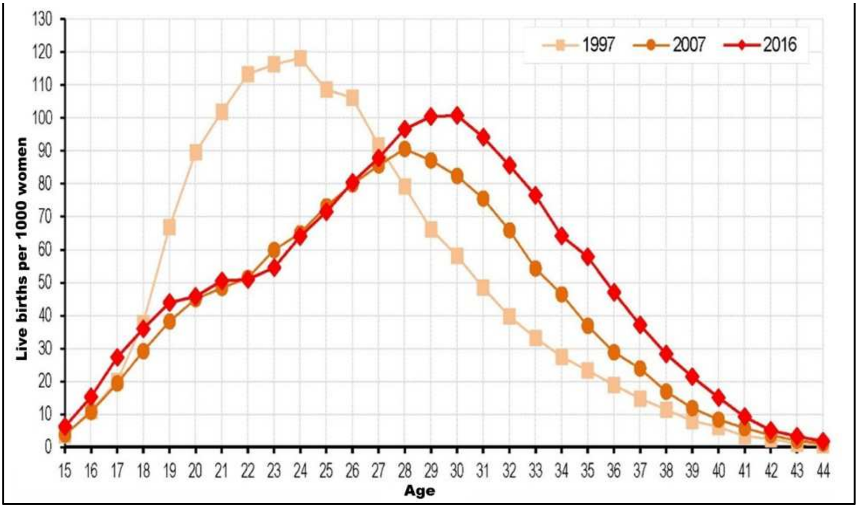


Fig. 1. Age - specific fertility rates in Slovakia.
Source: ŠÚ SR

MORTALITY

In 2016, 52,351 persons deceased, which was by 1,475 persons less than in the previous year. The gross mortality rate decreased by 0.3 point to 9.6 ‰. Only a slight fluctuation in the number of deaths at the over a long period stable level of gross mortality rate is characteristic for the last decade of the timeline. Except for the age group above 75 (in 2016 also in the age group 5 - 9), the mortality rate in men is in the long run higher than in women. In 2016, for example, in each of the age groups 20-24 to 55-59, over 70% deaths were in men. Infant mortality is gradually becoming insignificant in statistics, which is also proved by the data in the reference year. The proportion of deaths within one year of the total deaths remained at the level of the last year (0.6%) and the gross infant mortality rate slightly increased to 5.3 ‰. The mean life expectancy for both sexes increased: for men to 73.7 years and for women it exceeded 80 years. The greatest number of deaths was caused by circulatory system diseases - 25,240 and tumors - 13,564. The two groups of causes of death represented 74.1% of all deaths. The lowest gross mortality rate was recorded in the districts of Tvrdošín (6.33), Námestovo (6.78) and Košice III (6.94). Significantly higher mortality rate than the average (9.64) was recorded in the districts of Myjava (13.39), Bratislava I (12.84), Turčianske Teplice (12.76) and Nové Zámky (12.42).

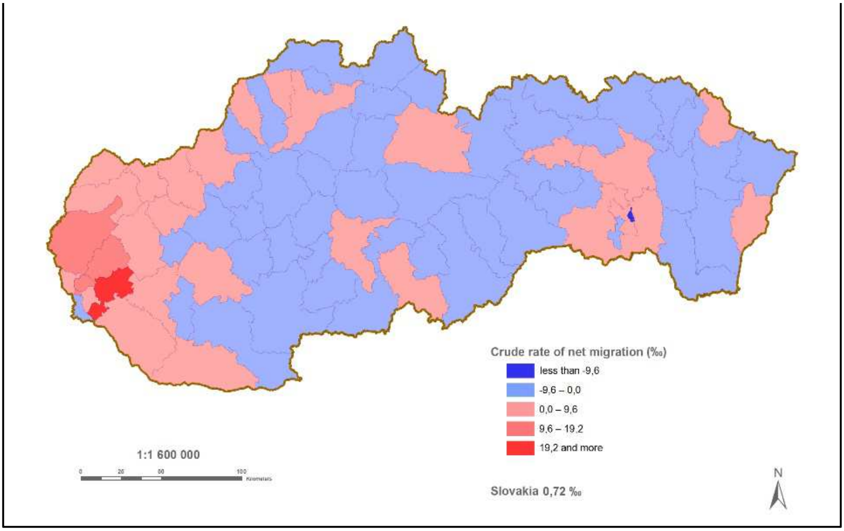
MIGRATION

Migration is one of the demographic phenomena that respond very rapidly to societal change (Bačík 2016a). After 1989, it was reflected in the intensity and character of foreign migration, as well as in changes in internal migration (significant decrease in volume and intensity). In 2016, nearly 7,700 foreign nationals moved to Slovakia and 3,800 Slovak nationals moved out of Slovakia. The Slovak Republic has gained almost 3,900 inhabitants by foreign migration, which was by 800 more than in the previous year. An increase in the volume of migration in its year-on-year fluctuations is characteristic for the last decade of the timeline. The migratory balance did not have a clearly rising trend. It was the highest (almost 7.1 thousand) in 2008 and the lowest in 2014 (1.7 thousand). In terms of individual countries, besides the Czech Republic (1.7 thousand) the most people moved to Slovakia from Great Britain (1.0 thousand), Austria (0.6 thousand), Hungary (0.5 thousand) and Romania (0.5 thousand). From Slovakia, most people moved to the Czech Republic (1.2 thousand), Austria (0.9 thousand) and Germany (0.3 thousand).

In the context of internal migration, in the last decade in Slovakia, the mobility is characterized by a migration volume of 90,000 people. In 2016, 95.8 thousand persons changed their permanent residence, which is by 5.0 thousand more than in 2015. The number of people changing their residence increased by 0.9 points to 17.6 ‰ (per 1,000 people). More than a half of the migrants were single and almost $^{2}/_{3}$ of them reported housing reasons and joining a family member as the most frequent reasons for the move. 45% of migrants moved between municipalities within the district and between districts within the county (about 30%). 31 districts reported population growth due to migration (Map 3). A migration boom was recorded in the district of Senec (37.07 ‰), higher values in the range of 10 - 15 ‰ were reported only in the districts of Bratislava III and I, Malacky and Pezinok. Most significant was the population migration in the district of Košice III (-12.23), followed by the districts of Bratislava V (-6.48), Košice II (-5.31) and Humenné (-5.16).

POPULATION GROWTH, STRUCTURE AND NUMBER OF INHABITANTS

As a result of the natural migration of Slovak people in 2016, the natural growth was 5.2 thousand persons, which was significantly higher than in the previous year (1.8 thousand). These values were reflected in the natural growth rate which increased by 0.7 point to 1.0 ‰. The migration increment was also higher (0.7 ‰) and so was the total growth (1.7 ‰). Kežmarok (9,29), Námestovo (8,84) and Sabinov (8,50) reported a higher gross natural growth. Population decline was recorded in 41 districts, especially in Myjava (-5.35) and Turčianske Teplice (- 4.85). A similar situation was in the development of the overall population growth. In 43 districts, the total growth was negative, ranging from -0.03 to -8.49 ‰.



Map 3: Crude rate of net migration in Slovakia

The structure of the population of Slovakia according to main age groups, compared to the previous year changed in the fact that the proportion of the population in the post-productive age increased by 0.5 point to 15.0%, in the working-age decreased by 0.7 point (69.5%) and in the pre-productive age (15.5%) remained almost unchanged. Continuing ageing of the population is characteristic for the last decade of the timeline. The proportion of the infant component was slightly reduced due to low birth rates. There was also a decrease in the proportion of the active component because the larger cohorts born in the middle of the last century are now at the end of the productive age in the age pyramid or they start to exceed this age. This is why - even to improve mortality rates, there is a significant increase in the proportion of the old-age component. The process of more intensive population ageing is also documented by age indicators (Table 2). The average age is above the age of 40, the aging index reached 97.0% (from 2007 it increased by 21 points) and the economic burden index was at 43.8%. According to the forecast of the population development of the Slovak Republic (Bleha - Šprocha - Vaňo 2013) in 2060, approximately 220 seniors will be allocated to 100 children.

As of December 31. 2016 Slovakia had 5,435.3 thousand inhabitants, of which women accounted for 51.2%. 1,000 men accounted for 1,050 women. The population of Slovakia lived in 2,927 municipalities. There were 1,857 inhabitants per municipality. The population of Slovakia increased by 0.17% in 2016.

Tab. 2: Development in selected characteristics of the age structure of the Slovak population in 1990 - 2016

Year	0-14 / 65+ (%)	Average age	Ageing index	Economic burden index
1990	25.1 / 10.4	33.6	41.4	54.9
1995	22.3 / 10.9	34.5	49.2	49.8
2000	19.2 / 11.5	36.0	59.8	44.3
2005	16.6 / 11.7	37.4	70.7	39.5
2010	15.3 / 12.4	38.7	81.0	38.6
2015	15.3 / 14.5	40.1	94.2	42.4
2016	15.5 / 15.0	40.4	97.0	43.8

Source: ŠÚ SR

CONCLUSION

Population development in Slovakia in 2016 almost did not differ from the demographic situation in the previous year, except for the higher number of marriages closed. In the context of the ten years development, there were no major changes. Marriages are low in the long run (despite a moderate increase in the last period), divorce rate, although declining year on year, high and artificial abortion continues to decrease but disproportionately lower than in the 1990s. Both the net reproduction rate and the total fertility rate are still below the critical value of 1.0 resp. 1.5. The gross mortality rate is long-term stabilized. It ranges between 9.5 and 10.0 ‰. The relative values of natality were slightly higher than mortality rates each year, thus recording a continuous but moderate natural increase. From the point of view of foreign migration, more people moved to Slovakia as they moved out of it. The migration balance with its low value did not affect the overall population growth.

The course of demographic processes is reflected in population structures, especially age, for which the ongoing aging process is characterized. The share of the child component is gradually offset by the component of 65 + yearly (in 2016 the difference was only 0.5 points).

Population development is ambiguous, in many ways difficult to predict in migration in particular. In the Slovak population, children will die at low levels of fertility, later probably grandchildren. Apparently, the proportion of children raised by both stable parents will drop and the relative growth of children born outside marriage will continue.

Thanks: Contribution was created with support of internal grant GAPF no. 02/12/2017.

REFERENCES

BAČÍK, M. Populačný vývoj na Slovensku v roku 2015. In: Nováček A. *Sborník příspěvků z Výroční konference ČGS.* Geografické myšlení jako aktuální společenská výzva. České Budějovice: Jihočeská univerzita v Českých Budějovicích, 2016a, s. 135 - 143. ISBN 978-80-7394-619-7

BAČÍK, M. Populácia Slovenska z pohľadu druhého demografického prechodu. **In:** Dubcová A. a kol. *Geografické informácie.* Nitra: Univerzita Konštantína Filozofa v Nitre, 2016b, roč. 20, č. 2, s. 10 - 23. ISSN 1337-9453

BLEHA, B., ŠPROCHA, B., VAŇO, B. *Prognóza populačného vývoja Slovenskej republiky do roku 2060*. Bratislava: INFOSTAT/Výskumné demografické centrum, 2013. ISBN 978-80-89398-23-2

HALAŠOVÁ, E. Vývoj potratovosti na Slovensku. *Statistika.* Praha: FSÚ, 1991, č. 12, s. 553 - 556 [30. 09. 2017]. ISSN 0322-788x

PODOLÁK, P. Vývoj obyvateľstva na Slovensku v r. 1989 - 1994. *Geografický časopis.* Bratislava: SAV, 1996, roč. 48, č. 1., s. 35 - 45 [15. 09. 2017]. ISSN 0016-7193

ŠTATISTICKÝ ÚRAD SR. *Štatistika v súvislostiach: Hlavné trendy populačného vývoja v SR v roku 2016.* [Online]. Bratislava: Ústredie ŠÚ SR, 2017, [10. 09. 2017]. Dostupné z: http//slovak.statistics.sk ISBN 978-80-8121-605-3

ŠTATISTICKÝ ÚRAD SR. *Pohyb obyvatelstva v Slovenskej republike v roku 2016 (Pramenné dielo).* [Online]. Bratislava: Ústredie ŠÚ SR, 2017, [20. 09. 2017]. Dostupné z: http//slovak.statistics.sk

TIRPÁK, M., ADAMICA, F. Populačný vývoj v Slovenskej republike v roku 1994. *Demografie.* Praha: ČSÚ,1995, roč. 37, č. 4, s. 254-266 [15. 09. 2017].

ISSN 0011-8265

VAŇO, B. (2005): Populačný vývoj na Slovensku po roku 1990. *Demografie.* Praha: ČSÚ, 2005, roč. 47, č. 2, s. 103 - 112 [15. 09. 2017]. ISSN 0011-8265

Shrnutí

Vývoj populace na Slovensku v roce 2016 se téměř v ničem nelišil od demografické situace v předchozím roce s výjimkou vyššího počtu uzavřených sňatků. V kontextu vývoje za deset let nenastaly podstatnější změny. Sňatečnost je dlouhodobě nízká (navzdory mírnému vzrůstu v posledním období), rozvodovost, i když meziročně klesla, vysoká a umělá potratovost nadále klesá, ale nepoměrně s nižší intenzitou než tomu bylo v 90. letech minulého století. Čistá míra reprodukce i úhrnná plodnost jsou stále pod kritickou hodnotou 1,0 resp. 1,5. Hrubá míra úmrtnosti je dlouhodobě stabilizovaná. Pohybuje se mezi 9,5 až 10,0 ‰. Relativně hodnoty natality byly každým rokem o něco vyšší než hodnoty mortality, čímž Slovensko zaznamenalo kontinuální ale jen mírný přirozený přírůstek. Z pohledu zahraniční migrace se více osob na Slovensko přistěhovalo, jak se z něho vystěhovalo. Migrační saldo svou nízkou hodnotou podstatnější neovlivnilo celkový přírůstek obyvatelstva.

Průběh demografických procesů se promítá do populačních struktur, zejména věkové, pro kterou je charakteristický pokračující proces stárnutí obyvatelstva. Podíl dětské složky se postupně vyrovnává se složkou 65 + ročních (v roce 2016 byl rozdíl jen 0,5 bodu).

Populační vývoj je nejednoznačný, v mnoha směrech zejména při migraci těžko předvídatelný. V populaci Slovenska bude při nízké úrovni plodnosti ubývat nejprve dětí, později pravděpodobně i vnuky. Zřejmě klesne podíl dětí vychovávaných oběma stabilními rodiči a bude pokračovat relativní růst dětí narozených mimo manželství.

POLISH MINORITY IN THE CZECH PART OF TĚŠÍN SILESIA IN 2017: CAN ACCENT ON SCHOOLS PREVENT THE ENTIRE ASSIMILATION?

Hynek Böhm

Technical University of Liberec, Studentská 2, 461 17 Liberec, Czech Republic

hynek.bohm@tul.cz

Abstract: The territory of Těšín Silesia was divided between Czechoslovakia and Poland in 1920. This artificial division forced about 200 000 non-Czech first language speakers – 64 000 of them declared themselves to be Poles - to become Czechoslovak citizens. Almost 90 years afterwards only 26 000 inhabitants declared Polish nationality during the last census in 2011.

The article analyses activities of both civic (non-governmental organisations - NGOs) as well as public institutions working for the Polish minority in Těšín Silesia region. It identifies strong efforts to stop the progressing assimilation of Polish minority into Czech society by multiple means, spreading from establishing special financial instruments supporting Polish minority organisations towards paradiplomatic activities. The research shows that the education in Polish and accent on the Polish language are the crucial tools to slow-down the assimilation, yet the entire assimilation seems to be inevitable.

Key words: Polish minority, Těšín Silesia, education, assimilation

INTRODUCTION AND GOALS OF THE PAPER

In a long-term horizon I have focused attention of my research on the cross-border co-operation (CBC) of the subject from (my home) Moravian-Silesian-Region. One of the active actors of the cross-border co-operation with Polish partners have been the subjects coming the Těšín region, which is the home of the Polish minority in the Czech Republic. Therefore, I decided to analyse their relations with the kin-state of Poland. The article is mostly a translation of a more complex text, which is assessing the paradiplomatic activities of actors from Moravia-Silesia. What differs that from the previously mentioned more complex text is an accent on the role of education in the Polish minority organisations.

As mentioned, in two years time more profound results will be presented by the means of a complex publication focusing on paradiplomacy of subjects from Moravia-Silesia. The aim of a current article is therefore rather modest, as it plans to present the principal organisations safeguarding the rights of Polish minority or working for this minority in the region of Těšín. Special attention will be given to the role of education and schools as the principal actors, which can slow-down the assimilation of the Polish minority in the very east of the Czechia. Těšín region. We will in more details analyse activities of two non-governmental organisations (NGOs): Congress of Poles in the Czech Republic and the Polish Association for Culture and Education. To bring a more complex and balanced picture we will also analyse activities of the Pedagogical Centre for Polish Minority Schools, founded and managed by Czech Ministry of Education, Youth and Sports, representing thus interest of the public authorities of the Czech Republic.

Czech Part of Těšín Region – Zaolzie

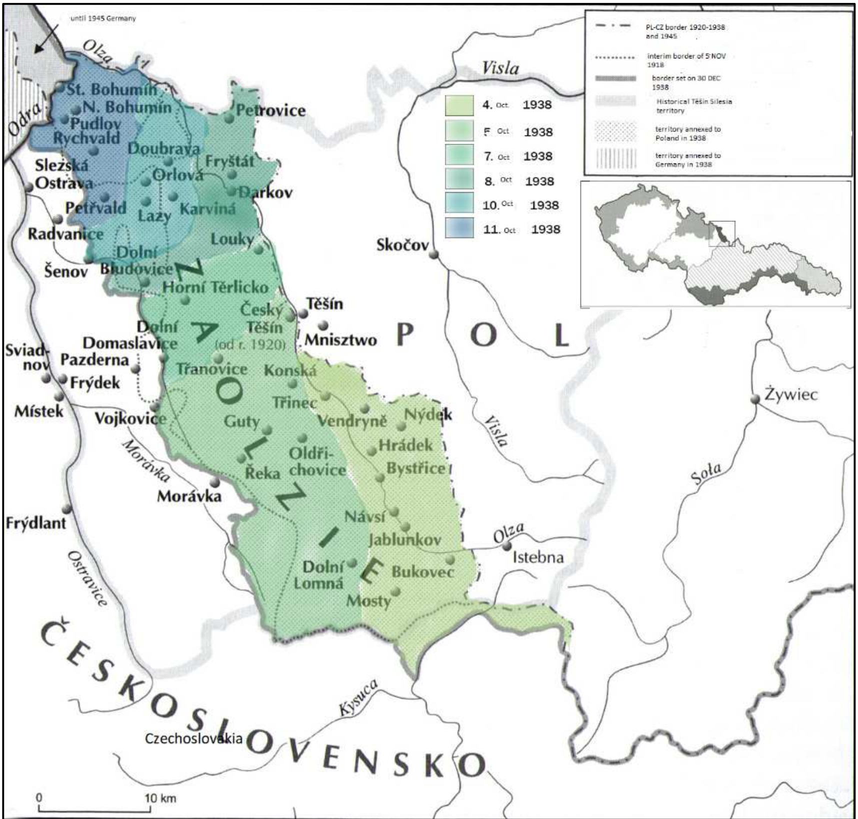


Fig. 1. Localisation of region.

Source: (Mahdal 2015), available at http://www.moderni-dejiny.cz/clanek/obsazovani-Těšínska-polskou-armadou/

The whole territory of Czech part of Těšín Silesia is called Zaolzie in Polish language, which means the territory behind Olza river, which creates the borders between Poland and Czechia. There is no Czech name used for the territory, which refers to the lower sensitivity of Czechs towards it. Therefore I will use either term Zaolzie, once the context will require it, and the term Těšín Region, having more neutral and "purely" geographic meaning. Another geographical term Těšínské Slezsko – Těšín Silesia – needs an explanation. Historically it is a territory of the former Duchy of Těšín, which is moreless identical to the scope of a current Euroregion Těšínské Slezsko (Těšín Silesia in English), which involves municipalities from both countries. Therefore author will prefer using term Těšín Region, which he tends to understand for the purposes of this paper as a territory in the Czech Republic.

Studied territory a was subject of a war between Czechoslovakia and Poland after the end of World War I (1919), which eventually resulted in the division of the area by an international arbitrage (Böhm, Drápela 2017). Mainly Poles felt (and some have been feeling it until now) this division as unfair, as most of the inhabitants who stayed on the Czech side identified themselves as Poles. Almost 100 years after, approximately 1/5 of the entire population living in the territory declare themselves to be Poles and use Polish as their mother tongue.

As studied actors enter in cross-border relation with their kin-state, Poland, we should explain several principal theoretical concepts. We will start with a term "paradiplomacy", which was introduced into the academic debate and developed theoretically by Panayotis Soldatos (1990) and Ivo Duchacek (1988, 1990) in the late 1980s (Klatt and Wassenberg 2017). This insinuates a form of parallel diplomacy besides "real" diplomacy, but it also alludes to the fact that the subnational and non-state actors involved have limited capacities and legal powers compared to those of national governments (Joenniemi & Sergunin, 2014: 18).

Another term to be used is *proto*-diplomacy, which has been applied to designate foreign activities of regions aspiring to become themselves nation states such as the Canadian province of Québec, the British region of Scotland or the Spanish autonomous community Catalonia (Duchacek, 1988: 22; McHugh, 2015).

It is necessary to state that after the fall of communism, eventual proto-diplomacy of Polish organisation resulting into irredentism did not manifest significantly. Representatives of the Polish interest groups repeatedly demanded the consistent safeguarding of the rights of the Polish minority at all possible occasions, mainly during their visits to Warsaw and Prague. Only a small radical group Zaolzie, which operates on both sides of the borders, considers Czech dominion over the territory being unjustifiable (Mareš, 2010). Therefore no proto-diplomacy of Polish organisations representatives can be expected.

We will also study cross-border relation of Polish organisations with those in Poland. While it is central for minorities to maintain and improve relations with their kinstate, majorities are interested in tangible financial or other qualitative gains from cross-border co-operation. The minorities interest in overcoming a border might also be contrary to the majorities' interest in the preservation of the border because of its protective functions. CBC then generally intensifies when a financial incentive, for example in the form of Interreg programme, is given to the majority population. (Klatt 2013).

Congress of Poles

The Congress of Poles in the Czech Republic (Kongres Polaków w Republice Czeskiej) is the umbrella organization of the Polish national minority in the Czech Republic. Its largest member is the Polish Association for Culture and Education (PZKO), which will be described later on. As an organization safeguarding the interests of Polish citizens in the Czech Republic, it gathers 30 Polish organizations, whose representatives form the Council of Representatives (Rada Przedstawicieli), the executive body of the Congress (Smolová 2010), which is elected for a four-year term. The current board, serving between 2016 and 2020, leads a successful entrepreneur, Mariusz Walach, founder of the Walmark company and recent Businessman of the year of the Czech Republic. Congress has two main tasks:

• Coordinates the activities of all organizations of the Polish national minority in the Czech Republic.

• Represents a Polish national minority in safeguarding its interests in negotiations with the Government of the Czech Republic.

The Congress was established, under the name of Polish Council, in Český Těšín on 3 February 1990. According to a current Vice-Chairman of the Congress, Jozef Szymeczek, Congress can be seen as a "Havel´s" child of the concept of civil society. According to the statute it should execute mainly following activities (modified, Congress of the Poles, 2016):

- Unifying and coordinating members' activities aimed at realizing common goals and safeguarding interests of Polish society living in the territory of the Czech Republic (Polish national minorities), protecting their rights and interests and supporting the organization of social life ......, in cooperation with public administration bodies and local authorities,
- Promoting the interests of the Polish national minority, in particular, vis-a-vis local government and public administration and political leaders. The Congress is a connection line between Poland and the Czech Republic bringing their interests closer together,
- Congress defends the rights of Poles to use their language at all levels, especially in the field of education, it also defends the right to promote multilingual inscriptions (road signs, signs on the public buildings etc.),
- Congress seeks to consolidate and deepen the relationship with the homeland (meaning Poland) and the universal expansion of the cultural heritage of Polish society in the Czech Republic. This is done inter alia through the use and promotion of Polish language and culture,
- Congress implements its activities mainly through the organization of cultural, sporting, social events, conducting editorial, documentation, educational and training activities, including trips,
- Congress supports cross-border and international co-operation activities and works with (Polish) expatriate organizations around the world.

The Statute clearly shows the emphasis on building and maintaining relations with the homeland – Poland, with an emphasis on the use of Polish language, principally – but not only – In the field of education. The motivation for focusing activities in this direction is relatively clear: as it is the case for the most of European minorities, also the Polish minority has faced progressive assimilation. While 64 000 inhabitants of the region declared Polish nationality in 1920, only 26,000 inhabitants reported Polish nationality during last census in 2011 – this was more than 10 000 less compared to the census of 2011. The change of nationality/identity change in the region is nicely illustrated in the following chart:

Chart 1: development of number of Czech and Polish inhabitants of Czech part of Těšín Region
Source: Szczyrba 2012

The dramatic decline in the population of Polish nationality is clearly attributable to the assimilation, which brings, among other things, also the gradual reduction of the number of elementary and secondary schools with Polish as a language of tuition, which plays an irreplaceable role in preserving their national identity. The right of national minorities to have education in their own language is defined in the Charter of Fundamental Rights and Freedoms and in the Act on the Rights of Members of National Minorities. Therefore there are nursery, elementary and secondary schools with a Polish as a language of tuition in Těšín region. Pedagogical Center for Polish Minority Education in Český Těšín, established by the Czech Ministry of Education, Youth and Sports, is the institution caring for the needs of these schools and in-service training of their teachers and it will be studied later on in this paper.

The decresing number of Polish schools and pupils is dramatic: while there were still almost 3 400 pupils in the region in 1988, the current number of pupils is just the half of that size in 20 schools. Hence, Congress is trying to reverse this trend, although it is a difficult task - pupils' loss is related, among other things, to a large number of mixed marriages in the territory of Těšín Region. Mixed married couples in most cases send children to the Czech school (Zormanová 2012). The author of the study himself considers that as a mistake, as graduates of these schools master both Polish and Czech at a native speaker level. Moreover, Polish minority schools offer significantly lower number of pupils in classes and contribute towards much larger community spirit creating local elites, which are often famous nation-wide. Recent examples include popular singer Ewa Farna, Walach brothers running successful family business Walmark or Ewa Katrušáková, the founder of "The whole Czechia reads to its children" NGO.

Another major activity of Congress is the publishing of newspaper Głos Ludu (Voice of the People) as well as books written by Polish writers in the Czech Republic. The Congress of Poles has also conducted documentary work, as it has been collecting documents and archival records on the history of the mutual coexistence of Poles and Czechs, and has been documenting the activities of Poles living in the Czech Republic. Other activities include the organization of cultural events, youth gatherings, cultural festivals, and the festival That´s Us (Tacy jesteśmy) presenting achievements, articles and cultural achievements of representatives of Polish nationality in the Czech Republic since 1993. The Congress is also a member of the European Federation of National Minorities, one of the consultative bodies to the European institutions.

The establishment of the Zaolzie Development Fund, which supports the activities of the Polish minority also financially, was an important novelty introduced in 2017. It was created as one of the follow-ups of the process of drafting a Strategy 2035, which will be described later on. The first projects supported by this Fund focused mainly on culture, education and sports, part of the projects supports travelling to the significant places in Polish homeland: Krakow as the spiritual center of the country, Warsaw as the capital city or Opole as a place where a national song contest is held every year. In particular, the fund will be made up of private sponsors and will distribute about four million crowns per year, an amount that exceeds the potential of many other local foundations. Its donors recruit from the Polish entrepreneurial elite, which declared their willingness to keep this status until the year 2035.

Vision and Development Strategy of "Polishness[1]" in Zaolzie until 2035

The Congress decided to proceed to a "soft form" of strategic planning and decided to elaborate a document called "Vision and Development Strategy of Polishness in Zaolzie until 2035" (Congress of Poles, 2016). The document should help to formulate the desirable status of the Polish national minority in Těšín in the 20 years horizon, which authors consider the shortest possible period in which the positive turn can be clearly seen.

According to the authors of the strategy and representatives of the Congress, the motivation for drafting the document was driven by the need to respond to the "waning Polish flower in Zaolzie", as poetically co-authored by Zygmunt Rakowski (Glos Ludu, 2015). According to the initiators and authors of the document, this is mainly due:

- decreasing number of Poles who report this nationality in census in the region,
- decreasing interest in mother tongue and its deteriorating level,
- the low interest in contacts with the homeland,

[1] Term Polishness should mean „being Polish or feeling Polish", its original Polish wording is „polskość"

- the low level of involvement of Polish minority representatives in organizational structures that would help to reverse this trend.

The authors of the document emphasize its importance, especially in terms of the “moral appeal” on members of the Polish minority, which is intended to encourage their greater participation in public affairs and greater self-identification with Polish nationality, for example through membership of organizations associating Poles in Zaolzie. The authors of the vision want to actively pursue the already established cooperation with the Polish authorities, including the Ministry of Foreign Affairs, the Polish Unity Foundation (Wspólnota Polska) and the “Help the Poles in the East” Foundation, although the primary focus of the last is on the Poles living in Ukraine, Lithuania and Belarus.

The main measures of the Strategy should be focused on the following areas:

- Supporting the use of Polish language and local dialect, Silesian gwara, both in everyday life and in literary use,
- Promoting the concept of Těšín Silesia as a “small homeland in Europe” (thus, it enters the concept of a high degree of self-identification with the region, including the cross-border “Euroregional” dimension),
- An appeal on higher degree of self-identification with Polish nationality accompanied by a higher degree of civic engagement,
- Higher level of communication and promotion of the Polish national minority in Zaolzie both towards the members of the community as well as outside to the Czech majority in the Těšín region and to the Poles in Poland,
- Supporting and further development of entrepreneurial activities of the Polish national minority members,
- Support of Polish culture in Zaolzie,
- Support for scientific activities focusing on fundamental problems of the Polish minority in Zaolzie.

The authors of the strategy, including academics respected in both Czech and Polish scientific environment (notably the former chairman of the Czech Geographic Society, professor Siwek of the University of Ostrava) are obviously aware of the difficulty of communicating and implementing strategy effectively. However, they seem to be determined to implement the strategy's goals. This can be evidenced by one of the main tools to be used to achieve these objectives - the Development Fund of the Zaolzie, which has really come into being. The strategy also anticipates the emergence of new entities, which will support the Polish minority and which should operate within an informal partnership called the Zaolzie Development Center. It is worth mentioning, in particular, the plan to establish a think tank that should bring new impetus to the development of the Polish minority in the Těšín region, as well as great emphasis on the need to be active and implement own projects.

The Congress of the Poles has been active in submitting own projects since the begining of 2000s. One of their recent project called Map of Zaolzie region brought a major controversy, which consisted mainly from two points: the first was the fact that only the Polish name and the man in the costume bearing the Polish flag were shown on the cover of the map; the second problem was the mapping of historical borders from 1918 and 1938, where the territory was controlled by Poland.

The project caused major and unprecedented controversy in the region among self-government representatives, which resulted in a declaring parts of the project costs ineligible by the euroregional steering committee, The cuts of projects´costs have never been cut because of the content, the cuts are acused by administrative omissions (Böhm and Drapela, 2017). However, it is necessary to say that there has been no real deterioration of the Czech-Polish relations.

As it has already been said, the international activity of the Congress of Poles focuses mainly on the relationship with the kin state, Poland. In particular, the relationship with the Polish Unity (Wspólnota Polska) and the Foundation "Assistance to the Poles in the East" has provided Congress in particular with easier access to financing its activities from Polish public finances. Congress representatives have also been active in the consultative bodies, which have supported the Polish language teaching and minority schools outside of Poland. Congress representatives have used these funds to finance the stays of all pupils of the 7th class of Polish minority schools on the Baltic coast, they have also launched a new initiative sending pupils of the eighth and ninth classes to weekly stays in schools in Poland to be in contact with the "mainstream" Polish.

The Congress has also been involved in pan-European networks dealing with national minorities, which also applies to their newspaper, Glos Ludu. A very specific role was played by Congress in the framework of the Czech-German reconcilliation, as it helped approximately 3 500 people from the region to obtain compensation for forced labor during the Second World War.

Polish Association for Culture and Education

Polish Association for Culture and Education (PZKO) is together with the Congress of Poles in the Czech Republic the principal organization of the Polish national minority in the Czech Republic and, at the same time, the largest organization of Poles in the Czech Republic. The PZKO was established in 1947. It was also the consequence of the intergovernmental treaty between the then Czechoslovakia and Poland (the Treaty on Friendship and Mutual Assistance), when part of this agreement was a supplementary protocol, governed by the principle of reciprocity of the Polish minority law in Czechoslovakia. One of the rights contained in this Additional Protocol was the right to establish the Association of Polish Youth and the Polish Association for Culture and Education, which was established in 1947. The authorities were not allowed to re-establish pre-war Polish organizations.

In the days of socialism, the PZKO was the only organization associating the Poles in Czechoslovakia for decades, and the life of the Polish minority unfolded within this organization, subsidized by the state but only allowing cultural and artistic activities. Political revival in the 1960s affected the PZKO. The Polish minority in Czechoslovakia sought to transform the PZKO into an organ of its political representation, but after the suppression of the Prague Spring and the invasion of Warsaw Pact troops – including those from Poland -

to Czechoslovakia was PZKO forced to develop activities exclusively in the field of culture and leisure-time. After 1989 the political representation of the Polish minority was overtaken by Congress of Poles in the Czech Republic. PZKO has continued to focus primarily on cultural and educational activities, as their goal is to preserve the ethnic identity of Poles in the Czech Republic (Szczyrba 2012).

Pedagogical centre for Polish minority schools

The Pedagogical Center for Polish minority schools is an organization established by the Ministry of Education, Youth and Sports of the Czech Republic. It is based in Český Těšín with the aim of providing the needs of schools with Polish as an instruction language in the Czech Republic and also with the aim to organise in-service training for teachers of these schools. The centre claims it is an education and training institution supporting actively European cooperation. Its unique feature is an accent on the identity and specificity of the Těšín Silesia Euroregion.

The Pedagogical Center differs thus from the two above-mentioned organizations, the Congress of Poles and PZKO, by the fact that it is established and controlled by the Czech Ministry of Education, who commissions the Pedagogical Center and approves its annual work-plans. These workplans foresee following main activities:

- In-service teachers´ training,
- supporting national minority education,
- issuing methodological didactic tools - Jutrzenka and Ogniwo,
- organising competitions for pupils and students,
- lifelong learning,
- cross-border cooperation,
- European cooperation,
- managing pedagogical library.

The staff of the Center is bilingual and recruits almost exclusively from members of the Polish national minority. The activities of the centre don´t focus on Polish minority schools only, as centre has offered its services to teachers from the Czech environment. Moreover, the Center participates in activities of the so-called Czech-Polish expert group on textbooks in subjects whose interpretation may cause potential controversy - especially history, geography and social sciences, while trying to suggest a mutually sensitive approach to some painful places in the past. At present, this cross-border group of experts is preparing for events in 2018, when both countries celebrate their 100th anniversary of independent existence.

The Center is also active at European level, as it is participating in EU-funded community programs, as well as by the programmes funded by the Czech Education Ministry. It has been actively participating in international congresses of Polish language teachers abroad. The centre has also been actively engaged in manifold cross-border cooperation initiatives and the grant-giving authorities have valued its projects very highly, mostly those representing INTERREG programme.

Most of the international activities of the Center are those with Poland. These projects are not limited to the cooperation of the Center and “Polish” schools from the Czech part of Těšín with partners in Poland, but they have been actively involving also Czech schools from the entire length of the Czech-Polish border. In terms of content, these cross-border cooperation projects have aimed at networking schools from both sides of the border, supporting regional education with a focus on the Euroregion Těšín Silesia and supporting the teaching of Polish language. It should be said that a short analysis of the projects carried out by the Center, enriched by the author's own experience with these projects, points to the politically correct approach of the Center, as it respects the fact that it is a contributory organization of the Czech Ministry.

In this context it is also worth noting the recent repeatedly endeavours of some representatives of the Czech part of the Těšín Silesian Euroregion (body administering part of INTERREG Fund, Micro-projects scheme for Těšín Silesia Euroregion) to complicate the access to these funds to the Centre. They were arguing that they did not wish to support Polish-Polish cooperation. It should be noted that this approach did not limit the ability of the Pedagogical Center to implement these projects and was rather connected with individuals in the Czech Secretariat.

CONCLUSIONS

As mentioned in the introduction, Polish minority has been facing a rapid assimilation with the Czech majority environment. The elites gathered in the organisations safeguarding the interest of Polish minority in Czechia are well aware of that and try to find an appropriate set of responses.

For the first time in history a strategic document “Vision 2035” was elaborated to prevent an entire assimilation. It is based on a mix of manifold measures, but the principal instrument is seen in education, support of Polish minority schools and support of the use of Polish language. To ease fulfilling the strategy the financial instrument was set-up, to which wealthy representatives of Polish minority promised to contribute annually until 2035 and the first subsidies were distributed in 2017.

The elaboration of a strategy itself was an important step. As mentioned, education has a crucial role in achieving the goals of strategy and preventing assimilation of Polish minority in Těšín. Hence, Polish minority representatives have been successful in fundraising for Polish minority schools, who are except for the core tuition expected to play an active role in community life and promote by all means the use of Polish language.

CBC and paradiplomacy are the tools used by Polish minority organisations to safeguard the interests of Poles in the Czech Republic as well as to raise sources for their own functioning. Primary they have co-operated with the public authorities and foundation from Poland as their kin-state, but they have also been active in European networks gathering national and ethnic minorities. It should also be noted that no proto-diplomacy or irredentism could have been observed from the Polish minority representatives, who seem appreciate the membership in the EU, as an organisation, which inter alia funds CBC and keeps an eye on the rights of minorities, much more than majority societies both in the Czech Republic and Poland.

However, despite all unprecedented efforts described in the paper the gradual assimilation of Poles in Czech Republic seems very likely to happen. General census of 2021 will indicate the speed of the assimilation: if the number of those indicating Polish nationality drops dramatically again it will result in further reducing the number of schools with Polish as tuition language and pupils in these schools. This will just speed-up the assimilation.

REFERENCES

BÖHM, H. & DRÁPELA, E. (2017): Cross-border cooperation as a reconciliation tool: Example from the East Czech-Polish borders, Regional & Federal Studies, https://doi.org/10.1080/13597566.2017.1350650

Congress of Poles (2016): "Vision and Development Strategy of Polishness in Zaolzie until 2035" (Congress of Poles, 2016). Available from http://www.polonica.cz/content/Wizja_2035_tekst.pdf, accessed 30 July 2017

Congress of Poles (2016): Navrhovaný statut (available from http://polonica.cz/content/Proponowany_statut_Kongresu_Polakow.pdf, accessed 27 July 2017

DUCHACEK, I. D. (1988), Multicommunal and Bicommunal Politics and their International Relations, in: I.D. Duchacek, D. Latouche and G. Stevenson (eds), *Perforated Sovereignties and International Relations: Trans-Sovereign Contacts of Subnational Governments*, pp.12-13. New York: Greenwood Press.

DUCHACEK, I. D. (1990), Perforated Sovereignties: Towards a Typology of New Actors in International Relations, in: H.J. Michelmann and P. Soldatos (eds), *Federalism and International Relations. The Role of Subnational Units,* pp.1-33. Oxford: Clarendon Press.

JOENNIEMI, P. and SERGUNIN, A. (2014), Paradiplomacy as a Capacity-Building Strategy, *Problems of Post-Communism,* Vol.61, No.6, pp.18-33.

KLATT, M. (2013), National minorities as a model for cross-border integration. Lessons from Schleswig', in J. Beck. and B. Wassenberg (eds), Grenzüberschreitende Zusammenarbeit leben und erforschen (Bd. 5): Integration und (trans-)regionale Identitäten, pp. 301–320. Stuttgart: Franz Steiner Verlag.

KLATT, M. & WASSENBERG, B. (2017), Secondary foreign policy: Can local and regional cross-border cooperation function as a tool for peace-building and reconciliation? Regional & Federal Studies Vol. 27, Iss. 3,2017, p. 205 – 2018, https://doi.org/10.1080/13597566.2017.1350652

MAHDAL, M. (2015), Obsazování Těšínska polskou armádou. Available at http://www.moderni-dejiny.cz/clanek/obsazovani-Těšínska-polskou-armadou/ , accessed on 31 October 2017.

MAREŠ, M. (2010), Iredentismus: tradiční a nová dimenze hrozby pro Českou republiku. Obrana a strategie, available from http://www.obranaastrategie.cz/cs/aktualni-cislo-2-

2010/clanky/iredentismus-tradicni-a-nova-dimenze-hrozby-pro-ceskou-republiku.html#.WX2gSIjyhPY, accessed on 30 September 2017.

McHUGH, J. T. (2015), Paradiplomacy, Protodiplomacy and the Foreign Policy Aspirations of Quebec and other Canadian Provinces, *Canadian Foreign Policy (CFP),* Vol.21, No.3, p.238-256.

SMOLOVÁ, I., (2010), Poláci v České republice, available from https://geography.upol.cz/soubory/lide/smolova/RGPOL/Polaci-v-CR.pdf, accessed 31 October 2017.

SOLDATOS, P. (1990), An Explanatory Framework for the Study of Federated States as Foreign-policy Actors, in: H. J. Michelmann and P. Soldatos (eds), *Federalism and International Relations. The Role of Subnational Units,* pp.34-53. Oxford: Clarendon Press.

SZCZYRBA, Z. (2012). Polsko- regionální geografie (e-textbook). available http://geography.upol.cz/soubory/lide/szczyrba/RGPOL/ucebnice/vztahy/polaci_cesi.html, accessed 29 October 2017

ZORMANOVÁ, L. (2012), Polské národnostní školství v ČR. Available from http://clanky.rvp.cz/clanek/a/16247/15555/POLSKE-NARODNOSTNI-SKOLSTVI.html/ , accessed on 29 July 2017.

Shrnutí

Území Těšínského Slezska bylo rozděleno mezi Československo a Polsko v roce 1920. Toto umělé rozdělení přispělo k tomu, aby se stali československými občany stalo asi 200 000 lidí, kteří nehovořili češtinou jakožto mateřštinou. 64 000 z nich se prohlásilo za Poláky. Téměř 90 let poté se pouze 26 000 obyvatel během posledního sčítání lidu v roce 2011 přihlásilo k polské národnosti.

Článek analyzuje činnost nevládních i veřejných institucí pracujících pro polskou menšinu v regionu Těšínsko Slezska. Pojmenovává velkou snahu zastavit postupující asimilaci polské menšiny s českou většinou společností různými způsoby, od rozvoje zvláštních finančních nástrojů na podporu polských menšinových organizací k paradiplomatickým aktivitám. Výzkum ukazuje, že vzdělávání v polštině a důraz na polský jazyk jsou rozhodujícími nástroji pro zpomalení asimilace, která se ale se jeví jako nevyhnutelná.

METHODOLOGICAL ISSUES OF USING THE GRAVITY MODEL TO DETERMINE THE POWER OF BORDER EFFECT

Emil Drápela, Nikola Kárníková

Technical University of Liberec, Komenského 314/2, 460 01 Liberec
emil.drapela@tul.cz

Abstract: Using modelling is one of the ways how to recognize the power of spatial interactions between sites. Output from the model is the inherent power of this spatial interaction, which should not be too different from real interactions when correctly calibrating the model. In cases when the model shows good results in most areas, but in certain locations its results are significantly different from reality, it is necessary to ask what is the reason of these deviations. In border areas, the results are often significantly affected by the border effect.

This article describes how to measure border effect strength using geographic spatial interaction models. The gravity model is used, for the individual masses are used data about the number of inhabitants of municipalities. Real interactions, expressed in measured data on the daily frequency of vehicles in individual sections, are compared with the expected values, their share being the border effect strength.

Key words: transport geography, regional development, border effect, spatial interactions, gravity model, cross-border cooperation.

INTRODUCTION

Gravity model is very successful empirical model in geography and economics, which is widely used for many types of scientific problems. We can find papers dealing with international transactions in financial assets and goods trade (Portes and Rey, 2005), role of geographic barriers on trade (Eaton and Kortum, 2002), international migration flows (DeWaard, Kim and Raymer, 2012), explanation of stock market correlations (Flavin, Hurley and Rousseau, 2002), describing strength of spatial interactions between regional centres (Drápela, 2017), etc. Thanks to the wide applicability of this model, there are a number of variations depending on the type of use. Moreover, as remarked by Anderson (2011), “incorporating deeper theoretical foundations of gravity into recent practice has led to a richer and more accurate estimation and interpretation of the spatial relations described by gravity”, which means that with the correct use of the model and good input data, this model gives very good results.

The key concept when using gravity model is a spatial interaction, which is described by Roy and Thill (2004) as “the process whereby entities at different points in physical space make contacts, demand/supply decisions or locational choices. The entities can be individuals or firms and the choices can include housing, jobs, production quantities, exports, imports, face-to-face contacts, schools, retail centres and activity centres". These spatial interactions occur most often in places where there is a large concentration of people, resources and capital; most often they are described by a function of the number of inhabitants in municipalities and the distance between them. Though recently there have been noticed some opinions that thanks to technological advances and ongoing globalization, the importance of distance is suppressed, Maggioni and Uberti (2009) in their work proves that this "death of distance" is not based on real data and is more wish than reality.

Spatial interactions may be attenuated in certain regions by various effects, such as the effect of geographic parameters of the area, the effect of political or administrative boundaries, the effect of economic deprivation on the territory, etc. One of the most common is the border effect. Border effects refer to asymmetries in spatial interactions' patterns between municipalities of different countries that share a national border and those that are located in the same country - it acts as an invisible barrier which attenuates the intensity of the spatial interactions. This barrier may be based on real territory parameters - e.g. on a worse or less dense transport infrastructure across borders, a different language on both sides of the border, which complicates communication between entities, or complications associated with different legislation. On the other hand, sometimes borders (or parameters of border areas) are only a mental barrier that is not based on objective reality (see Drápela and Böhm, 2016). The negative impact of the border effect can be overcome through cross-border cooperation (Böhm, 2015; Böhm and Drápela, 2016, 2017). The force of the border effect can then be described as the difference between the expected spatial interaction value calculated using the gravitational model and the real spatial interaction value measured in the field.

METHOD

Gravity model in its basic version explains the power of spatial interactions by two factors: the size or importance of area, and the distance between areas. Marshall (2016) uses following definition:

$$\boldsymbol{F_{ij} = k\frac{P_i P_j}{d_{ij}}}$$

Where, F_{ij} is the number of flows between area i and area j, P_i and P_j are the population size of areas i and j, d_{ij} is the distance between i and j, and k is a scaling factor which relates the number of flows (F_{ij}) to the ratio P_iP_j/d_{ij}. The values of P_i and P_j are taken from actual data of Continuous population register and for d_{ij} is used Euclidean distance of city centres in m. The value of scaling factor k is crucial for further calculations, because all results will be relativized by it. Drápela (2017) recommended as typical for the Czech Republic values for Prague-Liberec, Prague-Hradec Králové and Praha-Ústí nad Labem routes, which are routes between regional centres where it was possible to separate the influence of other routes (especially transit routes) on values of spatial interactions. Therefore, this article uses the value obtained from the calibration on the Prague-Liberec route (see Results chapter).

In the literature there is a strong debate if the waveform attenuation of gravity between the two sites have a linear character, as foreseen in the basic pattern, or not. Henderson and Millimet (2008) demonstrated that this mathematical function may be a bit complicated, when splitting the dataset to multiple levels to receive valid results. The assumption of a different value of the coefficient k for different size groups of municipalities is also used in this work where the value for regional centres may not be suitable for smaller towns and municipalities. For this reason, the analysis will also use non-border locations, which will be used for comparison. Halás, Klapka and Kladivo (2014) then argued that the intensity decrease with distance is not linear at all but can be described by curve. However, the authors only analysed commuting, for the general simplification of all kinds of spatial interactions the linear function can be used.

For quantification of border effect, expected values of spatial interactions (F_{ij}), calculated by gravity model, will be compared to real-measured values (C_{ij}), to reveal the intensity of spatial interactions on this route (I_{ij}):

$$\boldsymbol{I_{ij}} = \frac{\boldsymbol{C_{ij}}}{\boldsymbol{F_{ij}}}$$

The intensity will be lower where the border effect is stronger and vice versa. Real-measured values (C_{ij}) are represented by values of annual average daily traffic (AADT), which is the total volume of vehicle traffic in the road for a year divided by 365 days. There were used data from the Census of Transport, which was implemented in 2016 by the Directorate of Roads and Highways. These data were calculated from shorter measured periods – methods how to do this are described in Gastaldi et al. (2013), Lam and Xu (2000), or Rossi et al. (2012), however, precise methodology is not known because the data provider protects it as secret know-how.

AADT values on a certain section of road are never the result of only one interaction between two locations, but the result of the sum of the many interactions whose shortest route runs through this section. This means that in order to calculate the supposed value of the spatial interaction it is necessary to first find all the pairs of municipalities that interact together through this section. There are usually many thousands of these couples, fortunately, some of them produce so little value of spatial interaction that it can be neglected. On the contrary, the largest settlements typically produce 80-90% of the total spatial interaction value, allowing us to use a smaller number of pairs to approximate very closely the value that would give us a much more complex calculation. This simplified method requires a researcher's experience, but it is very time efficient, so it will be used in this paper.

RESULTS

The first step to quantifying the border effect is to calibrate the model. In this case, the Prague-Liberec route, or part of the D10 motorway between exits 67 and 71, was used. This section of motorway is suitable for calibration because there are strong spatial interactions in the form of commuting to work between North Bohemian towns on one side and Prague, Mladá

Boleslav and some other cities along this motorway on the other. The result of the calibration was the value of the k coefficient: 0.007245.

In the next step, it was possible to proceed to quantification of expected spatial interactions (F_{ij}). The simplified model uses only larger centres, depending on the distance from the monitored route. In the most proximity the model counts municipalities with a population of more than 2,000, with growing distance the required minimum size of the city is increasing, while over 100 km are used only cities with more than a million inhabitants. The example of expected spatial interaction value calculation for one selected route is shown in Tab. 1.

Tab. 1: Example of expected spatial interaction value (Fij) calculation – route Nové Město pod Smrkem – Świeradów-Zdrój

Name (i)	Name (j)	P_i	P_j	d_{ij}	k	F_{ij}
Frýdlant	Mirsk	7536	3967	21920	0.007245	9.88
Frýdlant	Swieradów-Zdrój	7536	4240	17830	0.007245	12.98
Frýdlant	Gryfów Slaski	7536	6693	26300	0.007245	13.89
Frýdlant	Jelenia Góra	7536	80524	45980	0.007245	95.62
Nové Město pod Smrkem	Mirsk	3753	3967	11820	0.007245	9.13
Nové Město pod Smrkem	Swieradów-Zdrój	3753	4240	7460	0.007245	15.45
Nové Město pod Smrkem	Gryfów Slaski	3753	6693	17250	0.007245	10.55
Nové Město pod Smrkem	Jelenia Góra	3753	80524	35470	0.007245	61.73
Raspenava	Mirsk	2820	3967	18960	0.007245	4.27
Raspenava	Swieradów-Zdrój	2820	4240	13790	0.007245	6.28
Raspenava	Gryfów Slaski	2820	6693	24150	0.007245	5.66
Raspenava	Jelenia Góra	2820	80524	41920	0.007245	39.25
Hejnice	Mirsk	2724	3967	17460	0.007245	4.48
Hejnice	Swieradów-Zdrój	2724	4240	11140	0.007245	7.51
Hejnice	Gryfów Slaski	2724	6693	23410	0.007245	5.64
Hejnice	Jelenia Góra	2724	80524	38830	0.007245	40.93
Liberec	Mirsk	103853	3967	31890	0.007245	93.60
Liberec	Swieradów-Zdrój	103853	4240	24740	0.007245	128.95
Liberec	Gryfów Slaski	103853	6693	38120	0.007245	132.11
Bogatynia	Mirsk	17984	3967	30620	0.007245	16.88
Bogatynia	Swieradów-Zdrój	17984	4240	26270	0.007245	21.03
Bogatynia	Jelenia Góra	17984	80524	54420	0.007245	192.79
Zittau	Mirsk	25636	3967	41200	0.007245	17.88
Zittau	Swieradów-Zdrój	25636	4240	36920	0.007245	21.33
Zittau	Jelenia Góra	25636	80524	65070	0.007245	229.84
Fij TOTAL						**1197.7**

Source: Czech statistical office, Central statistical office of Poland, Statistical regional office of the Free State of Saxony, own calculation.

After the values of expected spatial interactions were calculated for all selected sections, it was possible to compare them with the real measured AADT values. This comparison is shown in Tab. 2.; in the first part of the table there are cross-border routes, in the second section the domestic routes. Low intensity values then indicate the strong influence of border effect.

Tab. 2: Intensity of spatial interactions on selected routes in Liberec region and surroundings

Route	Road	F_{ij}	C_{ij}	I_{ij}
Harrachov-Szklarska Poreba	I/10	15966.9	1112	6.96%
Hrádek nad Nisou-Zittau	I/35	11544.8	5468	47.36%
Habartice-Zawidów	I/13	3368.6	2065	61.30%
Petrovice-Lückendorf	II/270	971.3	669	68.88%
Nové Město p. S.-Świeradów-Zdrój	II/291	1197.7	846	70.64%
Varnsdorf-Seifhennersdorf	II/265	1799.8	2707	150.41%
Varnsdorf-Großschönau	II/264	1348.6	2568	190.41%
Hrádek nad Nisou-Zittau	35J	1708.9	3321	194.33%
Frýdlant-Bogatynia	3511	827.2	2074	250.73%
Česká Lípa-Mladá Boleslav	I/38	8108.9	7147	88.14%
Turnov-Jičín	I/35	8578.9	7604	88.64%
Desná-Hejnice	II/290	328.3	668	203.46%
Chrastava-Nový Bor	I/13	4980.3	10203	204.87%

Source: Czech Directorate of Roads and Motorways, General Directorate for National Roads and Motorways of Poland, own calculation.

The table shows three main results:

- there are significant differences between first class and second or lower class roads,
- the border effect is stronger on cross-border routes,
- in some routes the expected values are significantly lower than real values.

The following chapter explains the nature of these three most significant phenomena.

DISCUSSION

The results presented in the previous chapter show that the proportion of expected and real values of spatial interactions can be very different and three main patterns can be observed. First of them is existence of differences between first class roads on the one side and second or lower class roads on the another side, when I_{ij} values are significantly lower on the first class roads. An explanation for this may be the fact that first-class roads form the backbone network between regions and regional centres, while lower-class roads are usually used only to transport locally. Thus, big masses of the large centres were included in the gravity model for the first class roads, but on the other hand, there was a significant impact of border effect on the borders between the regions. This impact is most evident in the Harrachov-Szklarska Poreba route, where I_{ij} is only 6,96%. On contrary, large centres are not included in the calculations on lower-class roads because the route of these roads mostly only complements the higher-class network and the inhabitants of large centres do not use them. For this reason, it can be concluded that the border effect is more pronounced at the regional level than at the local level, because there is a significantly stronger border effect among the big centres than among the smaller towns near the border.

The second above mentioned result is the fact that the border effect is stronger on cross-border routes. This is the supposed result, because it has already been confirmed by Drápela (2017) on regional level. However, at the local level, this effect has much less influence, results are different, but no so different as in above mentioned work. We can say that the differences between road types are considerably larger than the differences between cross-border and domestic roads. This may be a surprise.

Finally, in some routes the expected values were significantly lower than real values, which means that the rate of intensity of spatial interactions is unexpectedly high. This is again due to the fact that the border effect is more pronounced at the regional level than at the local level. The gravity model was calibrated using the Prague-Liberec route, which is domestic, but there is also a border effect between the regions of the Czech Republic. On the other hand, some areas at national borders function as integrated regions, the border effect does not appear much here and the intensity of spatial interactions is paradoxically higher than in the calibration route. This excellent result may not only be thanks to good cross-border cooperation, but also because the state border in the Liberec region is rather rugged and some territories serve mainly for transit: namely Varnsdorf-Großschönau, Varnsdorf-Seifhennersdorf and Hrádek nad Nisou-Zittau routes serve for Czech Republic to Czech Republic transit and Frýdlant-Bogatynia and Nové Město p. S.-Świeradów-Zdrój routes serve for Poland to Poland transit. From this point of view, consideration should be given if such routes as cross-border or not. However, the intensity of the working and business relations between the Czech and German border regions is supporting this “cross-borderness”, when German shops are often the destinations of Czech customers and both regions benefit from cross-border tourism.

CONCLUSION

In this article we tried to describe how the border effect affects spatial interactions intensity on selected routes in the Euroregion Nisa-Neisse-Nysa. We chose the routes where the road crosses the national border with Germany or Poland and added several domestic routes for comparison. For each route, we calculated the value of spatial interactions intensity (I_{ij}) using gravity model and then we tried to explain how this value is affected. During this process, we have come up with interesting findings that relate to both the results themselves and the methodology used.

Regarding the methodology, we can say that the use of the gravitational model for this type of task proved to be good. However, it is necessary to take into account the factor that has somewhat distorted the results, namely the regional or local level of the survey. At the regional level, even distant larger centres are included in the calculation as the routes are used by the inhabitants of these large cities. As a result, the impact of the border effect will be greater. On the other hand, a large number of lower-class roads serve only for local transport and the inhabitants of large agglomerations do not use them. If these local roads do not overcome a significant geographical barrier (as in the case of the Harrachov Road), the border effect will show lower intensity. Therefore, when calibrating the gravity model, it is necessary to take into account the road class and to distinguish the core infrastructure and the roads of the lower classes.

The main hypothesis of our work that the border effect will be recorded at national borders is confirmed, but this effect was not as strong as we expected (especially when we take into account the results of the previous study: Drápela, 2017). This is caused by the fact that the border area of the Liberec region is, from a geographic point of view, mostly well permeable, the border is very curvy, so some border areas act as transit for daily commuting from abroad to abroad. However, the results also reflect the long-term successful cross-border cooperation between the Czech Republic, Germany and Poland in this region, which has significantly reduced the negative impact of the border effect.

Acknowledgements: This article was created thanks to the project SGS-FP-TUL 10/2017 "Quantifying the border effect using geographic models of spatial interactions".

REFERENCES

ANDERSON, J. E. The Gravity Model. *Annual Review of Economics*. 2011, 3(1), 133-160. ISSN 1941-1383. https://doi.org/10.1146/annurev-economics-111809-125114

BÖHM, H. New forms of cross-border co-operation governance as a tool of environmental protection strategies – example from Czech-Polish-Slovak borders. **In:** *International Multidisciplinary Scientific GeoConference*. Albena: SGEM, 2015, 15(3), 739-747. ISBN 978-619-7105-40-7.

BÖHM, H. a DRÁPELA, E. Selected cross-border cooperation governance forms within the EU. **In:** *Central Europe Area in View of Current Geography. Proceedings of 23rd Central European Conference*. Brno: Masarykova univerzita, 2016, 472-481. ISBN 978-80-210-8314-1.

BÖHM, H. a DRÁPELA, E. Cross-border cooperation as a reconciliation tool: Example from the East Czech-Polish borders. *Regional & Federal Studies*. 2017, 27(3), 305-319. ISSN 1359-7566.
https://doi.org/10.1080/13597566.2017.1350650

DEWAARD, J., KIM, K. a RAYMER, J. Migration Systems in Europe: Evidence from Harmonized Flow Data. *Demography*. 2012, 49(4), 1307-1333. DOI: 10.1007/s13524-012-0117-9. ISSN 0070-3370.
https://doi.org/10.1007/s13524-012-0117-9

DRÁPELA, E. Quantification of border effect on different types of borders: case study of the Czech Republic. In: *International Multidisciplinary Scientific GeoConference*. Albena: SGEM, 2017, 17(53), 687-693. ISBN 978-619-7408-10-2.

DRÁPELA, E. a BÖHM, H. Perceptions of barriers to cycle commuting: The geographic perspective. **In:** *Central Europe Area in View of Current Geography. Proceedings of 23rd Central European Conference*. Brno: Masarykova univerzita, 2016, 464-471. ISBN 978-80-210-8314-1.

EATON, J. a KORTUM, S. Technology, Geography, and Trade. *Econometrica*. 2002, 70(5), 1741-1779. ISSN 0012-9682. https://doi.org/10.1111/1468-0262.00352

FLAVIN, T., HURLEY M.J. a ROUSSEAU, F. Explaining Stock Market Correlation: A Gravity Model Approach. *The Manchester School*. 2002, 70(S1), 87-106. ISSN 1463-6786. https://doi.org/10.1111/1467-9957.70s1.5

GASTALDI, M., ROSSI, R., GECCHELE, G. a Della LUCIA L. Annual Average Daily Traffic Estimation from Seasonal Traffic Counts. *Procedia - Social and Behavioral Sciences*. 2013, 87, 279-291. ISSN 18770428. https://doi.org/10.1016/j.sbspro.2013.10.610

HALÁS, M., KLAPKA, P. a KLADIVO, P. Distance-decay functions for daily travel-to-work flows. *Journal of Transport Geography*. 2014, 35, 107-119. ISSN 09666923. https://doi.org/10.1016/j.jtrangeo.2014.02.001

HENDERSON, D.J. a MILLIMET, D.L. Is gravity linear? *Journal of Applied Econometrics*. 2008, 23(2), 137-172. ISSN 08837252. https://doi.org/10.1002/jae.974

LAM, W. H. K. a XU, J. Estimation of AADT from short period counts in Hong Kong - A comparison between neural network method and regression analysis. *Journal of Advanced Transportation*. 2000, 34(2), 249-268. ISSN 01976729. https://doi.org/10.1002/atr.5670340205

MAGGIONI, M. A. a UBERTI, T. E. Knowledge networks across Europe: which distance matters? *The Annals of Regional Science*. 2009, 43(3), 691-720. ISSN 0570-1864. https://doi.org/10.1007/s00168-008-0254-7

MARSHALL, A. Quantitative Modelling in Human Geography, **In:** Clifford N. et al., *Key Methods in Geography*, 3rd Ed., London: Sage, 2016, 302-322. ISBN 978-1-4462-9860-2.

PORTES, R. a REY, H. The determinants of cross-border equity flows. *Journal of International Economics*. 2005, 65(2), 269-296. ISSN 00221996. https://doi.org/10.1016/j.jinteco.2004.05.002

ROSSI, R., GASTALDI, M., GECCHELE, G. a KIKUCHI, S. Estimation of Annual Average Daily Truck Traffic Volume. Uncertainty Treatment and Data Collection Requirements. *Procedia - Social and Behavioral Sciences*. 2012, 54, 845-856. ISSN 18770428. https://doi.org/10.1016/j.sbspro.2012.09.800

ROY, J. R. a THILL, J.-C. Spatial interaction modelling. *Papers in Regional Science*. 2004, 83(1), 339-361. ISSN 1056-8190. https://doi.org/10.1007/s10110-003-0189-4

Shrnutí

Použití modelování je jednou z možností, jak poznat sílu prostorových interakcí mezi lokalitami. Výstupem z modelu je očekávaná síla této prostorové interakce, která by se při správném nakalibrování modelu neměla příliš lišit od reálných interakcí. V případech, kdy model vykazuje dobré výsledky pro většinu území, avšak v určitých lokalitách se jeho výsledky výrazně odlišují od reality, je třeba se ptát, čím jsou tyto odchylky způsobeny. Pokud se jedná o pohraniční oblasti, bývají výsledky často významně ovlivněny border effectem.

Tento článek popisuje metodu, jak změřit sílu border effectu pomocí geografických modelů prostorových interakcí. Pro úlohu je využit gravitační model, pro jednotlivé masy jsou použita data o počtu obyvatel obcí. Reálné interakce, vyjádřené naměřenými daty o denní frekvenci vozidel na jednotlivých úsecích, jsou porovnávány s očekávanými hodnotami, přičemž jejich podíl vyjadřuje sílu border effectu.

ACTORS OF TERRITORIAL DEVELOPMENT IN THE CITY OF BRNO: FOCUSED ON SIGNIFICANT DEVELOPERS OF HOUSING CONSTRUCTION

Zdeněk Dvořák, Josef Kunc, Petr Tonev

Masaryk University, Faculty of Economics and Administration, Lipová 41a, 602 00 Brno

dvorak.zdenek@mail.muni.cz; kunc@econ.muni.cz; tonev@econ.muni.cz

Abstract: For some time, the economic crisis of the last decade had paralyzed territorial and specific development projects in urban environments of the Czech Republic, as well as other countries. After many major development projects were suspended or canceled, territorial development activities started to revert to their pre-2008 state characterized by a large-scale development boom. In the long run, the construction of above-standard non-residential (offices, administration buildings) and residential (suburbs and villas) complexes predominates. Recently, there has been an increasing number of resonating projects that focus on research, development and innovation, as well as culture and education. These are built either on greenfields, or, more frequently, in previously utilized locations (brownfields). Investors are generally recruited out of private, mostly multi-national companies. However, the public sector (cities, regions) is also showing activity in this regard. The aim of the paper is to present the current state of the functional and spatial aspects (morphology) of the development environment in the city of Brno from the point of view of developers focusing on housing construction.

Keywords: territorial development, developers, housing construction, city of Brno

1 INTRODUCTION

"Development" has been linked to planning (Escobar, 2010). In European conditions, planning has been helping in the development of cities facing issued connected to rapid growth in the context of industrialization since the 19th century. There has also been a rise in social planning and governmental interventions for the greater good of the society (Hall, 2002). The very idea of "development" is related to the economic changes which took place in individual states after World War II, whereas the last 40 years or so could be called the development age (Sachs, 2010). Planning, especially regional planning, does therefore have a considerable influence on the development of a given location. As stated by Maier and Čtyroký (2000), in face of investors, regional planning is primarily regulatory. Territorial development is a closely related concept, referring to the purposeful assessment of the territory in order to increase its utility.

Maier and Čtyroký (2000) also speak of territorial development subjects, which they divide according to the way in which they engage in investment construction processes and the way they treat the finished structure. The categories are: *builders*, *investors* and *developers.* As Achour (2004) states, the main difference between a developer and an investor is that the investor wishes to own the resulting structure/property while not being willing to bear construction-related risks. Subjects are further divided by territorial development investment criteria: *commercial entrepreneurs*, *public bodies* and *non-profit subjects*. The list of subjects concerned is, naturally, not finite. Property owners, financial institutions, real estate agents, brokers, appraisers, legal advisers, construction companies, architects, and others enter into the process of territorial development.

Another important concept is a *development project.* In their study, Achour (2004) states that a development project falls into project financing and is therefore a body of economic, technical, and other elements. As such, it can be divided into three phases:

i. *preparatory* - assessment of project feasibility and financing,
ii. *implementation* - purchase of property, legal audit of the land, obtaining the necessary permits, contracts about future leases, etc.,
iii. and the *final* phase - the project is sold to the final investor.

With any development project, limitations posed by the authorities, especially by the ground plan or historic preservation must be considered. Based on any limitations, it is then essential to decide whether the project will be residential or non-residential. The technical and economic feasibility of the project also play a key role (Esteva, 2010).

Development projects and regional planning are connected primarily (but not exclusively) to the urban environment, which is the object of interest in the present contribution. It should be noted that there is no comprehensive definition of a city – it depends on the science that discusses it. The dictionary of human geography considers cities *business centers and marketplaces* where *non-agricultural work has been separated from the land*, or *a society of free citizens belonging to higher territorial units* (Gregory et al., 2009: 85). In the 1920s, Ernest W. Burgess (1924) of the Chicago sociological school examined the internal structure of a city, which still has its general applications and it important for our contribution. His concentric zone model, in which the city is divided into functional areas was followed by others, such as the sector model or the multiple nuclei model (Fyle and Kenny, 2005).

Over the last 20 years or so, the urban environment of Central and Eastern Europe has undergone very significant changes. These are connected not only to the economic and social transformations (as well as the intensive deindustrialization), but also to new elements of regional planning, which are linked, among other things, to the dynamic construction of residential, administrative, and commercial complexes (Sýkora, 2008; Krzysztofik et al., 2016; Mulíček and Malá, 2016). Cities, which have gone through such classic historical development have a similar urban structure traditionally tied to the definition of the aforementioned concentric zones - i) the historical core, ii) the transitional zone, sometimes also called the inner city with a deteriorating residential environment and factories, iii) the working class zone, iv) the residential zone, and v) the commuter zone in the suburbs (originally Burgess, 1924; Park et al., 1925, later Horská, 2002; Pike et al., 2006 and many other authors across disciplines).

The aim of the paper is to present the current state of the functional and spatial aspects of the development environment in the model city of Brno. It focuses on the most significant actors (housing construction developers) and the internal structure (morphology) of the city, as well as the specifics of the respective analyses.

2 AREA UNDER STUDY, THE DATA AND METHODS

Brno is the second largest city of the Czech Republic, home to nearly 400 thousand inhabitants. As early as in the pre-industrial era, the city became an important administrative and economic center. The main element which facilitated city creation, as was the case in other historically formed European cities, was the intensive industrialization in the 19th and 20th centuries, including the Socialist industrialization after the Word War II (Horská et al., 2002). The 1990s and later years are, however, typical of economic base deindustrialization processes. As in other transitional economies, the formerly under-proportioned retail trade and services started to develop, new industrial zones and technological parks were created, the first wave of residential and commercial suburbanization occurred, etc. Emphasis moved to the support of research and development, innovation, creativity, education and increasing the quality of life (Sýkora, 2002; Jackson, 2002; Wu, 2003; Mulíček and Toušek, 2004; Kunc and Tonev, 2008; Kunc et al., 2008, 2014a; Chaloupková, 2017). Over the years, number of studies regarding the transformations of functional and spatial structures and/or the development environment of the city have been carried out and published in the city of Brno and its vicinity (such as Mulíček, 2002, 2007; Dvořák, 2016; Dvořák and Fránková, 2016; Foral and Andráško, 2012; Malachová and Kunc, 2014; Kunc et al., 2014b; Frantál et al., 2015; Tonev et al., 2017). Our contribution aims to follow up on these and discuss current events.

The data base comprises research of websites of development or construction companies, with the addition of information sources of the Brno City Municipality (Magistrát města Brna, MMB). During the current research phase, we focus mainly on housing construction. Methodically, the text is based on the interpretation, evaluation and comparison of available sources and information. Furthermore, field investigations took place in selected locations, photo-documentation was obtained and interviews with the representatives of Brno (specifically the MMB) were conducted. The morphogenetic zones of the city were adapted from Mulíček (2007). The graphical presentation of the data was created in the program ArcGIS.

3 CURRENT STATUS OF CONSTRUCTION IN BRNO

Within the Czech Republic, Brno is currently a significant science and research center and has been receiving good appraisal on an international scale. It must be noted that it did not achieve its status right away. The policies of the city, which aimed to focus on science and research, played a significant part.

The fact that Brno (unlike, for example, Prague) could utilize European funds to finance its science and research infrastructure is no less important. Another informal status of Brno is also closely related to science and research – it is considered a student city. At the same time, it is the core of the Brno metropolitan area, which makes it the main center of commuting for work, education and services. However, it must be noted that its territorial plan is not up-to-date, which has a significant impact on its successful development. This critical document has a considerable effect on the current construction situation in the city, which shall be further discussed below.

The Association of Brno architects and builders (ABRAST) comments on this fact. ABRAST aims to create a platform which will address the future development of the city in relation to regional planning. It also notes that the Brno territorial plan falls short of the actual demand, both in the commercial and housing areas. In recent years, Brno and its outskirts have been battling the problem of suburbanization. One of the reasons for this are rising real estate prices, which force the inhabitants to move to the outskirts. The amount of areas free for new construction is decreasing, which causes the prices of existing homes to increase. Prices of real estate and land in the immediate vicinity of Brno are, however, also increasing. In this and the following year, limitations of mortgages are being implemented. Still, it is difficult to predict how large an impact this might have on the supply and demand for housing. However, complicated the real estate market situation in Brno might be, it is critical to resolve the issue of a new territorial plan. Until then, it is necessary to work with the current territorial plan and utilize brownfields.

3.1 Spatial aspects of housing development construction in Brno

The members of ABRAST are among the significant players in the development of Brno. Over the last twenty years, tens of housing construction projects were executed thanks to them. There were both small-scale and large-scale projects. The following findings emerged from an analysis of the available information:

- if the projects are executed close to the city center, they are small-scale projects,
- larger projects were executed in the outer parts of the city,
- investors/developers focus on projects which can be executed on greenfields.

The investigation further revealed that the largest and most significant housing construction projects of the last two decades were executed in the outer parts of Brno, namely Medlánky, Slatina, Lesná, Bystrc, and Žebětín. Data from subjects, which are members of ABRAST, and selected large-scale projects outside of the association were entered into the list, while projects with a budget under 50 million CZK were not considered. Due to the information, which individual developers or builders share on their websites, the analysis focused on the following subjects in particular: Impera style, REKO, IMOS, Bemett, Stavos, and Kaláb. Despite the aforementioned limitations, the selection is highly representative of the most significant housing construction development projects in Brno.

Tab. 1: Districts of Brno with the highest concentration of housing construction projects

City district	Number of projects	Investors/builders/developers
Bystrc and Žebětín	8	Reko, Impera styl, IMOS, Moravská stavební
Slatina	3	IMOS, Bemett, STAVOS
Lesná	3	Reko, IMOS, Pancommerc
Medlánky	2	Impera styl, Reko
Other city districts	20	Stavos Brno a.s., Bemmet, Aplus, Impera styl, Reko, IMOS, Kaláb

Source: Original table according to the websites of individual developers and MMB data.

The following map shows the distribution of selected analyzed projects in the area of Brno (morphogenetic zones) and brief comments on selected locations (city districts).

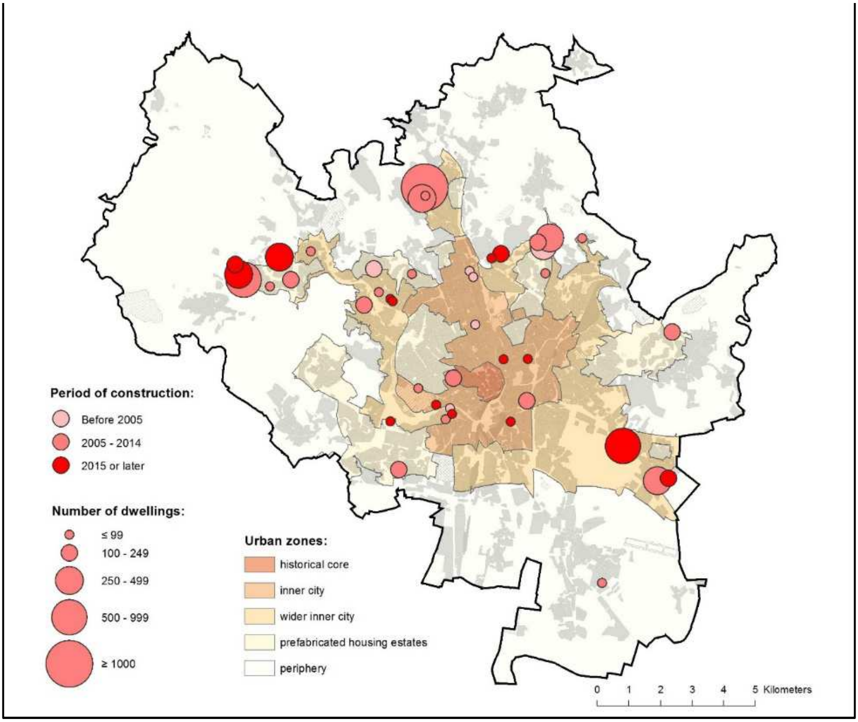


Fig. 1. Biggest projects of housing construction in Brno.
Source: Web pages of particular projects, own processing.

Bystrc and Žebětín

By area, Bystrc is the largest city district, home to one of the largest housing estates of prefabricated houses in Brno, which was added to the original rural settlement. A hilly, wooded landscape and a significant body of water, the Brno reservoir, are typical of the northwest estate. Together with the Brno ZOO, the reservoir and the surrounding forests are among the greatest attractions of the area, which is also sought after by housing developers. The same is true for the city district Žebětín, which is adjacent to Bystrc. Žebětín was originally a typical rural municipality, but in recent years, it has gained a significantly more suburban character. The largest modern housing estate in Brno (Kamechy and Pod Chvalovkou, forming one complex which may house up to several thousand people) is being finished in the cadastral territories of both districts (Bystrc and Žebětín). Neither district is affected by industrial production. They are serviced by trams, buses and trolleybuses (in Bystrc, only buses in the case of Žebětín) and do not have a direct railway link.

Tab. 2: Significant housing construction development projects in the districts of Bystrc and Žebětín

Builder/developer/investor	Project name	Year of completion	Number of apartments
IMOS	Bytové domy Farské zahrady, Brno	2004	210
Moravská stavební – INVEST	Bystrc, Přístavní	2005	32
Moravská stavební – INVEST	Bystrc, Šemberka	2009	60
Impera styl	Bystrc – Kamechy	2012	750
Impera styl	Adamcova - bytové domy	2014	110
REKO	Polyfunkční soubor Brno – Kamechy, sector 16, 17, AB24	2016	250
REKO	Polyfunkční soubor Pod Chvalovkou, Brno, sectors 37 and 38	2016	220
Moravská stavební – INVEST	Panorama I and II	2017/2018	321

Sources: original table; http://www.reko.cz/reference-ukoncene-developerske-projekty/; http://www.imperastyl.cz/reference; http://www.imos-development.cz/realizace/bytove-domy-farske-zahrady-brno

Slatina

Slatina has preserved the core of the original village. Following railroad development (Slatina has its own station), significant industrial production began to form in its vicinity. Although this district is located southeast of Brno on flat land and temporarily retains its agricultural character, housing construction has always been supported here. The construction of a prefabricated housing estate in the 1970s and 80s, the regression of army and partly industrial objects, and modern apartment buildings can be mentioned. At the beginning of the millennium, one of the largest industrial zones of the region – Černovická terasa – was constructed in its immediate vicinity. On the other hand, the project Slatina – Zelené město (Green city) is among the most important new housing construction projects in Brno. More than 800 apartments were finished in this location in the year 2017 alone. The district is serviced by buses and trolleybuses.

Tab. 3: Significant housing construction development projects in the district of Slatina

Builder/developer/investor	Project name	Year of completion	Number of apartments
STAVOS Brno	Obytný soubor Šmahova, Brno - Slatina	2012	285
Bemett	Brno - Slatina II	2017	about 180
IMOS	Zelené město	2017	655

Sources: http://www.bydlenibrno.cz/byty/brno-slatina-ii/bytove-domy/zakladni-informace http://www.slatina-zelenemesto.cz/o-projektu/ http://www.stavos.cz/file/photo_gallery/20140527_083514_bs_obytny_soubor_smahova_brno_slatina.jpg

Lesná

Aside from a couple dozen small houses, the district of Lesná comprises a prefabricated housing estate, which was constructed in the 1960s and 70s on a gentle slope in the northern part of the city. The housing estate, surrounded by forests and containing several forest parks, is considered the most well-constructed and sought after one in Brno. In the last two decades, some not very successful development activity has been in progress at the northern tip of the district. The emerging apartments complexes and houses fall short of the Socialist construction qualities in all aspects. Small-scale industrial production has not been a limiting factor for the quality of life and housing, as in the case of the large machine plant in Královo Pole, which is adjacent from the south. The district is very easily accessible by trams and buses. There is also a direct rail link and a train station on the south edge of the district.

Tab. 4: Significant housing construction development projects in the district of Lesná

Builder/developer/investor	Project name	Year of completion	Number of apartments
Moravská stavební – INVEST	Majdalenky	2000	390
REKO	Polyfunkční dům „LUČINA“, Brno – Lesná	2006	67
IMOS	Bytový komplex Nové Majdalenky, Brno	2009	371
Pancommerc	Bytový komplex Orion	2009	105

Sources: original table; http://www.imos-development.cz/realizace/bytovy-komplex-nove-majdalenky-brno; http://www.reko.cz/reference-ukoncene-developerske-projekty/

Medlánky

The district of Medlánky is, by its nature, quite suitable for housing and makes for a very popular location. It is located in the northern part of the city, known for its rolling hills and strong green elements (parks, gardens, meadows, forests), and it is not affected by the industrial infrastructure. The district is a combination of the original rural settlement and both Socialist housing estates and newly constructed houses and apartment complexes, which have been emerging around it since the early 1990s. The project Nové Medlánky (New Medlánky) is among the largest non-prefabricated residential complexes built in Brno after the year 1990. A direct rail link does not exist in the district; however, the area is serviced by buses, which are linked to a central tram line.

Tab. 5: Significant housing construction development projects in the district of Medlánky

Builder/developer/investor	Project name	Year of completion	Number of apartments
Impera styl	Medlánky	2007	270
REKO a.s.	Bytový komplex Nové Medlánky, Brno	2009	1100

Source: http://www.imperastyl.cz/reference;http://www.reko.cz/reference-ukoncene-developerske-projekty/

Fig. 2. Projects of Bystrc – Kamechy and Slatina – Green City.
Source: Josef Kunc

4 DISCUSSION AND CONCLUSION

In recent years, housing policy has been a very sensitive and largely discussed topic in the Czech Republic. Both the Czech Ministry of Regional Development (which oversees housing policy) and the government itself have been criticized for weak programme support and new laws. Insufficient support of communal housing construction, starter homes and homes for low-income groups are among the most heavily discussed issues. The unfavorable situation is further intensified by a long-term shortage of homes and the increase in real estate prices, which is inevitable in times of economic growth. Still, in 2017, the Czech construction industry has been showing certain parameters that indicate a future improvement. So far, however, the ongoing construction is effectively designated for population groups with the highest income.

In Brno, housing construction and the housing market are representative of the situation in the whole country. In the long term, there is a lack of new homes, and although prices of the ones that are being built are at a record high, the demand still significantly exceeds the supply. According to some statistics, the number of homes on the market is lower by about a third compared to previous years. The main reasons are:

- the ongoing trend of moving to large cities,
- more investors who buy and rent apartments,
- the prices significantly increase due to the shortage,
- sometimes, the apartments in a new complex will be sold out before the house is finished, often because of financial speculation.

Housing construction development projects on which we focused in our contribution show certain spatial and functional specifics in the city of Brno. These have been indicated on the map (Figure 1). The projects are mostly residential complexes, with small houses being rather an exception. Large projects of 500 and more apartments in building with a low number of storeys (typically 3-5) are located in the outer parts of Brno and are usually constructed on greenfields. Solo projects with a lower number of apartments and a higher number of storeys tend to fill formerly used locations in the inner parts of the city. The localities which are the most sought after by developers are attractive districts with a lot of greenery, namely Bystrc, Žebětín, Jundrov, Medlánky, Královo Pole-Sadová and Lesná in the north and northwest of the city, and Slatina in the flat southeastern part of Brno (one of the large new projects, Slatina – Green City, is being built here in place of old barracks).

A number of development projects which could also revive the real estate market is being developed or realized. Examples include: the project Maloměřické nábřeží, which focuses on the construction of single-family detached houses, the construction of an apartment building in Juliánov, or a larger project, the complex Na Kamenkách – Černovice, which should be finished in 2020. However, for a developer, housing construction on its own is not as profitable as the construction of commercial buildings, or a combination of the two. Additionally, considering that the amount of suitable greenfields in Brno is neither increasing, nor are they "politically desirable" (criticism of uncoordinated city growth and disintegrated construction), one should search for locations with pre-existing construction, which are not being utilized in the long term. A typical example of this is the former machine-industrial area Zbrojovka. In place of the former industrial plant, a new city quarter Nová Zbrojovka will be constructed, containing about 800 apartments, large office spaces, shops, and light industry (the developer CPI Property Group). The revitalization of a Siemens factory building in Berlin, where several functions were joined together, was the inspiration for this project. A project of CTP Invest. the largest development company operating in Brno, is another example of brownfield utilization. In place of the former textile factory Vlněna, office spaces and apartment buildings (in later stages of construction, according to the current plans) will be constructed. The use of brownfields or, in general, places formerly utilized (not only) for housing construction is an important element for the revitalization of the city and a desired future state.

Acknowledgement: This paper has been elaborated in the scope of an internal grant of the Faculty of Economics and Administration, Masaryk University, entitled "Metropolitan processes formating traditional city structure: an example of Brno Metropolitan Area" (MUNI/A/0976/2016).

REFERENCES

A PLUS A.S. [online] 2017. [cit. 2017-10-14] URL: http://www.aplus.cz

ABRAST. *O asociaci.* [online] 2015. [cit. 2017-10-10]. URL: http://www.brast.cz/o-asociaci/

ACHOUR, G. EPRAVO.CZ *Developerské projekty I. - financování developerského projektu*. [online] 2004. [cit. 2017-05-22]. URL: http://www.epravo.cz/top/clanky/developerske-projekty-i-financovanideveloperskeho-projektu-22654.html

ARCHIWEB. *Víceúčelový komplex ORION.* [online] 2009 [cit. 2017-10-14] URL: https://www.archiweb.cz/buildings.php?action=show&id=2166

BEMETT, A.S. [online] 2017. [cit. 2017-10-14] URL: http://www.bydlenibrno.cz

BURGESS, E. W. *The Growth of the City: An Introduction to a Research Project*. Publications of the American Sociological Society, no. 18, 1924. pp. 85-97.

DVOŘÁK, Z. and FRÁNKOVÁ, Š. Potenciál soukromých investic pro inovační infrastrukturu města Brna. In Fakulta regionálního rozvoje a mezinárodních studií. *Region v rozvoji společnosti 2016*. Brno: Mendelova univerzita, 2016. pp. 201-214. ISBN 978-80-7509-459-9.

DVOŘÁK, Z. Velké developerské projekty na území města Brna. In Nováček, A (ed.): *Geografické myšlení jako aktuální společenská výzva*. České Budějovice: Jihočeská univerzita, 2016. pp. 73-78. ISBN 978-80-7394-619-7.

ESCOBAR, A. *The Development dictionary: a guide to knowledge as power.* New York: Zed Books. 2010, pp. 145-160. ISBN 978-1-84813-379-2.

ESTEVA, G. *The Development dictionary: a guide to knowledge as power.* Development. New York: Zed Books, 2010. pp. 1-23. ISBN 978-1-84813-379-2.

FORAL, M. and ANDRÁŠKO, I. Developerské kancelářské projekty v Brně. In Andráško, I, Dvořák, P., Ira, V. (eds): *Časoprostorové změny regionálních struktur ČR a SR*. Brno: Ústav geoniky AV ČR, 2012. pp. 12-19. ISBN 978-80-86407-25-8.

FRANTÁL, B., GREER-WOOTTEN, B., KLUSÁČEK, P., KREJČÍ, T., KUNC, J. and MARTINÁT, S. Exploring spatial patterns of urban brownfields regeneration: The case of Brno, Czech Republic. *Cities*, Amsterdam, Netherlands: Elsevier, Ltd., 2015, vol. 44, pp. 9-18. ISSN 0264-2751. https://doi.org/10.1016/j.cities.2014.12.007

FYFE, N. R., KENNY, J. T. *The Urban Geography Reader. London: Routledge,* 2005, pp. 404. ISBN 0-415-30701-5.

GREGORY, D. *The dictionary of human geography. 5th edition*. Malden, MA: Wiley-Blackwell, 2009, vol. XVI, pp. 1052. ISBN 978-1-4051-3287-9.

HALL, P. *Cities of tomorrow: an intellectual history of urban planning and design in the twentieth century*. Oxford, UK: Blackwell Publishers, 2002. ISBN 0-631-23264-8.

HORSKÁ, P., MAUR, E. and MUSIL, J. *Zrod velkoměsta: urbanizace českých zemí a Evropa*. Praha: Paseka, 2002. pp. 352. ISBN 80-7185-409-3.

CHALOUPKOVÁ, M. Subjective dimension of the quality of life: case study of the Lelekovice municipality. In: Klímová, V., Žítek, V. (eds): *XIX. Mezinárodní kolokvium o regionálních vědách. Sborník příspěvků*. 2017. Brno: Masarykova univerzita, pp. 481-488. ISBN 978-80-210-8586-2

IMOS DEVELOPMENT [online] 2016. [cit. 2017-10-14] URL: http://www.imos-development.cz

IMPERA STYL, A.S. [online] 2016. [cit. 2017-10-14] URL: http://www.imperastyl.cz

JACKSON, J. Urban sprawl. *Urbanismus a územní rozvoj*. Brno: Ústav územního rozvoje, 2002, vol. 5, no. 6, pp. 21-28.

KALÁB STAVEBNÍ FIRMA S.R.O. [online] 2017. [cit. 2017-10-14] URL: http://www.kalab.cz/cs/

KRZYSZTOFIK, R., TKOCZ, M., SPÓRNA, T. and KANTOR-PIETRAGA, I. Some dilemmas of post-industrialism in a region of traditional industry: The case of the Katowice conurbation, Poland. Institute of Geonics, Czech Academy of Sciences, Moravian Geographical Reports, 2016, vol. 24, no. 1, pp. 42–54. ISSN 1210-8812. https://doi.org/10.1515/mgr-2016-0004

KUNC, J. and TONEV, P. Funkční a prostorová diferenciace brownfields: příklad města Brna. *Regionální studia*, Praha: Vysoká škola ekonomická v Praze, 2008, vol. II, no. 1, pp. 30-37. ISSN 1803-1471.

KUNC, J., TONEV, P. and ANDRÁŠKO, I. *Rozvojové zóny a soukromý developer: vybraný příklad ve střední Evropě (CTP Invest)*. Geographia Cassoviensis, Košice: Univerzita P. J. Šafárika v Košiciach, 2008, vol. II, no. 1, pp. 93-97. ISSN 1337-6748.

KUNC, J., NAVRÁTIL, J., TONEV, P., FRANTÁL, B., KLUSÁČEK, P., MARTINÁT, S., HAVLÍČEK, M. and ČERNÍK, J. Perception of urban renewal: reflexions and coherences of socio-spatial patterns (Brno, Czech republic). *Geographia Technica*, Cluj-Napoca: Cluj University Press, 2014, vol. 9, no. 1, pp. 66-77. ISSN 1842-5135.

KUNC, J., MARTINÁT, S., TONEV, P. and FRANTÁL, B. Destiny of urban brownfields: spatial patterns and perceived consequences of post-socialistic deindustrialization. *Transylvanian Review of Administrative Sciences.* Cluj-Napoca: Babes-Bolyai University, 2014, vol. 10, 41E, pp. 109-128. ISSN 1842-2845.

MAIER, K. and ČTYROKÝ, J. *Ekonomika územního rozvoje.* Praha: Grada, 2000. ISBN 80-7169-644-7.

MALACHOVÁ, A. and KUNC, J. Developerské projekty na brownfields: případové studie z Brna. In Klímová, V., Žítek, V (eds): *XVI. mezinárodní kolokvium o regionálních vědách*. Sborník příspěvků. Brno: Masarykova univerzita, 2013. pp. 245-255. ISBN 978-80-210-6257-3.

MALÝ, J. and MULÍČEK, O. European territorial cohesion policies: Parallels to socialist central planning? *Moravian Geographical Reports*, Institute of Geonics, Czech Academy of Sciences, 2016, roč. 24, vol. 1, pp. 14-26. ISSN 1210-8812.

MORAVSKÁ STAVEBNÍ – INVEST, A.S. [online] 2013. [cit. 2017-10-14] URL: http://ms-invest.cz/byty-panorama/

MULÍČEK, O. and TOUŠEK, V. Changes of Brno Industry and their Urban Consequenses. *Bulletin of Geography (socio-economic series)*, Toruń: Nicolaus Copernikus University, 2004, vol. 3, pp. 61-70. ISSN 1732-4254.

MULÍČEK, O. Prostorové aspekty současného vývoje brněnské maloobchodní sítě. *Urbanismus a územní rozvoj*. Brno: Ústav územního rozvoje, 2007, 2007/6, pp. 14-20. ISSN 1212-0855.

MULÍČEK, O. Suburbanizace v Brně a jeho okolí. In: SÝKORA, Luděk (ed.). *Suburbanizace a její sociální, ekonomické a ekologické důsledky*. Praha: Ústav pro ekopolitiku, o.p.s., 2002, pp. 171-181. ISBN 80-901914-9-5.

PARK, R. E., BURGESS, E. W. and MCKENZIE, R. D. *The city*. Chicago: University of Chicago Press, 1926, XI.

PIKE, A., RODRÍGUEZ-POSE A. a TOMANEY, J. *Local and regional development.* London: Routledge, Taylor & Francis Group, 2006. ISBN 0-415-35717-9.

REKO, A.S. [online] 2011. [cit. 2017-10-14] URL: http://www.reko.cz

SACHS, W. *The Development dictionary: a guide to knowledge as power.* Introduction. New York: Zed Books, 2010. ISBN 978-1-84813-379-2.

STAVOS BRNO A.S. [online] 2017. [cit. 2017-10-14] URL: http://www.stavos.cz/cs/

SÝKORA, L. Suburbanizace a její důsledky: výzva pro výzkum, usměrňování rozvoje území a společenskou angažovanost. In: SÝKORA, Luděk (ed.). *Suburbanizace a její sociální, ekonomické a ekologické důsledky*. Praha: Ústav pro geopolitiku, o.p.s., 2002, pp. 9-19. ISBN 80-901914-9-5.

SÝKORA, L. Urban Development, Policy and Planning in the Czech Republic and Prague. In: Altrock, U., Günter, S., Huning, S., Peters, D. (eds.): *Spatial Planning and Urban Development in the New EU Member States. From Adjastment to Reinvention*. Burlington: Ashgate, 2008. pp. 113-140. ISBN 9781138273214.

TONEV, P., DVOŘÁK, Z., ŠAŠINKA, P., KUNC, J., CHALOUPKOVÁ, M. and ŠILHAN, Z. Different approaches to defining metropolitan areas (Case study: cities of Brno and Ostrava, Czech Republic). *Geographia Technica,* Cluj: Cluj University Press, 2017, vol. 12, no. 1, pp. 108-120. ISSN 1842-5135. https://doi.org/10.21163/GT_2017.121.11

WU, F. “Transitional cities. Commentary”. *Environment and planning A*. London: SAGE, 2003, vol. 35, no. 8, pp. 1331-1338. ISSN 0308-518X.

Shrnutí

Hospodářská krize, která začala zhruba před deseti lety, ochromila na určitou dobu územní rozvoj i konkrétní developerské projekty v urbánním prostředí nejen v České republice. Poté, co byla řada významných developerských projektů pozastavena či zrušena, se aktivity aktérů územního rozvoje již po několik let vrací ke stavu před rokem 2008, který byl charakteristický velkým developerským boomem. Dlouhodoběji převažuje výstavba nadstandardních nerezidenčních komplexů (administrativa, kanceláře), obytných souborů „sídlištního“ i vilového typu a v posledních letech také stále více rezonují projekty, jejichž klíčovou náplní je výzkum, vývoj a inovace, příp. kultura a vzdělávání. Staví se jak na zelené louce, tak častěji na dříve již využívaných lokalitách (brownfields). Investoři se v zásadě rekrutují z řad privátních společností, většinou nadnárodních, aktivní se však snaží být i veřejný sektor (města, kraje). Cílem příspěvku je představit aktuální stav funkčně-prostorových aspektů (morfologii města) developerského prostředí ve městě Brně z pohledu developerů zaměřujících se na bytovou výstavbu.

Bytová výstavba a trh s byty v Brně kopírují celorepublikovou situaci. Ve městě je dlouhodobě nedostatek nových bytů, a přestože cena těch, co se postaví, je rekordně vysoká, poptávka stále výrazně převyšuje nabídku. Na trhu je podle některých statistik až o třetinu méně bytů, než tomu bylo v minulých letech. Jedná se hlavně o tyto důvody:

- pokračuje trend stěhování do větších měst,
- je více investorů, kteří byty skupují a dále pronajímají,
- nedostatek bytů výrazně zvyšuje jejich cenu,
- byty z nové výstavby někdy zájemci vykoupí ještě před dokončením domu, často také za účelem finanční spekulace.

Developerské projekty bytové výstavby, na které jsme se v našem příspěvku zaměřili, vykazují v Brně určitá prostorová a funkční specifika. Staví se převážně komplexy bytových domů, rodinné domy jsou spíše výjimkou. Velké projekty s 500 a více byty v domech s nižším počtem pater (typicky 3-5) jsou lokalizovány v okrajových částech Brna a jejich výstavba probíhá většinou na zelené louce, sólo projekty s malým počtem bytů a vyšším počtem pater vyplňují dříve využívaná území spíše ve vnitřních částech Brna. Developery nejvíce vyhledávané lokality se nacházejí v přírodně atraktivních městských částech Bystrc, Žebětín, Medlánky, Královo Pole-Sadová a Lesná na severu a severozápadě Brna, a na jihovýchodě v rovinaté části Slatina (právě zde je jeden z velkých a nových projektů, Slatina – Zelené město, stavěn na ploše bývalých kasáren). Vzhledem k tomu, že volných ploch pro výstavbu dalších bytových jednotek ubývá, bude zajímavé do budoucna sledovat, jak se bude trh s nemovitostmi (nejen v Brně) vyvíjet.

HEALTH GEOGRAPHY – THE CONTEXT OF HEALTH AND THE ENVIRONMENT ON THE EXAMPLE OF ASTHMA DIAGNOSIS

Dana Hübelová[1], Alice Kozumplíková[1], Jarmila Überhuberová[2]

[1] *Fakulta regionálního rozvoje a mezinárodních studií Mendelovy univerzity v Brně, Třída gen. Píky 7, Brno 613 00*

[2] *Dětská léčebna se speleoterapií v Ostrově u Macochy, Ostrov u Macochy 389, 679 14*

dana.hubelova@mendelu.cz, alice.kozumplikova@mendelu.cz, uberhuberova@detskelecebny.cz

Abstract: Non-communicable diseases are the most common cause of morbidity and mortality in developed countries. The aim of the paper is to present the development of patients with asthma diagnosis and mortality on diseases of the respiratory system in relation to the emissions of major pollutants in 2006–2015 and the air pollution load expressed in five-year averages between 2011 and 2015. Model regions represent deliberately selected regions of the Czech Republic. The growth of the number of dispensarized patients with asthma diagnosis is reported by the whole Czech Republic and selected regions in the period 2006–2015. The highest share of growth by age groups has populations aged 20+. The number of patients with asthma diagnosis (per 100,000 inhabitants) significantly exceeds the Czech Republic in the Moravian-Silesian Region, while the low number of these patients is in the South Bohemian Region. These trends also correspond to the emission and values of the main air pollutants transferred to the burden of the territory, despite the improvement in their status compared to 2006 and 2015.

Key words: population health, asthma diagnosis, mortality on diseases of the respiratory system, emissions of major pollutants

INTRODUCTION

Health is fundamental for the reproduction process and development of the work potential an thus for the overall economic growth of the country. The level of health and health condition of the population reflects the standard of development of the society and its history reflects historic conditions affected by environmental, demographic, economic and other factors. Morbidity is the basic indicator of the health of the population. Morbidity study monitors prevalence of individual diseases in the population under the subject name epidemiology (Tobiasz-Adamczyk et al., 2011). The relationship between the environmental factors and human health is studied by the newly formed subject of environmental health, with a very broad and very topical scope of interest. Environmental health focuses on disease prevention and creation of a health-supporting environment (Lakes et al., 2014). A correlation between human health and the environment has been found, inter alia, in the prevalence of paediatric asthma and allergies (Friis, 2011), in the recent decades representing the most frequently occurring non-communicable diseases (NCD; Ministry of Health of the Czech Republic, 2016).

THEORETICAL ASSUMPTIONS

The theoretical part of this contribution offers a brief survey of the subject of health geography, presenting disease classification, specifying NCD and environmental effects and focusing on asthma and the role of speleotherapy.

Health Geography in Context of Health and Morbidity

Health geography deals with environment effects on human health, trying to penetrate into the synergies of the phenomena affecting the landscape sphere, including the landscape population. Health geography significantly contributes to discovering and potential elimination of diseases, encouraging support of prevention, development of human health care and improvement of its availability (Preis, 2011). Supportive non-geographical disciplines of health geography include medicine (traditional, human, veterinary, social, occupational medicine, hygiene etc.), environmental studies, psychology, sociology etc. (Goovaerts, 2010).

While abroad the themes of health geography are paid substantial long-term attention (for a survey see Cummins, Milligant, 2000), in our country only sporadic contributions have recently begun to appear after a considerable attenuation since 1990s (for details see Pavlík et al., 2017). Health geography, unlike clinical medicine, specifically follows flat processes with an emphasis on the location and spatial issues (for example disease spread in connection with the way people are organised in space and in relation to the environment; Lakes et al., 2014). Geographers often use mapping as a visual instrument of search for and examination of spatial models in relation to health and the subject cooperates with geo-statistics (Goovaerts, 2009; 2010) and also represents an important instrument of planning and implementation of public health policies (Guimarães, 2010).

Disease Classification, NCD and Environmental Effects

With regard to their nature and the possibility to affect their prevalence diseases can be classified as follows: (1) infectious (contagious) and (2) non-infectious (non-communicable diseases; NCD), which may further be divided to (a) preventable with the potential of timely prevention, and (b) non-preventable. NCD become a great threat for future population health and their highest prevalence is noted in developed countries with the highest level of social and economic progress. After having mastered prevention and treatment of the most common infectious diseases the structure of chronic morbidity has changed substantially. NCD represent about 80% of all diseases in the developed countries. NCD can be perceived as degenerative diseases related to the way of life, lifestyle and environmental factors (Komárek, Provazník, 2011). NCD mean for the affected individual and for the society loss of quality of life manifested by a high level of limitation of work and leisure-time activities with economic impact and increasing number of premature deaths (Santos, Moreira, 2012). For the next couple of decades there are global predictions of NCD growth, as the currently most frequent cause of morbidity and the main cause of mortality worldwide (Ribeiro et al., 2012).

In the Czech Republic (CR) population health is significantly determined by air quality affected by transport, fossil fuel burning in industry and households. The effect of air pollution on human health, especially on the respiratory and the cardiovascular system, is documented by numerous studies (such as Dockery et al., 1993; Pope, 2002; Tonne et al., 2016). The relationship between air pollution by transport (substances PM_{10}; $PM_{2,5}$; NO_2; BaP) and prevalence of asthma in the paediatric population is mentioned by a number of authors (Wilhelm et al., 2009; Weinmayr et al., 2010; Di Novi, 2013; Šrám et al., 2013).

Asthma and Role of Speleotherapy

Bronchial asthma (*asthma bronchiale*) is chronic disease of the respiratory tract characterised by chronic inflammation of the bronchial tube wall. As shown by epidemiology studies, the global count of patients with diagnosed *asthma bronchiale* exceeds 300 million, with different prevalence and significant geographic variability. The ISAAC (*International Study of Asthma and Allergy in Children*) proved prevalence of wheezes in the past 12 months in children of the age group 6–7 ranging between 4–32%, respectively between 2.1–32% in the age group 14–15 years. The lowest values were recorded in India, Indonesia, Iran, Malaysia, Albania, China and Greece and the highest values were noted in Australia, New Zealand, Great Britain and Brazil. The prevalence is lower in the adult population with the same geographical distribution (Asher et al., 2006). The ECRHS (*European Community Respiratory Health Survey*) reports asthma prevalence in Germany, Spain, Estonia, Greece and Italy between 2–3%, while in Great Britain, Australia and New Zealand between 8–11.9%. The difference is mainly attributed to environment effects, civilisation factors and the way of life (Hazenkamp-von Arx et al., 2004). Estimated asthma prevalence in the Czech Republic is 8% (800 thousand individuals), with over 10% recorded in the paediatric population. Despite this relatively high share many patients are believed not yet to be diagnosed at all (Pohunek, Svobodová, 2007).

Asthma is classified by severity of symptoms and level of their therapeutic management. Medication is inevitable, biological therapies are available in the cases of hard-to-treat asthma. Other officially recommended complementary therapeutic procedures include specific immunotherapy, speleotherapy, breathing rehab, yoga, psychotherapy etc. (Asher et al., 2006). Speleotherapy is a climatic therapeutic method using the specific cave climate as a natural healing resource. Speleotherapy represents a complementary element of the complex therapy of asthmatic patients, including pharmaceuticals, reducing their need to a minimum. Speleotherapy reduces asthma episodes up to five times and minimises administration of the otherwise frequently needed antibiotic therapy. The origins of speleotherapy in the Czech environment date back to 1970s when speleotherapy was provided at three locations: (1) paediatric sanatorium Edel in Zlaté Hory in a reconstructed mine, (2) stalagmite cave Císařská used by paediatric sanatorium with speleotherapy at Ostrov u Macochy, and (3) paediatric sanatorium Vojtěchov. The first two sanatoria still continue to use speleotherapy exclusively for paediatric patients. The cave microclimate must comply with the strict requirements defined by the Permanent Committee for Speleotherapy working under the NGO called International Union of Speleology of UNESCO (UIS, 2014). The controlled parameters include stable temperature (7–8 °C), minimum air flow, high relative humidity (close to 100%), dust-free environment and microbial and allergen sterility, increased CO_2 level, low pH, negative ion concentration etc. (Uhlíř et al., 2015).

The complex speleotherapeutic programme in the paediatric sanatorium at Ostrov u Macochy is operated in 3.5-hour daily runs in the unique microclimate of the Císařská cave inaccessible to the public. The original and the ongoing studies of the speleotherapeutic sessions in the paediatric sanatorium at Ostrov u Macochy indicate that the clinical symptoms of the patients are reduced during and after the treatment to varied extents. Repeated speleotherapeutic therapies deepen the effects and extend the time of their duration after treatment. Three successive therapies significantly improved the condition of 60–65% of the patients and in 30% of cases the clinical effect was more moderate and required more rounds. The prediction is good in the case of early diagnosis and early preventive care. Paediatric asthma in the second decade of life often reaches spontaneous remission allowing for discontinuation of the chronic medication. Unfortunately, in up to half of these asthmatic children the disease relapses at a later age (unpublished data).

STUDY ENDPOINT, METHODS, MODEL LOCALITIES AND DATA USED

The purpose of the present article is to present the relationship between the development of the dispensary patients with diagnosed asthma (2005–2013) and emissions of the main air pollutants in the period 2005–2015. Dispensary patients mean patients actively sought and early diagnosed and treated and requiring systematic preventive or therapeutic care. Out of the basic statistical methods of timeline and spatial data analyses this study used statistical processing of chain indices and mean growth coefficients. With regard to data availability the defined time period was 2005–2015. The model localities were intentionally chosen in three regions of the Czech Republic: (1) South Moravia Region (SMR), (2) Moravian Silesia Region (MSR) and (3) South Bohemia Region (SBR). (1) South Moravia Region was selected for the reason of the existing paediatric sanatorium with speleotherapy at Ostrov u Macochy, (2) Moravian Silesia Region for the reason of the maximum pollutant emission stress of the population, and (3) South Bohemia Region on the contrary for the lowest long-term stress of the population with emissions of the main pollutants.

The data on the dispensary patients with diagnosed asthma were taken from Healthcare Yearbooks of the Institute of Health Information and Statistics of the Czech Republic for the regions of interest in the years 2005–2013 (2013 is so far the last year for which the data are published; IHIS CR, 2004–2014). The data on the development of mortality related to respiratory tract diseases were taken from the Public Database of the Czech Statistical Office (CSO, 2016). Pollutant emissions for the selected regions and for the whole country are interpreted as the sum of emissions (solid particles, SO_2, NO_x, CO, VOC, NH_3) in $t.year^{-1}.km^{-2}$ recorded in the database of the Register of Emissions and Sources of Air Pollution (REZZO 1-4) for the period 2006–2015. The definition of time periods is determined by the difference in data availability (dispensarized patients versus pollutant emissions). For the purpose of interpretation of emission burdens of the Czech regions the substances polluting the air and contributing to asthma prevalence in the Czech Republic were chosen. The table below shown the substances and their air pollution limits defined by the Air Protection Act (Tab. 1). Regional burdens with these substances are shown by figures (Fig. 1 to 4) based on five-year means concentrations of the air pollution (2011–2015) in a 1x1 km grid in the regions of the Czech Republic.

Tab. 1: Selected air pollutants and their air pollution limits for CR

Pollutant	Air pollution limit
NO_2	40 μg.m-3
PM_{10}	40 μg.m-3
$PM_{2,5}$	25 μg.m-3
BaP (in particles PM_{10})	1.0 ng.m-3

Source: Air Protection Act

RESULTS

Development of the number of dispensary patients with diagnosed asthma was monitored for the Czech Republic and for the selected regions and for the sake of comparability recalculated to 100 thousand inhabitants. While in the South Bohemia Region the development of the numbers of registered patients with diagnosed asthma in the period 2005–2013 was stabilised, the South Moravia Region showed a slightly growing trend over the same period. The highest increase was seen in Moravian Silesia with the peak in 2009 (Chart 1).

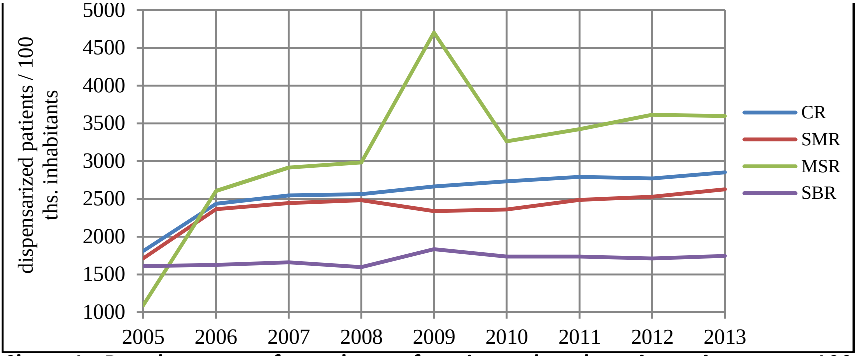


Chart 1: Development of numbers of registered asthmatic patients per 100 thousand inhabitants in the Czech Republic and in selected regions (2005–2013)
Source: IHIS CR (2006–2014), in-house calculations and data processing

Data evaluation in time and records of year-on-year changes used the growth coefficient (in %). The development of the numbers of registered asthmatic patients in South Moravia and South Bohemia in fact copies the development in the whole country, with South Bohemia keeping stable development of the number (the curve ranges around 100%). A similar situation may be observed in South Moravia, only with a higher increase in 2006. Moravian Silesia shows stable year-on-year growth from the baseline lowest value with the most significant peak increase in 2009. Only the years 2011, 2012 and 2013 are stabilised in analogy to the other two regions (Chart 2).

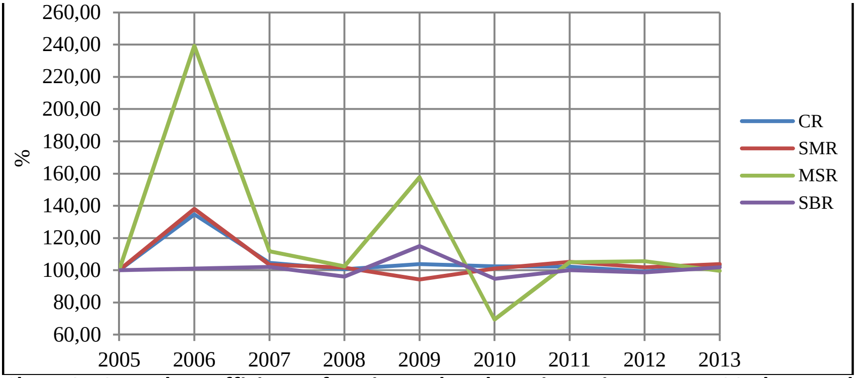


Chart 2: Growth coefficient of registered asthmatic patients per 100 thousand inhabitants in the Czech Republic and in selected regions (2005–2013)
Source: IHIS CR (2006–2014), in-house calculations and data processing

Negative development of emissions and the highest pollution with the selected pollutants are shown by Moravian Silesia, while South Bohemia shows the lowest pollution level (Chart 3). Thanks to the introduction of new industrial technologies and application of administrative instruments of air pollution reduction the annual emissions decrease with slight fluctuations in all the monitored indicators.

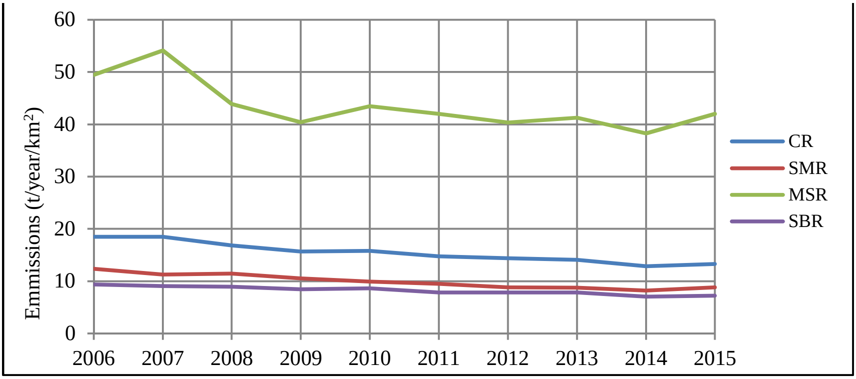


Chart 3: Development of emissions of the main pollutants in selected regions and the country situation in the period 2006–2015
Source: REZZO 1-4 (Czech Hydro Meteorological Institute), in-house processing

Figs. 1–4 show five-year means of selected substance concentrations (NO_2, PM2,5; PM10; BaP) (2011–2015) in the 1x1 km grid in the regions of the Czech Republic. The red colour highlights the regions where the legislative air pollution limits pursuant to the Air Protection Act (201/2012 Coll.) and the

Decree on the Method of Assessment and Evaluation of Pollution Levels (330/2012 Coll.) were exceeded. Clearly NO_2 pollution most strongly affects urban agglomerations (Prague, Brno, Ostrava) due to traffic (Fig. 1). Suspended particles PM_{10} and $PM_{2,5}$ most heavily burden industrial zones (Fig. 2 and 3). Problematic and hard to control in this respect is the transport of pollutant particles across long distances by air flows including from regions outside the Czech Republic to Silesia and Moravia (mainly from Poland). The greatest danger in this context is represented by suspended particles with bound polycyclic aromatic hydrocarbons with proven carcinogenic effects (C-PAU mainly represented by benzo[a]pyrene; Fig. 4).

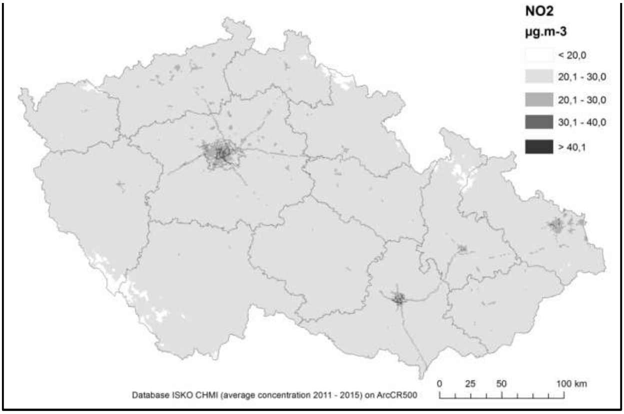


Fig. 1. Five-year mean concentrations of NO_2 (µg.m^{-3}) across 1x1 km grid in regions of CR (2011–2015).

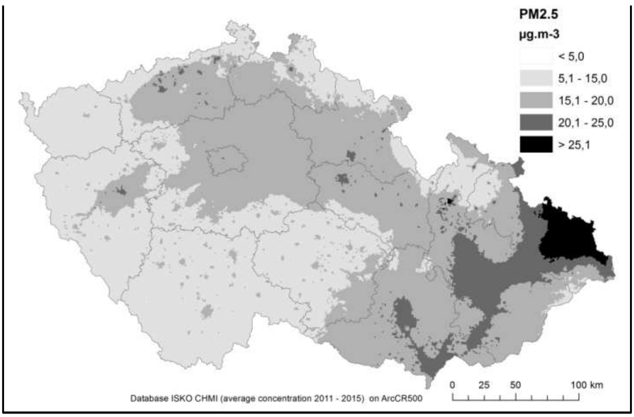


Fig. 2. Five-year mean concentrations of PM2.5 (µg.m^{-3}) across 1x1 km grid in regions of CR (2011–2015).

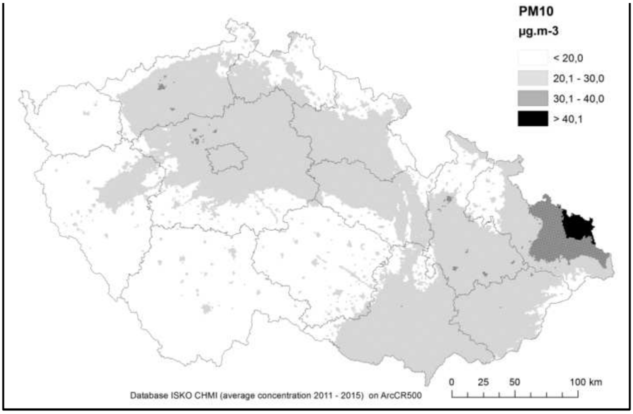


Fig. 3. Five-year mean concentrations of PM10 (µg.m^{-3}) across 1x1 km grid in regions of CR (2011–2015).

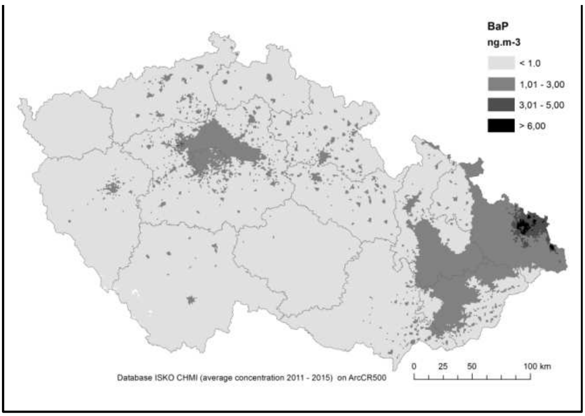


Fig. 4. Five-year mean concentrations of benzo[a]pyrene (ng.m^{-3}) across 1x1 km grid in regions of CR (2011–2015).

Source: ISKO CHMI

Monitoring of the development in the numbers of asthmatic patients in the individual regions by age group indicates that the incidence grows in the 20+ age group, while age groups 6–14 and 15–19 show a rather decreasing tendency. The youngest age group of 0–5 is relatively stable (Chart 4a; 4b). The year 2009 in Moravian Silesia shows a very specific break in the development, which may be due to transiently increased diagnosing of the disease by reporting the new age group of 0-5 and worsened smog situation (Chart 4c).

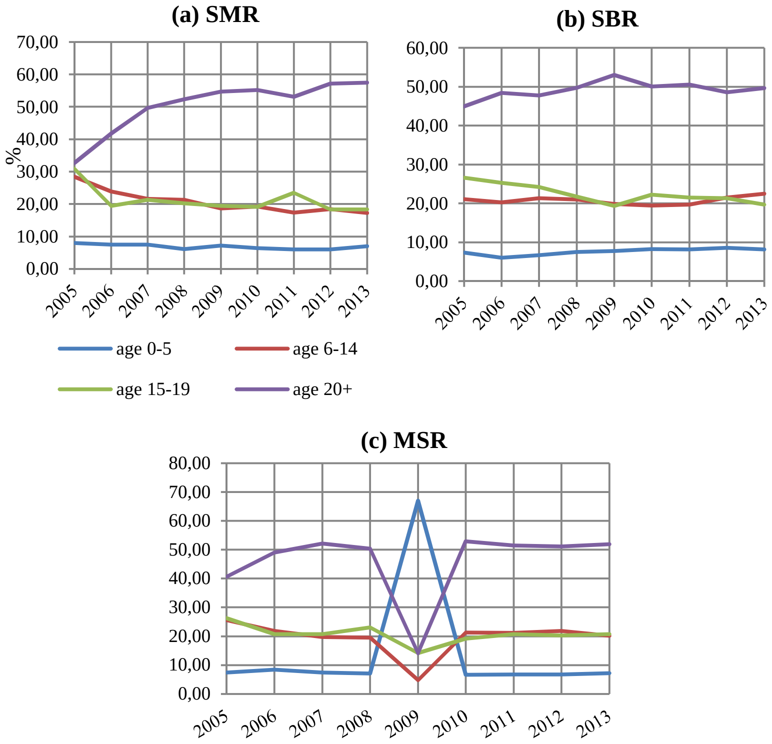


Chart 4: Proportions of registered patients by age group in SMR (a), MSR (b) and SBR (c) in the years 2005–2013
Source: IHIS CR (2006–2014), in-house calculations and processing

RESULT SUMMARY AND CONCLUSION

Unfavourable health condition is one of the global problems, therefore health and health condition of the population is every society´s first priority. Heath is one of the major assumption of quality of human life. Health is also an indispensable condition for economic growth and social progress (Pavlík et al., 2017; Somerlíková, Hübelová, 2016). Clearly the activities of the various entities in the field of health support, healthy nutrition and adequate physical activity do not show the expected results in a broader scale. What is need is measures across all areas of governmental policy and on all levels of public administration using different including legislative tools. The private sector should also contribute to health support (for example the food processing industry), together with civic associations, families and individuals (Kalman et al., 2011).

Our analytical results show continual growth of the numbers of dispensary (registered) patents with diagnosed asthma in the period 2006–2013, on the level of the Czech Republic as a whole and in the selected model regions. The highest increase of asthma incidence was noted in the 20+ age group. The count of known asthmatic patients per 100 thousand inhabitants significantly outnumbers country values in Moravian Silesia, while South Bohemia shows constantly lowest values. These trends correspond to emission stress by the main pollutants per territory despite the improvement of air quality between the baseline in 2006 and the final year of the monitored period, 2015. The same results documenting existence of a relation between air pollution by traffic (PM_{10}; $PM_{2,5}$; NO_2; BaP) and paediatric asthma incidence are presented by a number of other authors (compare Wilhelm et al., 2009; Weinmayr et al., 2010; Šrám et al., 2013).

The therapeutic effect of speleotherapy is in improvement of the condition of the child with the chronic respiratory disease in a dust-free, sterile environment, overall reduction of morbidity and minimisation of medication needed to maintain good control over asthma. Thus speleotherapy significantly and unquestionably contributes to improvement of quality of life of its subjects.

The text was created in the project "The spatial dimensions of demographic factors, health and health status of the population in the Czech Republic" with registration number 2017/008 supported by the Internal Grant Agency of the Faculty of Regional Development and International Studies of Mendel University in Brno.

REFERENCES

ASHER, M. I., MONTEFORT, S., BJÖRKSTEN, B., LAI, C. K., STRACHAN D. P., WEILAND S. K, WILLIAMS H. (and the ISAAC Phase Three Study Group). Worldwide time trends in the prevalence of symptoms of asthma, allergic rhinoconjunctivitis, and eczema in childhood: ISAAC Phases One and Three repeat multicountry cross-sectional surveys. *Lancet*, 2006, 368(9537): 733–743. ISSN 0140-6736.

CSO. *Selected demographic data by district*. [online]. Praha: CSO, 2016 [cit. 25.09.2017]. Available at: <https://www.czso.cz/csu/xb/okresy>

CUMMINS, S., MILLIGANT, C. Taking up the challenge: new directions in the geographies of health and impairment. *Area*, 2000, 321: 7–9. ISSN 1475-4762.

DI NOVI, C. The indirect effect of fine particulate matter on health through individuals' life-style. *Journal of Socio-Economics*, 2013, 44(C): 27–36. ISSN 1759-3441.

DOCKERY, D. W., POPE C. A., XU, X., SPENGLER, J. D., WARE, J. H., FAY, M. E., FERRIS, B. G., SPEIZER, F. E. An association between air pollution and mortality in six U.S. cities. *The New England Journal of Medicine*, 1993, 329(24): 1753–1759. ISSN 0028-4793.

FRIIS, R. H. *Essentials of Environmental Health*. Sudbury: Jones & Bartlett, 2011. ISBN 978-07-637-7890-3.

GOOVAERTS, P. Combining areal and point data in geostatistical interpolation: applications to soil science and medical geography. *Mathematical Geosciences*, 2010, 42(5): 535–554. ISSN 1874-8953. https://doi.org/10.1007/s11004-010-9286-5

GOOVAERTS, P. Medical geography: a promising field of application for geostatistics. *Mathematical Geosciences*, 2009, 41(3): 243–264. ISSN 1874-8953. https://doi.org/10.1007/s11004-008-9211-3

GUIMARAES, M. C. Geography of science makes a difference: an appeal for public health. *Cadernos de Saude Publica*, 2010, 26(1): 50–58. ISSN 1678-4464

HAZENKAMP-VON ARX, M., GOTSCHI, T., MATHYS, P., STERN W. B. et al. *Final Report of Work Package 7 (WP7)*. Los Angeles, London: European Community Respiratory Health Survey, 2004.

IHIS CR. *Health Statistics Yearbook of the regions* [online]. Praha: IHIS CR, 2005–2014 [cit. 2017-08-10]. Available at: <http://www.uzis.cz/category/edice/publikace/rocenky>

KALMAN, M., SIGMUND, E., SIGMUNDOVÁ, D., HAMŘÍK, Z., BENEŠ, L., BENEŠOVÁ, D., CSÉMY, L. *HBSC - Národní zpráva o zdraví a životním stylu dětí a školáků 2010*. Olomouc: Universita Palackého, 2011. ISBN 978-80-244-2986-1

KOMÁREK, L., PROVAZNÍK, K. *Ochrana a podpora zdraví*. Praha: Nadace CINDI, UK, 2011. ISBN 978-80-260-1159-0.

LAKES, T., BRUCKNER, M., KRÄMER, A. Development of an environmental justice index to determine socio-economic disparities of noise pollution and green space in residential areas in Berlin. *Journal of Environmental Planning and Management*, 2014, 57(4): 538–556. ISSN 0964-0568. https://doi.org/10.1080/09640568.2012.755461

Ministry of Health of the Czech Republic. *Zpráva o zdraví obyvatel České republiky 2015*. Praha: Ministry of Health of the Czech Republic, 2016. ISBN 978-80-85047-49-3.

PAVLÍK, I., HÜBELOVÁ D., KONEČNÝ O. Contribution to Health Geography: Sources of the contamination of surface waters and health risks in the Moravian Karst Protected Landscape Area. *Geographia Cassoviensis*, 2017, 11(1): 33–50. ISSN 1337-6748.

POHUNEK, P., SVOBODOVÁ, T. *Průduškové astma v dětském věku*. Praha: Maxdorf, 2007. ISBN 978-80-7345-118-9.

POPE, C. A. Mortality Effects of Longer Term Exposures to Fine Particulate Air Pollution: Review of Recent Epidemiological Evidence. *Inhalation Toxicology*, 2002, 19(1): 33–38. ISSN 1091-7691. https://doi.org/10.1080/08958370701492961

PREIS, J. *Geografické rysy pandemie HIV/AIDS: Kolaps v ohrožených regionech světa, rizika pro střední a východní Evropu* [online]. Brno, PrF MU, 2011 [cit. 2017-09-03]. Available at: <http://is.muni.cz/>

RIBEIRO, A. G., Cotta, R. M. M., Ribeiro, S. M. R. The promotion of health and integrated prevention of risk factors for cardiovascular diseases. *Ciênc Saúde Coletiva*, 2012, 17(1): 7–17. ISSN 1413-8123.

SANTOS, J. C., MOREIRA, T. M. M. Risk factors and complications in patients with hypertension/diabetes in a regional health district of northeast Brazil. *Rev Esc Enferm USP*, 2012, 46(5): 1125–1132. ISSN 1980-220X.

SOMERLÍKOVÁ, K., HÜBELOVÁ, D. The importance of monitoring health status of the population for the development of the region - selected determinants of university students' health. In *XIX. Kolokvium o regionálních vědách*. Brno: MU, ESF, 2016, 513–521. ISBN 978-80-210-8273-1.

ŠRÁM, R. J., BINKOVÁ, B., DOSTÁL, M., MERKEROVÁ-DOSTALOVÁ, M., LÍBALOVÁ, H. et al. Health impact of air pollution to children'. *International Journal of Hygiene and Environmental Health*, 2013, 216: 533–540. ISSN 1438-4639.

TOBIASZ-ADAMCZYK, B., BRZYSKI, P., GALAS, A., BRZYSKA, M., FLOREK, M. Relationship between characteristics of social network, health-related quality of life and mortality patterns in older age. Krakow study. *Journal of Epidemiology and Community Health*. 2011, 65 (supl. 1), A215. ISSN 1470-2738. https://doi.org/10.1136/jech.2011.142976h.23

TONNE, C., HALONEN, J. I., BEEVERS, S. D., DAJNAK, D., GULLIVER, J., KELLY, F. J., WILKINSON, P., ANDERSON, H. R. Long-term traffic air and noise pollution in relation to mortality and hospital readmission among myocardial infarction survivors. *International Journal of Hygiene and Environmental Health*, 2016, 219: 72–78. ISSN 1438-4639.

UHLÍŘ, P., OPAVSKÝ, J., SLAVÍK, P. Efekt terapeutického pobytu se speleoterapií na variabilitu srdeční frekvence dětských pacientů s asthma bronchiale. *Rehabilitace a fyzikální lékařství*, 2015, 22(4): 185–189. ISSN 1803-6597.

UIS *What is the UIS?* [online]. Lyon: UIS, 2014 [cit. 2017-09-02]. Available at: <http://www.uisspeleo.org/index.php?option=com_content&view=article&id=60&Itemid=184>

WEINMAYR, G., ROMEO E., SARIO, DE M., WEILAND, S. K., FORASTIERE, F. Short-Term effects of PM_{10} and NO_2 on respiratory health among children with asthma or asthma-like symptoms: A systematic review and Meta-Analysis. *Environmental Health Perspectives*, 2010, 118(4): 449–457. ISSN 0091-6765. https://doi.org/10.1289/ehp.0900844

WHO. *Asthma* [online]. Geneva: World Health Organization, 2006 [cit. 2017-08-28]. Available at: <http://www.who.int/mediacentre/factsheets/fs307/en/index.html>

WILHELM, M., QIAN, L., RITZ, B. Outdoor air pollution, family and neighborhood environment, and asthma in LA FANS children. *Health and Place*, 2009, 15(1): 25–36. ISSN 1353-8292.

Shrnutí

Základním ukazatelem zdravotního stavu je nemocnost, jejíž studium se zabývá výskytem jednotlivých onemocnění v populaci. Korelace mezi životním prostředím a zdravím člověka byl shledán mj. při výskytu astmatu a alergií, které se v posledních desetiletích stávají jedněmi z nejčastějších neinfekčním onemocněním. Z epidemiologických studií vyplývá, že se celosvětový počet nemocných s diagnózou *asthma bronchiale* pohybuje na více než 300 milionů, přičemž se vyskytuje s různou prevalencí a významnou geografickou variabilitou.

Výsledky analýz vývoje počtu dispenzarizovaných pacientů s diagnózou astma v letech 2006–2013, a to jak na úrovni České republiky, tak modelových krajů (Jihomoravský, Jihočeský a Moravskoslezský kraj) ukázaly kontinuální růst. Nejvyšší podíl růstu podle věkových skupin zaznamenává populace ve věku 20 a více let. Počet sledovaných pacientů na 100 tis. obyvatel významně převyšuje hodnoty České republiky v Moravskoslezském kraji, naopak ve všech letech vykazuje nízké počty těchto pacientů Jihočeský kraj. Daným trendům odpovídají také hodnoty emisí a imisního zatížení hlavních znečišťujících látek převedené na zátěž území, přestože ve srovnání let 2006 a 2015 dochází ke zlepšení stavu ovzduší. Výsledky dokládají vztah mezi znečištěním ovzduší dopravou (látkami PM_{10}; $PM_{2,5}$; NO_2; BaP) a výskytem astmatu u dětské populace. Léčebný efekt speleoterapie spočívá v navýšení kondice chronicky nemocného dítěte v prakticky bezprašném, sterilním prostředí, celkovém snížení nemocnosti a minimalizaci medikace nutné k udržení dobré kontroly nad astmatem.

COMPARISON OF CZECH REGIONS USING CREATIVITY INDEX

Markéta Chaloupková

Ekonomicko-správní fakulta, Masarykova univerzita, Lipová 41a, 602 00, Brno-Pisárky

390728@mail.muni.cz

Abstract: Globalization, development of information and telecommunication technologies as well as innovation development and research are one of the main factors that form contemporary society. As such, economies of most countries face many challenges. One of them is a search of an alternative source that would allow their further development. Therefore, creative economy goes into prominence. The aim of this article is to map conditions for creative economy development in the regions of the Czech Republic. Based on the selected methodology, we computed and analysed the Creativity Index which is composed of talent, technology, and tolerance areas. We chose the 2011-2015 timeframe to capture the development trend.

Keywords: creativity, creative economy, Creativity Index, talent, technology, tolerance

INTRODUCTION

Economies of most countries undergo significant changes in the recent years. Therefore, it is important to search for alternative sources, which will enable their further and sustainable development. The so-called creative economy goes into forefront as its concept and foundation can be a vital source of potential for future development. Creative economy can be generally considered as competitiveness based on creativity, which can contribute to region and whole country development.

1 CREATIVE ECONOMY CONCEPT

There is neither universal nor single terminology regarding the creative economy. However, the term "creative economy" was first used by Howkins (2002) when he analysed relationships between creativity and economy. According to the author, creative economy represents 15 different creative industries (such as art, architecture, design, film, or music). Howkins is also concerned with the advent of a new creative workforce on which Florida (2002) elaborates.

The author, Richard Florida, is probably the most fruitful author of this domain. He published the theoretical base in the publication "The Rise of the Creative Class" (2002). In this book, he defined human creativity as a main driving force of future development. Florida (2002) mentions that the ability to come up with innovative ideas and with better solution is the factor increasing productivity, which in turn increases standard of living and life quality. He considers human creativity to be determining competitive advantage.

Human creativity was also defined by Marget A. Boden as an “ability to come up with ideas or artefacts which are new, unexpected, and which have some value” (Boden, 2004:1). The idea of human ability to create meaningful new forms was also mentioned by Howkins (2002), who described human creativity as a new idea meeting four basic conditions (an idea must be personal, original, meaningful, and useful).

As opposed to classical production sources, we can consider human creativity as an unlimited and hardly identifiable input. The above-mentioned statement is also confirmed by Kloudová (2010), who says that creative economy is based on a potential of an unlimited resource of human creativity, and its exhibition of an idea.

From all the sources, 2010 UNCTAD report has probably the most comprehensive concept of the creative economy. The report defined the creative economy as “*developing concept based on creative assets generating economic growth and development. It includes economic, cultural, and social aspects in interaction with technology and intellectual property. It can support income generation, job creation and export revenues, as well as social inclusion, cultural diversity, and the development of human resources*” (Selada et al., 2010).

2 MEASURING CREATIVE ECONOMY

Existing statistical tools do not allow evaluating a creative economy and the measurement of its output is very difficult. This is due to discrepancy in the conceptual apparatus, methodologies used, and because human creativity is an input but not an output of a creative economy. Experts' attention is therefore focused on measuring the conditions for developing a creative economy.

2.1 Creativity index 3T

For the basics of measuring the creative environment, Florida (2002) formulated the so-called “creative index”, which is composed from the “3T” model. That is the talent, technology, and tolerance. The goal of the indicator is to express the ability of a defined region to attract a creative class and to transform its potential into realistic outputs of the creative economy. Each of the components of the Creativity index is significant. However, to attract creative people, to generate innovation and to stimulate economic growth, their combination is essential.

Tab. 1: Creativity index

Talent index	**Human capital index**	The percentage of population with a university degree in a specific region
	Creative class index	The proportion of creative job positions to total employment in a specific region
Technology index	**Innovation index**	The number of patents per person in a specific region

	High-tech index	The proportion of the high-end industry outcome to the total outcome
Tolerance index	**Gay index**	The number of registered gay couples in the population of a specific region
	Bohemian index	The percentage of population with focus on art in a specific region
	Immigration index	The percentage of immigrants in a specific region

Source: Florida (2002), edited

Regions that achieve satisfactory results in the Creativity index are generally called creative centres. These places are diverse, tolerant, and open to new ideas, which, according to Florida (2002), leads to a concentration of creative capital in the region and consequently to a higher degree of innovation, development of high-tech trade, job creation, economic growth, and generally positive economic, social, and environmental effects. (Cikánek, 2009)

2.2 Euro-creativity index

Florida's creativity index was subsequently edited in 2004 by Florida himself, in collaboration with Tinaglie, in the publication "A study on creativity index", which adjusts the measurement methodology for the use in European countries. The overall Euro-creativity index is composed from three sub-areas (see the table below).

Tab. 2: Euro-creativity index

Euro-talent index	**Human capital index**	The percentage of population in the age of 25-64 with a university degree
	Creative class index	The proportion of creative job positions
	Research talent index	The number of researchers and engineers per one thousand workmen
Euro-technology index	**Innovation index**	The number of patent applications in the population
	High-tech index	The proportion of the high-end industry outcome to the total outcome
	R&D index	The proportion (in percentage) of research and development cost to the GDP
Euro-tolerance index	**Attitude index**	The percentage of population tolerant of minorities
	Values index	The importance of traditions in people values
	Self-expression index	The attitude to the rights and opinions of individuals

Source: Florida and Tinagli (2004), edited

The Euro-talent index, like the previous talent index, is based on the Creative class index with two more additional indexes. The Creative class index is based on the International Labour Organization methodology and includes scientists, engineers, artists, musicians, architects, managers, professionals, and other creative activists. The main difference from the basic 3T base model lies in tolerance due to the difficulty of gathering data in European countries. A research in the area of tolerance is based on broader surveys of citizens' attitudes and opinions. It is *de facto* an attitude index identifying relations with minorities, an index of values that finds the relationship of citizens to traditional values, and an index of self-expression, which identifies the attitude of the individual towards the individual rights and the self-expression of the individual. (Kloudová, 2013)

2.3 5 C Model

In 2005, a creative index study was also published for Hong Kong. It was created on the initiative of the Office of Internal Affairs by a research team of Desmond Hui. This study has extended Florida's theory with other factors that stimulate the development of a creative class. The output of creativity results from the interaction of four forms of capital:

- Structural/institutional capital (eight criteria are proposed that influence the growth of creativity, such as legal system, corruption, freedom of expression, financial, ICT social and cultural infrastructure, community facilities, and business activity),
- Human capital (three criteria are proposed here: the ability of a company to ensure the development of a "knowledge bank", the availability of educated and skilled workers and the mobility of human capital),
- Social capital (including: general trust in society, trust in institutions, participation in politics, social participation, approaches to human rights, foreign migrants, or the ability to accept diversity),
- Cultural capital (the willingness and ability of the public sector and institutions to use financial resources for art, culture, and education in the specific area).

The effects of these four kinds of capital are mutually reinforcing, influencing, and contributing to the growth of creativity, and their cumulative effect creates an output of creativity, that is the fifth component of the model. (Hui, Chung-Hung, and Mok, 2004)

3 METHODOLOGY AND DATA

To explore the conditions of creative economy development in the Czech Republic, a methodology inspired by Florida (2002) and Kloudová (2009) was created. The method of compiling the overall index of creativity for individual regions of the Czech Republic was created by calculating partial sub-indexes – talent, technology, and tolerance. The following table summarizes the calculation of the sub-indexes.

Tab. 3: Method of Creative index sub-indexes calculation

Talent	Human capital index (HCI)	Ratio of population with university education in the region to the total population of the region
	Creative class index (CCI)	Ratio of creative professionals in the region to the total employment of the region
Technology	Research and development (R&D) index	Ratio of research and development spending to the GDP of the region
	Innovation index (INI)	Number of patent applications per inhabitant of the region
Tolerance	Gay index (GI)	Share of registered partnerships in the region on the total population of the region
	Immigration index (IMI)	The share of foreign migrants in the region on the total population of the region

Source: Florida (2002) and Kloudová (2009); edited

Two indexes were used to discover the concentration of talent in the regions of the Czech Republic. The data for the calculation of the human capital index was taken from the Czech Statistical Office. In particular, data regarding the number of inhabitants and the number of university educated inhabitants in the concerned regions was found. The data from the Czech Statistical Office and from the National Information and Consulting Centre for Culture were used to calculate the index of the creative class. There, data regarding the number of employees and the number of creative jobs in the region were determined.

The ability of the region to create and develop new technologies, as well as the willingness of the public and the private sector to invest in new technologies, indicate the rate of technology development. Technology development was evaluated using the Research and development index (R&D) and the Innovation index (INI). Data from the Czech Statistical Office and the Industrial Property Office of the Czech Republic were used to calculate both indexes. There, we retrieved data regarding the number of patent applications, research and development spending, and GDP in the regions concerned.

Society's openness to new identities and the ability to accept different personalities and cultures indicates the degree of tolerance. Two indicators were measured to determine the situation of the tolerance. The data related to the calculation of the immigration index were taken from the Czech Statistical Office (region population) and the immigration portal of the Ministry of the Interior (number of foreign migrants in the region). The calculation of the second indicator, the Gay Index, encompassing the number of registered partnerships in a region, was based on information from relevant matrices and the Czech Statistical Office.

After sub-indexes calculation, the individual regions were sorted from the best (with the highest score achieved) to the worst. Consequently, the values for each region were transformed according to the “Min-Max” standardized method (Joint Research Center – European Commission, 2008), which is used to transform the data to values between 0 and 1. This allows expressing the distance from the best result (region) to the worst. The aggregate Creativity index was calculated based on the average of the sub-indexes values (talent, technology, tolerance). The order of individual regions was determined by the Creative index value.

4 RESULTS OF THE RESEARCH

Talent

The level of talent determines the ability of society to create, innovate, come up with new ideas, and to implement these ideas in practice. The level of talent in individual regions is based on the evaluation of the Human capital index and the Creative class index. As can be seen from the following table, Prague is clearly dominating all the years under review. South Moravian Region also reached a high level, and Vysočina Region ended up last. It is important to mention the huge year-on-year increase in talent in 2014-2015 due to a significantly higher share of creative employment to total employment in the region (a significant increase of the Creative class index). The growth was most affected by Karlovy Vary Region (200% increase), Pardubice Region (increase by 100%), Plzeň Region (70% increase), Liberec Region (increase by 60%), and South Bohemian Region (increase by 58%).

Tab. 4: Development of the Talent index in the regions of the Czech Republic (2011-2015)

Talent index	Year				
Region	2011	2012	2013	2014	2015
Prague	**1.00**	**1.00**	**1.00**	**1.00**	**1.00**
Central Bohemian	0.17	0.19	0.18	0.10	0.11
South Bohemian	0.36	0.26	0.25	0.31	0.49
Plzeň	0.30	0.20	0.17	0.27	0.46
Karlovy Vary	0.26	0.29	0.15	0.16	0.48
Ústí nad Labem	0.23	0.23	0.06	0.28	0.39
Liberec	0.23	0.20	0.24	0.30	0.48
Hradec Králové	0.28	0.24	0.30	0.25	0.36
Pardubice	0.09	0.09	0.02	0.13	0.26
Vysočina	0.11	0.09	0.02	0.02	0.01
South Moravian	**0.47**	**0.49**	**0.53**	**0.47**	**0.62**
Olomouc	0.19	0.22	0.18	0.23	0.37
Zlín	0.25	0.19	0.21	0.25	0.36
Moravian-Silesian	0.22	0.25	0.32	0.34	0.38

Source: ČSÚ (2011-2015), own calculations

Technology

In the field of technologies, year-on-year changes in the monitored years within the Czech Republic are the least noticeable. The Prague Region is on the first place in all observed years, but it does not reach the net maximum. The reason for this is the lower value of the R&D index compared to the South Bohemian Region, which clearly leads in this respect. The high values of the Technology index were also measured in the Liberec region. On the contrary, the worst is the Vysočina Region, especially due to the almost zero value of the Innovation index.

Tab. 5: Development of the Technology index in the regions of the Czech Republic (2011-2015)

Technology index	Year				
Region	2011	2012	2013	2014	2015
Prague	**0.93**	**0.85**	**0.86**	**0.89**	**0.94**
Central Bohemian	0.35	0.28	0.40	0.35	0.33
South Bohemian	0.21	0.21	0.21	0.22	0.19
Plzeň	0.33	0.34	0.35	0.38	0.33
Karlovy vary	0.01	0.00	0.05	0.00	0.00
Ústí nad Labem	0.08	0.06	0.04	0.08	0.05
Liberec	**0.51**	**0.48**	**0.49**	**0.48**	**0.43**
Hradec Králové	0.24	0.22	0.31	0.22	0.17
Pardubice	0.37	0.42	0.40	0.35	0.35
Vysočina	0.07	0.07	0.11	0.10	0.09
South Moravian	**0.67**	0.66	**0.69**	**0.68**	**0.66**
Olomouc	0.22	0.29	0.28	0.29	0.22
Zlín	0.32	0.26	0.28	0.26	0.20
Moravian-Silesian	0.34	0.30	0.27	0.28	0.24

Source: ČSÚ (2011-2015), ÚPV ČR (2011-2015), own calculations

Tolerance

Prague is the most tolerant, which *de facto* confirms the idea of Florida (2002) regarding the existence of a creative city in which people with different races, opinions, or orientations concentrate. All other regions are far behind Prague. There is an interesting development in the Karlovy Vary Region, which has the second highest share of foreign migrants to the total population of the region (high value of Immigration index) in all observed years. On the other hand, the development of the Gay index is interesting to follow in the Ústí nad Labem Region, which (after Prague) reached the highest values in 2012 (0.52) and 2014 (0.51). The high value of Gay index was also measured in 2011 in the Plzeň Region (0.68) and Liberec Region (0.66).

Tab. 6: Development of the Tolerance index in the regions of the Czech Republic (2011-2015)

Tolerance index	Year				
Region	2011	2012	2013	2014	2015
Prague	**1.00**	**1.00**	**1.00**	**1.00**	**1.00**
Central Bohemian	0.26	0.26	0.20	0.23	0.29
South Bohemian	0.16	0.11	0.08	0.09	0.08
Plzeň	0.46	0.32	0.18	0.19	0.25
Karlovy vary	0.35	0.42	0.24	0.33	0.25
Ústí nad Labem	0.25	0.36	0.23	0.36	0.21
Liberec	0.44	0.24	0.22	0.25	0.28
Hradec Králové	0.12	0.08	0.12	0.09	0.17
Pardubice	0.15	0.19	0.08	0.05	0.04
Vysočina	0.01	0.01	0.01	0.01	0.05
South Moravian	0.31	0.22	0.18	0.23	0.20
Olomouc	0.13	0.16	0.10	0.05	0.07
Zlín	0.02	0.05	0.10	0.02	0.01
Moravian-Silesian	0.10	0.19	0.10	0.08	0.10

Source: ČSÚ (2011-2015), MV ČR (2011-2015), own calculations

Creativity index

One can see the clear dominance of Prague from the development of the aggregate Creativity index measured for the regions of the Czech Republic. Second place belongs to the South Moravian Region and the third to Liberec Region. The permanent (worst) position holds the Vysočina Region, which lags far behind all other regions.

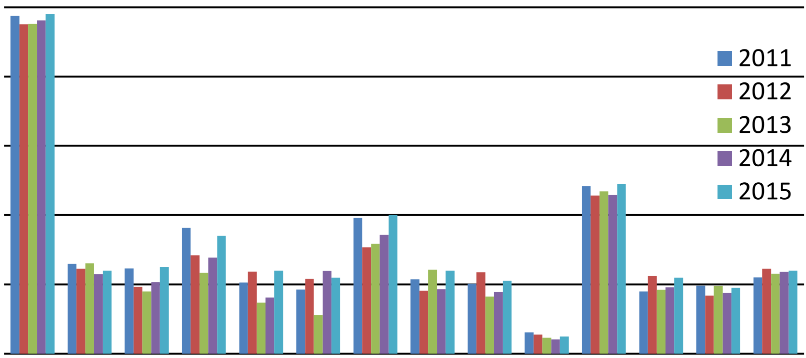


Fig. 1. Development of the Creativity index in the regions of the Czech Republic (2011-2015).
Source: own processing

In total, the most volatile development was recorded in the Hradec Králové Region, which shifted four ranks downwards in 2011-2012 thanks to a significant decline in the value of the Gay index (by 43%). By contrast, in the period of 2012-2013, the region shifted seven ranks upwards due to an increase in the Creative class index (41%) and in the number of patent applications (up 57%). In the 2013-2014 periods, the region again fell from fifth to tenth rank due to a decline in CCI (26%), INI (46%), and GI (40%).

Another region with volatile overall ranking is the Ústí nad Labem region, which experienced the biggest increase in the 2013-2014 periods due to a significant increase of the Creative class index. The index shifted from negative value in 2013 (-0,01) to positive value in 2014 (+0.43). In that period, the growth of the Gay index was significant (96%). On the contrary, the largest descent was experienced by the Ústí nad Labem Region in 2014-2015. The fall was caused by a decline of the Gay Index value (59%).

The South Bohemian Region jumped significantly due to fluctuation of the Innovation index in 2011-2012 (a fall of five ranks down due to INI's decline by 140%) and in 2014-2015 (a shift of three ranks upwards due to INI growth of 44%). The shift in the last year under review was also due to an increase in the Creative class index (by 109% as compared to 2014).

The development of the Karlovy Vary region was also volatile. The biggest downfall (by five ranks) in 2012-2013 was due to a decline in the Creative class index (46%), which was caused by a decline in the number of employees and creative jobs in the region. On the contrary, a significant increase of six ranks occurred in 2014-2015 due to rise of the Creative class index.

The Zlín Region appears on the lower positions. The exception was 2013 when there was an increase in Technology and the Gay indexes, which shifted the region five ranks upwards as opposed to the situation in 2012

The order of the other regions was relatively stable. The Central Bohemian Region averaged on sixth rank. The exception was the year 2013-2014, when the region experienced a three-rank drop due to a fall in the value of the Creative class index (42%) and in the Innovation index (23%). The Plzeň Region appears on the fourth rank, while the Moravian-Silesian Region on the seventh and Olomouc Region on the ninth. The Pardubice Region appears on the eleventh rank, except for 2012, when it has improved in three ranks due to the increase in the number of patent applications.

CONCLUSION

The aim of this paper was to explore the conditions for the development of the creative economy in the regions of the Czech Republic using the methodology of exploiting a Creativity index. To capture development and identify the development trend, the five-year period of 2011-2015 was chosen. The overall Creativity index was comprised of three sub-indexes – talent, technology, and tolerance, which further contain other sub-indexes. Talent development was analysed using the Human capital index and the Creative class index. The evaluation of the technology field was based on the Innovation index and the R&D index. The degree of tolerance and openness to diverse cultures was explored using the Gay index and the Immigration index.

The results of the research clearly showed the unquestionable primacy of Prague Region. Nevertheless, the analysis has shown that South Moravian Region dominates in the field of technologies, specifically in R&D. In all the years under the review, the Liberec Region has also achieved good results by keeping the third rank, but the region experienced improvement in 2014-2015. A similar upward shift was observed at the South Bohemian, Plzeň, Karlovy Vary, and Hradec Králové Regions. The reason for the growth in these regions was a significantly higher share of creative employment to total employment in the region that is a higher value of the Creative class index.

On the other hand, significantly worse results were recorded for the regions of Vysočina, Ústí nad Labem, Zlín, and Pardubice Regions. In these regions, the low value of Human capital Index (ratio of population with university education in the region to the total population of the region) and the low Immigration index (the share of foreign migrants in the region on the total population of the region) were the reasons of the bad situation. Vysočina Region significantly lags behind all other regions in all of the measured indicators.

Acknowledgement: This contribution was supported by an internal grant of the Faculty of Economics and Administration, Masaryk University, entitled "Metropolitan Processes Formatting Traditional City Structure: an Example of Brno Metropolitan Area" (MUNI/A/0976/2016).

REFERENCES

BODEN, M. A. *The creative mind: Myths and mechanisms.* Psychology Press, 2004.

CIKÁNEK, M. *Kreativní průmysly: příležitost pro novou ekonomiku.* 1. vyd. V Praze: Institut umění, 2009, 79 s. ISBN 978-80-7008-231-7.

FLORIDA, R. The Rise of the Crative Class–and how it's transforming work, leisure, community and every day life. *New York*, 2002.

FLORIDA, R., GATES, G. Technology and tolerance: The importance of diversity to high-technology growth. *In: The city as an entertainment machine.* Emerald Group Publishing Limited, 2003. p. 199-219.

HOWKINS, J. *The creative economy: How people make money from ideas*. Penguin UK, 2002.

HUI, D. et al. *A study on creativity index. Home Affairs Bureau, The Hong Kong Special Administrative Region Government,* 2005.

JOINT RESEARCH CENTRE-EUROPEAN COMMISSION, et al. *Handbook on constructing composite indicators: Methodology and user guide.* OECD publishing, 2008.

KLOUDOVÁ, J. Kreativní ekonomika a její měření. *Ekonomický časopis*, 2009, 57.3: 247-262.

KLOUDOVÁ, J. Kreativní ekonomika-Trendy, výzvy, příležitosti. *Trends Economics and Management*, 2013, 4.7: 163-164.

SELADA, C. et al. Creative Clusters in low density urban areas: a case study approach. In: *ERSA conference*. 2010.

Shrnutí

V rámci teoretické části výzkumu byla provedena rešerše literárních pramenů vhodných pro vymezení základních pojmů. Představeni byli stěžejní odborníci zabývající se kreativní ekonomikou a tři základní metody měření kreativní ekonomiky (Index kreativity 3T, Euro-kreativity index, Model 5C). Na základě uvedených metod byla vytvořena vlastní metodika pro měření podmínek pro rozvoj kreativní ekonomiky v podmínkách České republiky. Sestaven byl Index kreativity, který se skládal ze tří sub-indexů (talentu, technologie, tolerance). Každý sub-index byl vypočten pomocí dalších dvou ukazatelů. V oblasti talentu se jednalo o Index lidského kapitálu a Index kreativní třídy. Index technologie byl vypočten pomocí Indexu inovace a Indexu výzkumu a vývoje. Třetí sub-index tolerance byl vypočten pomocí gay indexu a imigračního indexu. Na základě řady výpočtů byl tedy analyzován současný stav a vývoj kreativního prostředí v jednotlivých krajích ČR. Pro zachycení vývoje a identifikaci trendu bylo zvoleno pětileté časové období 2011–2015.

Na základě výsledků výzkumu bylo potvrzeno jednoznačné prvenství Prahy. Nicméně z analýzy vývoje vyplynulo, že ve výzkumu a vývoji dominuje kraj Jihomoravský. Ve všech sledovaných letech dosáhl dobrých výsledků i Liberecký kraj, který se drží na standardní třetí příčce, nicméně posun k lepšímu kraj zaznamenal zejména v letech 2014–2015. Obdobný posun směrem vzhůru byl pozorován u kraje Jihočeského, Plzeňského, Karlovarského a Královéhradeckého. Důvodem růstu byl u všech jmenovaných krajů výrazně vyšší podíl kreativních zaměstnání na celkové zaměstnanosti v regionu čili vysoký index kreativní třídy.

Naopak výrazně horší výsledky byly naměřeny u krajů Vysočina, Ústecký, Zlínský a Pardubický. Ve zmíněných krajích byl důvodem nízký Index lidského kapitálu (podíl osob vysokoškolsky vzdělaných na celkové populaci v kraji) a nízký Imigrační index (podíl zahraničních migrantů v regionu na celkové populaci kraje). Ze všech krajů je na tom nejhůře s výrazným odstupem Vysočina, která zaostává ve všech naměřených ukazatelích.

MILITARY TRAINING AREAS AND THEIR HINTERLAND IN THE CZECH REPUBLIC WITH FOCUS ON TOURISM

Martina Jaňurová, Aneta Krajíčková

Masaryk University, Faculty of Economics and Administration, Lipová 41a, 602 00 Brno

martina.janurova@mail.muni.cz, aneta.krajickova@mail.muni.cz

Abstract: After the fall of the Iron curtain and due to the deployment of Warsaw Pact army, the use of Military Training Areas (MTA) use significantly decreased. Since 1989, four out of the original eight MTAs have been canceled and it is probable that the territorial reductions will continue. The hinterlands of MTA and MTAs themselves are characterized by a low population density, a greater share of woods and agricultural areas and, thanks to a restricted entry, also by relatively untouched nature. These specific features can contribute to the development of tourism, hiking and cycling, bio agriculture, etc., in general to the sustainable forms of tourism and business. The aim of this paper is to point out the possible potential for tourism development in municipalities situated in the hinterland of MTA Boletice, Březina, Libavá, Hradiště and former MTA Brdy. Via selected tourism indicators (employment, tourism-recreational functions of municipalities, tourism-recreational load of municipalities…) and more general indicators of agriculture and business, the current development potential of the municipalities in designated areas is presented. Furthermore, the possibilities of future activities, not only in the near vicinity, but also with the envisaged further territorial reductions and MTAs themselves, are discussed with an emphasis on tourism.

Key words: hinterland, Military Training Area, nature protected area, rural tourism

1 INTRODUCTION

To support the development of the tourist industry in rural and border areas, for which the Military Training Areas and their hinterlands are so typical, is desirable for various reasons. Already in the early 1990s, authors mainly from the US, where the rural tourism is bound with up to two thirds of population, began to show interest in this area. Gibson (1993) sees here a chance for rising of new local businesses and Woods (1992), Burr (1995) and Brass (1996) confirm this hypothesis to some extent, saying that for the proper functionality and growth, it is necessary to include local public as well as private subjects in the development and secure their mutual cooperation. Unlike the US, Europe's rural tourism is not as widely popular. It is perceived rather as a more traditional way of development in the rural, that is peripheral and marginal, areas. However, Holland et al. (2003) state that, in particular after the fall of the Iron curtain, its importance has been gradually growing. Despite the norm being at first seen rather as a low-cost (McMahon, 1996), with its increasing popularity it caught the attention of wealthier Western tourists to such extent that in 2000 the European Commission officially defined the term ‘rural tourism’ and the activities that relate to it (Giannakis, 2014).

Rural tourism is closely connected to the concept of sustainable tourism, particularly in terms of environmental protection and conservation of nature for future generations. One of the possible tools for sustainability of an area is declaring it a Nature Protected Area (NPA). It can be a park, forest, mountain range or a larger unit under the control of a higher authority. Gazenbeek (2005) suggests that, due to their isolation from the outside world, MTAs rank among the most preserved and unpolluted natural areas. He also highlights their inclusion in the Natura 2000 network. Stone (2013), however, claims that such solution does not always have a positive effect on the local inhabitants (for the sake of restrictions and prohibitions it causes). Therefore, Eagles et al. (2002) recommend that local communities take part in the management of the NPA, mainly because it provides funds for the local budgets which thus the locals can control.

The specific area of tourist industry development in the MTAs and their hinterlands is not new to the world, nor Europe. Already in the early 90s, the idea of conversion of military areas for the purposes of tourism was established in Sweden (Stromberg, 2010). Baltic states followed as within the *Baltic Green Belt Project* a tourist complex (bike paths, museums, etc.) along the fallen “Iron curtain” was constructed with the aim to draw attention to the remnants of the Cold War and to preserve the natural heritage (Celotajs, 2011). In the Czech Republic, some authors began to discuss the development of tourism in MTAs only in connection with the closing of former MTA Ralsko (Poštolka, 1998), the optimization of MTA Boletice (Seidl, 2008), and later in reaction to the closing of MTA Brdy (Matušková, 2015).

The purpose of this contribution is to highlight the potential for tourism development in the hinterland of MTAs and MTAs as such. Based on the obtained information, new possible scenarios for the development of studied areas will be presented, with a focus on tourism.

2 METHODOLOGIES

Municipalities within the hinterland of MTAs (or in an MTA itself) are the subject of study here. Whether the area under study has all the characteristics for successful development of tourism can be revealed in several ways. For the purposes of this contribution, the indicators described below (Table 1 and 2) have been designed. These can be used to identify the MTA’s hinterland as an area of low, medium, or high tourism potential. These indicators are primarily aimed at the issue of tourism. More universal indicators focusing on business activities, agriculture and housing are also presented as a supporting source of information. Based on the synthesis of findings, indicative proposals of how to cultivate the monitored areas are being introduced. The proposals and their arrangements are reflected in three levels, that is separately for local residents, local government and local business community.

This article relies mainly on data from the Czech Statistical Office (Population and housing census from 1991, 2001, 2011), the Cadastre of Real Estate, the Ministry of Labour and Social Affairs, the Business Register and the Ministry of Agriculture of the Czech Republic. These hard data are used to design the mentioned indicators, which are then presented in Chapter 4. As a supplementary source of information were, among others, used individual web pages of MTAs.

It should be noted that the presented indicators were compiled as an average of the municipalities located within the hinterland of an MTA. It can be assumed that within the designated area the data will stay homogeneous, and therefore it is not necessary to break the numbers down separately for each municipality. Not only would it make the research disorganized, but it would not be able to assess the tourism potential of MTAs as a whole either.

Tab. 1: Indicators Aimed at Tourism

Indicator	Method of calculation	Description
Employment in tourism	Number of persons employed in tourism/Persons employed in total	Refers to the share of tourism on the local labor market, seasonality must be taken into account
Tourism-recreational functions of municipalities*	Number of tourist and recreation beds/Number of permanent residents	Shows the intensity of the touristic activity
Tourism-recreational load of the region**	Number of tourist and recreation beds in the region per km^2	Shows the intensity with which the region is being used in a way that is crucial for the concept of sustainable tourist industry

Source: Produced by authors

Tab. 2: Universal Indicators

Indicator	Method of calculation	Description
Business activity rate	(Businesses/Population) × 1000	Refers to the potential for development of the business sector and subsequent cooperation
Proportion of unoccupied apartments	Unoccupied apartments/Apartments in total	Refers to the potential for setting up recreation beds
Proportion of permanent grasslands on agricultural land	Permanent grasslands/Agricultural land (km^2)	Refers to the possible use of land for agro/biotourism

Source: Produced by authors

*** classification: fully dominant (201 or more), very significant (101-200), significant (51-100), developing (26-50), minor (25 or less) (Vystoupil, 2007)**

**** classification: fully dominant (50 or more), very significant (35-49,9), significant (20-34,9), developing (10-19,9), minor (9,9 or less) (Vystoupil, 2007)**

3 RESEARCH

3.1 The Examined Area: Basic Information

Currently, there are four Military Training Areas in the Czech Republic-Boletice, Březina, Hradiště, Libavá and a former MTA Brdy, which was shut down by the Act No. 15/2015 Sb. The map presented below shows the position of each MTA within the Czech Republic. It is necessary to note here that all the MTAs including their hinterlands under study can be altogether labeled as inner peripheries, that is areas located on the outskirts of metropolitan regions or at the margins of regional centers (Jaňurová, 2017).

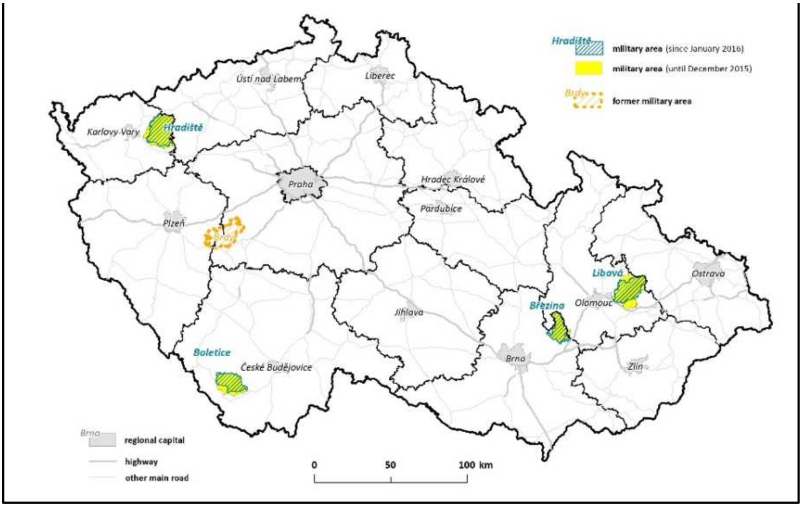


Fig. 1. The Locations of Military Training Areas in the Czech Republic.
Source: Produced by authors

Table 3 presents basic characteristics of examined MTAs from the perspective of tourism. In these areas, the emphasis on environmental protection is placed through various forms of natural reserves and NPAs, and that hiking and bicycle tourism prevail over occasional sight-seeing. In the case of MTA Brdy, the public administration engages in the development of tourism within the area as well as in the rest of the region. They intend to transform the former training ground into a relaxing zone, which would be the closest for inhabitants of the capital of Prague and Central Bohemia. Currently, it is planned to expand the network of bike paths up to 450 km in total.

Tab. 3: Basic Characteristics of MTAs from the Perspective of Tourism

	Area (in 1,000 ha)	Natural sights / Nature conservation	Tourist attractions
Boletice	16,6	Natura 2000, NPA Šumava, Blanice	95 km of bike paths, 85 km of hiking trails
Březina	15,9	A great number of man-made bodies of water	5 bike paths, castles Melice and Vícov
Hradiště	33	Doupov Mountains, Úhošť, Rock Garden of Gnomes (Skalka skřítků), Ostrov Ponds, Sedlec	Bike paths network
Libavá	22		Castle Drahotuš, a biking event Bílý Kámen
Brdy	26	NPA Brdy	270 km of bike paths

Source: Produced by authors

3.2 Selected Fundamental Data and Results

The tables below (Table 4 and 5) present the final values of each indicator. For a variety of objective reasons (availability, the need for a longer-term comparison), the time spans during which the indicators were monitored differ. However, the long-term assessment of the monitored area should not be affected by that significantly.

Tab. 4: Results for Indicators Aimed at Tourism

	Employment in tourism (2001)	Employment in tourism (2011)	Change
Boletice	3,8%	5,9%	+ 2,1%
Březina	0,9%	2,5%	+ 1,6%
Hradiště	2,4%	4,7%	+ 2,3%
Libavá	2,1%	3,3%	+ 1,2%
Brdy	1%	3,3%	+ 2,3%
	Tourism-recreational functions of municipalities (2011)	Tourism-recreational load of the region (2011)	
Boletice	102,6	16,1	
Březina	40,4	36,4	
Hradiště	71,7	40,5	
Libavá	24,3	22,6	
Brdy	50,6	56,7	

Source: Our own design and data compiled from: Cadastre of Real Estate 2016 (ČÚZK, 2017), Ministry of Labour and Social Affairs of the Czech Rep. (2017), Ministry of Agriculture of the Czech Rep. (2017), Regional Information Service (2017), Business Register 2000, 2010 (ČSÚ, 2017), Population and housing census from 1991, 2001, 2011 (ČSÚ, 2017)

Tab. 5: Results for Universal Indicators

Business Activity Section			
	Rate of business activity (2000)	Rate of business activity (2010)	Change
Boletice	349,4	430,4	+ 23,2%
Březina	284,4	347,8	+ 22,3%
Hradiště	250,9	317,1	+ 26,4%
Libavá	288,7	348,3	+ 20,6%
Brdy	336,9	412,8	+ 22,5%
Residential and Housing Stock Section			
	Number of apartments in total	Unoccupied apartments	Proportion of unoccupied apartments
Boletice	5 837	1 213	20,8%
Březina	16 186	2 527	15,6%
Hradiště	18 955	1 960	10,3%
Libavá	22 139	2 708	12,2%
Brdy	26 446	3 873	14,6%
Agriculture Section (2006)			
	Agricultural land in km^2	Permanent grasslands in km^2	Proportion of permanent grasslands
Boletice	178,2 km^2	158,4 km^2	88,9%
Březina	130,9 km^2	17,2 km^2	13,1%
Hradiště	247,2 km^2	137,4 km^2	55,6%
Libavá	243,4 km^2	100,1 km^2	41,1%
Brdy	84,7 km^2	29,2 km^2	34,5%

Source: Our own design and data compiled from: Cadastre of Real Estate 2016 (ČÚZK, 2017), Ministry of Labour and Social Affairs of the Czech Rep. (2017), Ministry of Agriculture of the Czech Rep. (2017), Regional Information Service (2017), Business Register 2000, 2010 (ČSÚ, 2017), Population and Housing Census from 1991, 2001, 2011 (ČSÚ, 2017)

On account of what is given above, the examined areas can be looked at in the following way. In all monitored areas, an increase in the number of people employed in tourism was recorded, as well as a growth in the business sector. Regarding the two indicators - Tourism-recreational functions of municipalities and Tourism-recreational load of the region - we can state that the MTA Boletice is one with the greatest potential for tourism and further possibility of development. MTA Hradiště and Brdy seem to be areas with medium potential for tourism development, and finally MTA Březina and Libavá show a rather low tourism development potential.

Additional indicators in the housing stock section suggest that there is an opportunity to increase the accommodation capacity in the hinterland of the MTA Brdy, which would be more than desirable given the intended changes. MTA Libavá and Březina are in a similar situation, but this seems insignificant due to the low potential for tourism development in these areas. Despite having the fewest available housing units among all monitored areas, MTA Boletice and Hradiště still dispose of more than 1000 apartments in absolute figures, which could be considered sufficient in case of enlargement of accommodation facilities.

The proportion of permanent grasslands points out to their use in agrotourism and considerate forms of agriculture. The greatest potential for that provide MTAs Boletice, Hradiště and Libavá with the surface area larger than 100 km^2. The hinterlands of MTA Březina and Brdy offer very limited options. In the MTA Brdy, though, the collected data from 2016 will possibly rise after the intended remediation of the area.

3.3 Discussion and Recommendations

With regard to the information acquired from public sources and to the selected indicators, this subchapter includes concluding recommendations which are reflected in three layers. The first layer is (representatives of) public authorities at the level of municipalities. The second are representatives of the private sector, that is local entrepreneurs, and the third one is locals themselves residing within the hinterlands of the monitored MTAs, who are probably most affected by the development of tourism.

3.3.1 Public Administration

On the ground of what was found above, it would be appropriate if at least a partial demilitarization of MTA Boletice and Hradiště took place. The main reason for this is the existence of Natura 2000, NPA Šumava, Doupov Mountains and others (see Table 3), thanks to which the army does not have access to a significant part of the territory. Besides that, a great potential for tourism has been identified here but its development can hardly be stimulated while the Army of the Czech Republic is actively using the area. If the mentioned demilitarization happened, it would mean for the public administration organizing an administrative division of the territory among the municipalities within the hinterland of the MTA, similarly as in the case of the former MTA Brdy.

It would be appropriate for the representatives of the public administration of municipalities in all studied MTAs to establish either an association of the municipalities or a local action group. Foundation of a larger administrative unit would increase negotiation power in obtaining grants. Another beneficial move would be the establishment of a housing stock and its management regarding the thousands of available apartments in the hinterlands of all MTAs. The residential units could then be offered to local entrepreneurs through public procurement in order to increase the number of lodging facilities.

3.3.2 Business Sector

The potential for tourism is very high in the proximity to MTA Boletice, and medium in MTA Brdy and Hradiště. Thus, it can be assumed that the local businessmen could profit from this situation, which would lead to rise in employment in tourism (and employment in general). As noted above, the lodging units could be offered for purchase to local businesses through public procurement. These apartments could be reconstructed into accommodation facilities in cooperation with hospitality services. Very popular today is the concept of bed&breakfast, which is an ideal choice for travelers spending several days on bike or hiking trails. These trails could be extended as far as to the “spa triangle” in MTA Hradiště and, in the case of MTA Březina, to the transnational bike path Eurovelo 9 or the Moravian Karst.

Even though the lowest potential for tourism was found in MTA Libavá, it would be convenient to take steps towards improvement of the living standards and employment of locals. Construction of an industrial or business zone near the cities Lipník nad Bečvou and Hranice appears to be one of the options. It was these cities where the largest number of entrepreneurs was recorded and also the agency Czechinvest identified these areas as regions where up to 100.000 CZK of funds per one new job position could be obtained.

Finally, the potential of the region for tourism lies in the sustainable and ecologically considerate agriculture, agrotourism and hipotourism (horse-riding). The hinterland of MTA Boletice, Hradiště and Libavá are dominant in this field, since the surface area with permanent grasslands here exceeds 100 km^2. Although the hinterland of the MTA Březina disposes of a rather small area, it would be desirable to prevent sale of the land stock to the developers as this could disrupt the serene characteristic of the landscape. Apparently, proximity to cities like Vyškov and Brno adds to the lucrativeness of local land resources. The data from MTA Brdy were collected in 2016. It is therefore likely that the number will rise after the remediation. The recovered areas then could also serve the purposes of agrotourism and hipotourism.

3.3.3 Local Residents

Residents would benefit from the demilitarization and tourism development for several reasons. Increased employment in the selected areas could be considered the main contribution. Accessibility of some municipalities would also improve, and at the same time their residents could have more profit from the lease of grasslands (see above). That is why it would be convenient not to be afraid of such changes, but welcome them as a means of improving the living standards. In MTA Brdy, where the process of demilitarization is nearly finished, it is clear now that these significant changes in organization of administrative boundaries and in the use of the region will surely influence the locals. The question is, to what extent they are able to respond to these changes and adapt to them. The demilitarization itself can provide them with a less restricted movement close to their homes, and give a chance to diversify their outdoor physical activities. It is desirable that the citizens become aware of these facts and try to accommodate the planned changes.

4 CONCLUSION

The aim of this contribution was to call attention to the often-underestimated potential for tourism in the hinterland of MTAs in the Czech Republic and the former MTA Brdy, and to contribute to the discussions regarding the conversion and further use of the studied territories. Entry to MTAs has been banned for decades, thanks to which the nature within them remained pure and preserved. These areas are thus suitable for the development of what is known as rural tourism or agritourism, taking into consideration the sustainability of the whole region. As was mentioned in the introduction, the concept of tourist industry following the conversion of military areas is not new to the world (and Europe). The former Eastern Bloc countries has gone on that path already at the beginning of the millennium. Thus, it would be relevant to take the earlier successfully completed projects in other European countries for an example and attempt to raise interest in tourism in the region, which can become an impulse for higher employment and an overall improvement of living standards of locals.

It was determined that in three out of five MTAs under study the potential for tourism is strong to medium, and only in the remaining two it is rather low. However, even the areas with lower potential can work to improve the living standard of their residents, whether through tourism development or other devices. The key element is establishing cooperation between the private and public sectors with support from the local citizens. If such alliance takes place, there is a good chance that the proposals above will be applicable.

The authors are aware that the proposals are somewhat indicative, to a certain degree subjective, and are adjusted according to the current state in which the economy is growing and the conditions for the expansion of businesses are favorable. The innovations in use of the hinterlands of MTAs might become reality only in more than a couple of years. But tourism will certainly play a significant role here anyhow.

This contribution was supported by an internal grant of the Faculty of Economics and Administration, Masaryk University, entitled "Metropolitan Processes Formatting Traditional City Structure: An Example of Brno Metropolitan Area" (MUNI/A/0976/2016)

Acknowledgments also go to the project "Military Training Areas as the territories of transformation: Scenarios of optimization and its influence on society and landscape" which is supported by the Institute of Geonics of the CAS in cooperation with The Silva Tarouca Research Institute for Landscape and Ornamental Gardening. It was created for the 3rd public call of the Technology Agency of the Czech Republic and the OMEGA Programme to support applied social-science research and experimental development.

REFERENCES

BRASS, J. L., Community Tourism Assessment Handbook. *Corvallis, Oregon: Western Rural Development Center*, Oregon State University. 1996

BURR, S. W. The Rural Action Class's Perceptions of Tourism and its Potential for Economic Development: Case Studies from Four Rural Pennsylvania Countries, *General Technical Report*, 1995, Report No. INT-323: pp. 82-89.

CELOTAJS, L. *Military Heritage: management guidelines*. Riga: Baltic Green Belt, 2011.

CZECH INVEST. Novela zákona o investičních pobídkách: Účinná od 1. května 2015. *Czech Invest: Agentura pro podporu podnikání a investic* [online]. 1994 [cit. 2017-10-22]. Retrieved from: http://www.czechinvest.org/data/files/investicni-pobidky-matice-pobidek-5205-cz.pdf

ČESKÝ STATISTICKÝ ÚŘAD [online]. Český statistický úřad, [cit. 2017-10-22]. Retrieved from: https://www.czso.cz/

ČESKÝ ÚŘAD ZEMĚMĚŘIČSKÝ A KATASTRÁLNÍ Nahlížení do katastru nemovitostí [online]. 2004 [cit. 2017-10-22]. Retrieved from: http://nahlizenidokn.cuzk.cz/

EAGLES, P. F. J., MCCOOL, S. F. a HAYNES, CH. D. *Sustainable tourism in protected areas: guidelines for planning and management*. Gland, Switzerland: IUCN--the World Conservation Union, 2002. ISBN 2-8317-0648-3.

GAZENBEEK, A.*: LIFE, Natura 2000 and the military*. Luxembourg: EUR-OP, 2005. ISBN 9289492139

GIANNAKIS, E. The role of Rural Tourism on the development of rural areas: the case of Cyprus. *Romanian Journal of Regional Science*. 2014, 8(1), 38-53.

GIBSON, L. J., The potential for tourism development in non-metropolitan areas', In: BARKLEY, David., L., ed, *Economic Adaptation: Alternatives for Non-metropolitan Areas*, San Francisco, Westview Press, 1993

HOLLAND, J., BURIAN, M. a DIXEY, L. *Tourism in Poor Rural Areas: Diversifying the product and expanding the benefits in rural Uganda and the Czech Republic*. Economic and Social Research Unit, 2003.

JAŇUROVÁ, M. *Vojenské újezdy v České republice: optimalizace jejich dalšího využití*. Brno, 2017. Diploma thesis. Masaryk University.

MATUŠKOVÁ, A. *Strategická transformace vojenského újezdu Brdy*. Plzeň: Katedra geografie FEK Západočeské univerzity v Plzni, 2015.

MCMAHON, F. Rural and Agri-Tourism in Central and Eastern Europe, In: RICHARDS, G. (ed) *Tourism in Central and Eastern Europe: Educating for Quality*, Tilburg: Tilburg University Press, 1996, pp. 175-182

MINISTERSTVO FINANCÍ. Administrativní registr ekonomických subjektů [online]. 2013 [cit. 2017-10-22]. Retrieved from: http://wwwinfo.mfcr.cz/ares/ares.html.cz

MINISTERSTVO PRÁCE A SOCIÁLNÍCH VĚCÍ Statistické publikace a vybrané statistické údaje z oblasti práce a sociálních věcí. [online]. Ministerstvo práce a sociálních věcí [cit. 2017-10-22]. Retrieved from: http://www.mpsv.cz/cs/3878

MINISTERSTVO PRO MÍSTNÍ ROZVOJ Regionální informační servis [online], 2012 [cit. 2017-10-22]. Retrieved from: http://www.risy.cz/cs

MINISTERSTVO ZEMĚDĚLSTVÍ. *EAgri* [online]. 2009 [cit.2017-10-22]. Retrieved from: http://eagri.cz/public/web/mze/zemedelstvi/

POŠTOLKA, V. Revitalizace a nové využití bývalého vojenského prostoru Ralsko. *Sborník České geografické společnosti*. 1998, 103(3), 156-170.

SEIDL, T. *Proces integrace marginálního území do regionálního systému – příklad Vojenského újezdu Boletice*. Univerzita Karlova, 2008. Diploma thesis.

STONE, M. T. *Protected Areas, Tourism and Rural Community Livelihoods in Botswana*. Arizona, 2014. Dissertation.

STROMBERG, P.: Swedish Military Bases of the Cold War: The Making of a New Cultural Heritage, *Culture Unbound*, Linköping University, 2010, Vol. 2, pp. 635–663.

VYSTOUPIL, J. *Návrh nové rajonizace cestovního ruchu ČR*. Brno: Masarykova univerzita, 2007. ISBN 978-80-210-4263-6.

WOODS, M. D. The Tourism/Rural Economic Development Link, *Blueprints for Economic Development*, Cooperative Extension Service, Oklahoma State University,1992, 2(2): pp. 2.

Shrnutí

Cílem tohoto příspěvku bylo poukázat na mnohdy podceňovaný potenciál cestovního ruchu v zázemí vojenských újezdů v České republice a bývalého VÚ Brdy a přispět do diskuze týkající se rekonverze a dalšího využití těchto oblastí. Díky zákazu vstupu do VÚ po celá desetiletí, což se projevilo zachováním čisté přírody, jsou tyto plochy vhodné pro rozvoj tzv. venkovského cestovního ruchu či agrárního cestovního ruchu s ohledem na udržitelnost celé oblasti. Koncept cestovního ruchu spojeného s rekonverzí vojenských prostor není ve světě, potažmo Evropě nic nového a jak je uvedeno v úvodu, státy bývalého východního bloku se touto cestou vydaly již na počátku nového tisíciletí. Bylo by tedy žádoucí vzít si příklady dobré praxe z dříve uskutečněných projektů v dalších evropských zemích snažit se zvýšit zájem o cestovní ruch v těchto oblastech, což může být impulsem pro zvýšení zaměstnanosti a celkové životní úrovně obyvatel.

Bylo zjištěno, že ve třech z pěti sledovaných VÚ je potenciál cestovního ruchu silný až střední a pouze ve dvou je spíše nízký. Nicméně i oblasti s malým potenciálem mohou zvýšit životní úroveň svých obyvatel ať už pomocí cestovního ruchu nebo jiných prostředků. Klíčovým prvkem je navázání spolupráce mezi soukromým a veřejným sektorem za podpory místních občanů. Pakliže by k takovému spojenectví došlo, je poměrně velká šance, že výše uvedené návrhy budou realizovatelné.

Autorky jsou si vědomy, že návrhy jsou spíše orientační a do jisté míry subjektivní a jsou přizpůsobeny stávající situaci, kdy se ekonomika roste a podmínky pro rozvoj podnikání jsou tedy příznivé. Realita nového využití území v zázemí VÚ bude v horizontu více let, možná i desetiletí, ale vše naznačuje, že cestovní ruch v něm bude hrát nezanedbatelnou roli.

WEEKEND RECREATION AS A TOOL FOR DISPERSED SETTLEMENT PRESERVATION (CASE STUDY OF VILLAGE TERCHOVÁ)

Dominika Kaisová

University of Constantin the Philosopher in Nitra, Tr. A. Hlinku 1, 949 74 Nitra
dominika.kaisova@ukf.sk

Abstract: Dispersed settlement, known as a type of settlement where settlement units are dispersed in the area, has several functions in present days. It is used by residents but it is often used by cottagers as well. Mainly those settlement units that are farther away from the village or town centre.
The village Terchová as a centre of tourist traffic in Micro region Terchovská dolina offers a lot of recreational possibilities. Beside summer and winter activities in Malá Fatra National park, there is also an option of a weekend recreation in marginal parts of the village Terchová in the area with dispersed settlement. House fund of dispersed settlement is used mainly by cottagers during weekends in remote parts of this area that are not suitable for residents. The main aim of this article is to focus on weekend recreation as a tool for preserving landscape character, characteristic traits of dispersed settlement and land use.

Key words: dispersed settlement, recreation, land use, landscape character.

1 INTRODUCTION

Dispersed settlement consists of dispersed settlement units that were created in villages beyond a compact settlement in 15th and 16th century, have their own name and are distant from each other (Horváth, 1980). According Sitár (1967) dispersed settlement is a settlement type that is spatially limited and fixed on agriculture. It consists of individual settlement units or group of houses that usually consists of 2-10 or more houses (Verešík, 1980). Dispersed settlement had one main function, housing function, in the past when dispersed settlement units were used by shepherds at first and then by farmers. In last decades of 20th century people started moving from dispersed settlement units to the central parts of villages and some of them became abandoned. Nowadays dispersed settlement units have housing as well as recreational function. Cottagers are using mainly those dispersed settlement units that are in marginal parts of the villages or cities and house fund and nature are quite preserved there (Ďurišová, 2004; Petrovič, 2006; Šuhajdová, Hamada, 2011; Hreško et al, 2015; Petrovič, Muchová, 2013; Kaisová et al., 2017).

Dispersed settlement is important in terms of landscape character that is defined as “distinct, recognizable and consistent pattern of elements in the landscape that makes one landscape different from another, rather than better or worse" (Swanwick, 2002).

Landscape is changing and its characteristic traits are disappearing (Jančura, Bohálová, 2010). There are two main trends in changing landscapes - extensification and intensification (Vos, Klinj, 2000). While one part of the landscape is used and changed by continuously expanding development, the other part of the landscape is affected by succession because people who used to use the country is now abandoning it (Council of Europe, 2000). Therefore historical forms of agriculture, rustic houses and characteristic traits of the landscape are disappearing (Jančura, Bohálová, 2010).

The landscape perspective in management, policy and planning is current focus in Europe as part of European Landscape Convention adopted in the year 2000 by European Council (Ode et al., 2008).

2 MATERIAL AND METHODS

2.1 Research area

Micro region Terchovská dolina is situated in the north-western part of Slovak republic (figure 1). It contains 17 villages: Belá, Dolná Tižina, Gbeľany, Kotrčiná Lúčka, Krasňany, Lutiše, Lysica, Mojš, Nededza, Nezbudská Lúčka, Stráňavy, Stráža, Strečno, Teplička nad Váhom, Terchová, Varín and Zázrivá. Six of them have dispersed settlement in their area. Terchová is the largest village in micro region Terchovská dolina and is centre of tourist traffic and recreation in the area. Although there is 74 dispersed settlement units in Terchová not all of them are used for recreation. Some of them are used by residents for living.

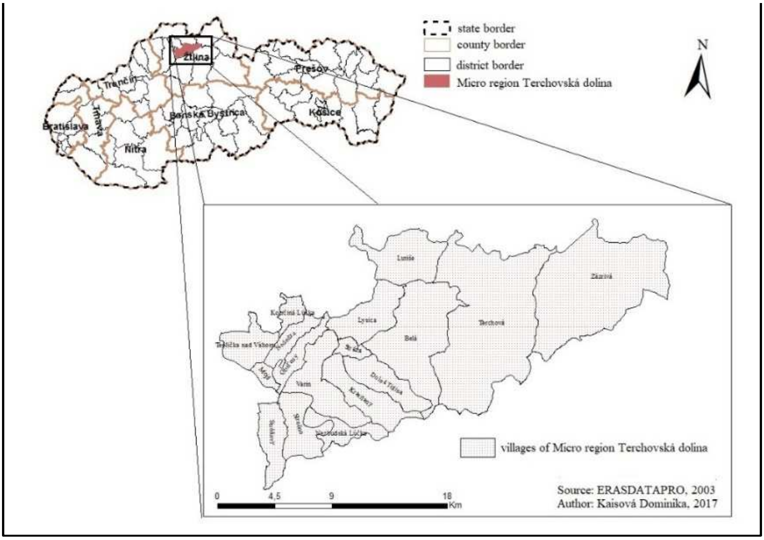


Fig. 1. Placement of Micro region Terchovská dolina within Slovak Republic.

Dispersed settlement is concentrated in western part of micro region Terchovská dolina (figure 2). In the past, remote parts of the land that were uninhabited were colonized to gain new soil that could be cultivated. Therefore in villages that are farther from historical centres dispersed settlement was created.

Village Terchová was chosen as a model area because there is majority of dispersed settlement units of all villages in micro region Terchovská dolina. Terchová has a lot of recreational possibilities and besides summer and winter recreational activities in Malá Fatra National Park it offers also possibilities for weekend recreation in the area with dispersed settlement. There are 74 dispersed settlement units that are concentrated in northern part of the village Terchová because in southern part of the village lays Malá Fatra National park, so the area is not suitable for living.

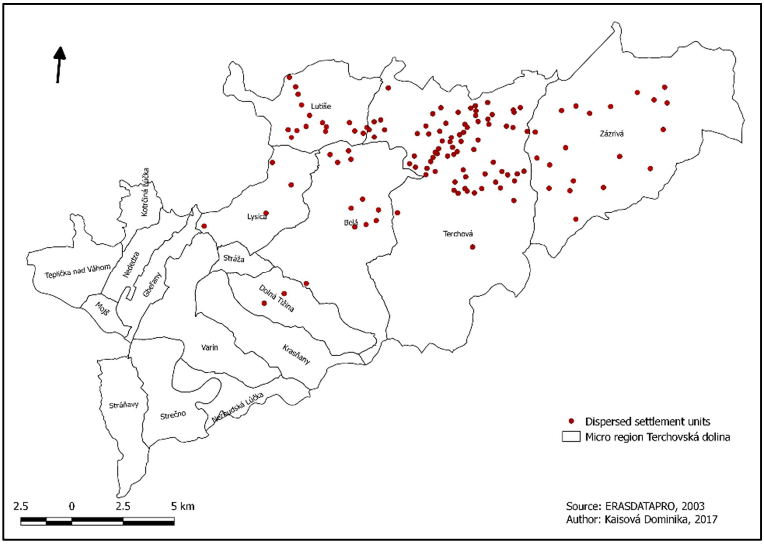


Fig. 2. Dispersed settlement in Micro region Terchovská dolina.

2.2 Methods

The first step in the research was to identify dispersed settlement units in the area and determine which one are used by cottagers for recreation and which one are used by residents for living. GPS device and topographic maps as well as touristic maps was used to identify dispersed settlement units in the area. GPS co-ordinates were noted down and transferred into Geographical information system (ArcGIS 10.1 and QGIS 2.14 were used).

Field research was one of the most important part of the whole research because only during the field research it was possible to observe how and if the house fund and surrounding area are used.

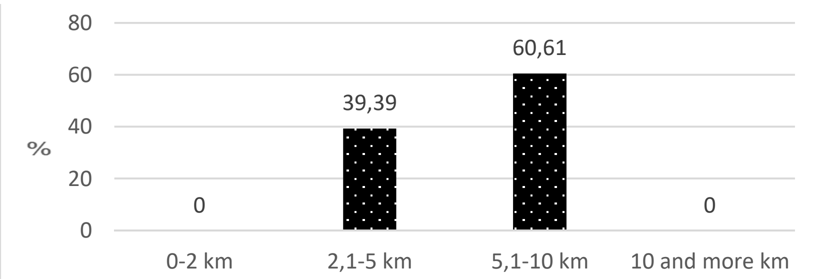
One of the most important factors that affect how dispersed settlement units are used is their accessibility. It turned out that accessibility is one of the main reasons why more distant dispersed settlement units are becoming abandoned. The accessibility was measured from the village centre (which was point in front of the municipal office in Terchová) to dispersed settlement units. After that, dispersed settlement units were put into four categories according Nahálka et al. (1966): 0-2 km, 2.1-5 km, 5.1-10 km and 10.1 and more km.

Data about number of inhabited houses and number of inhabitants was obtained from parish register. These data helped to determine which dispersed settlement units are depopulated and used mainly for recreational purposes. Inhabited houses were categorized into five categories: without lived in houses, 1-5 houses, 6-9 houses, 10-19 houses and 20 and more houses. Number of residents was categorized into 5 categories according Nahálka et al. (1966): without residents, 1-10 residents, 11-50 residents, 51-100 residents and 100 and more residents.

3 RESULTS

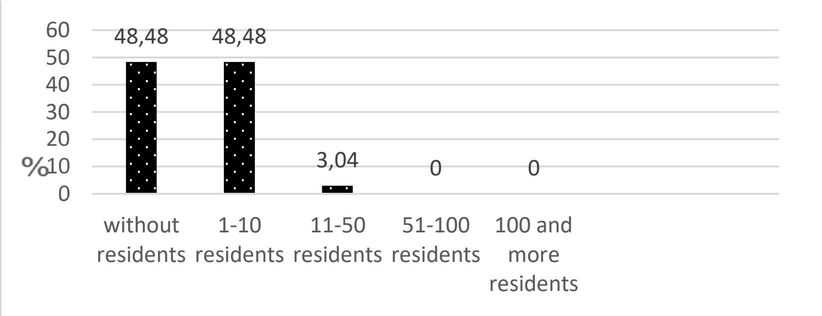
Only dispersed settlement units with mainly recreational function were assessed. Mainly recreational function means that in these dispersed settlement units are no or very few inhabitants and house fund is used for weekend recreation by cottagers. Dispersed settlement's function was determined according number of inhabitants and lived in houses and field research was helpful as well.

Distance from village centre to dispersed settlement units are in interval from 2.1 km to 10 km. Most of them are in distance from 5 to 6 km from village centre. There are 39.39% of dispersed settlement units in interval 2.1-5 km and 60.61% of them are in interval 5.1-10 km (graph 1). There are no dispersed settlement units that are closer to village centre and are used mainly by cottagers.



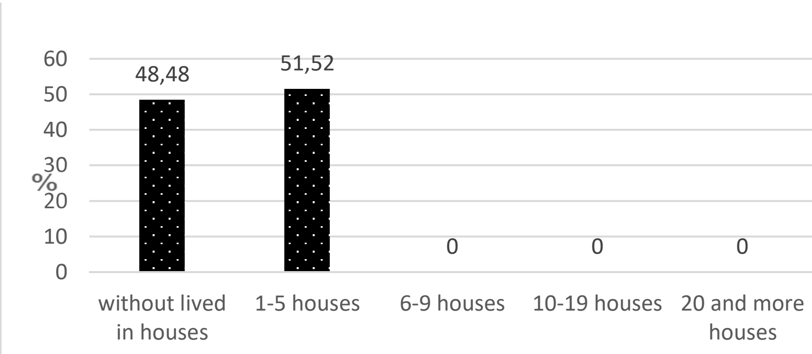
Graph 1: Distance from the village centre to dispersed settlement units
Source: Internal materials of parish register

Almost half (48.48%) of dispersed settlement units are without residents and the same number of dispersed settlement units have 1-10 residents. Only one dispersed settlement unit is in interval 11-50 residents (graph 2).



Graph 2: Number of residents in dispersed settlement units in Terchová in 2015
Source: Internal materials of parish register

House fund of assessed dispersed settlement units is created mostly by old wooden houses. Some of them are declining because there is no one to take care of them and nature in this part of Slovak republic, mainly in winter, could easily destroy old houses. 48.48% of house fund is without residents and 51.52% have 1-5 lived in houses (graph 3).



Graph 3: House fund of dispersed settlement units in Terchová in 2015
Source: Internal materials of parish register

Great distance from the village centre is not convenient for people who need to commute to work or to school and are less appealing for tourists who need certain infrastructure during their stay in the area. So dispersed settlement units in marginal parts of Terchová are more suitable for weekend recreation and cottagers. There are also no civic amenities such as grocery store, bus stop, school or policlinic in these dispersed settlement units. It is another sign that these dispersed settlement units are not used permanently.

Instead of building new houses, cottagers are reconstructing old house fund and preserve traditional architecture. It also helps to stop succession and therefore preserve characteristic traits of the landscape such as terrace fields, orchards or meadows that are also home for some protected animal and flower species. These dispersed settlement units seems to have more preserved characteristic traits than dispersed settlement units nearby the village centre, where developers are building new wooden houses with foreign architecture that are not natural for the area with dispersed settlement.

There are 33 dispersed settlement units (figure 3) that are used mainly by cottagers, although there still could be some residents, but most of them are retired now. Most of the cottagers bought these old houses from residents and a lot of cottages belong to foreign cottagers, mainly from Czech Republic. There are recommendations to reconstruct these old houses instead of new construction in local plan of the village Terchová. Cottagers as well as resident should respect these recommendations to preserve landscape with dispersed settlement for other generations.

Dispersed settlement units in other villages of micro region Terchovská dolina are used by cottagers as well. It seems that more remote dispersed settlement units are more attractive for weekend recreation that those near village centres. Terchová has a lot of dispersed settlement units that are close to the village centre but in the other villages dispersed settlement units are not so tied to village centre and it is easier to establish where the village centre ends and where the dispersed settlement units started. In Terchová it not so explicit.

If we want to preserve landscape with dispersed settlement it is important to find balance between extensification and intensification of landscape exploitation. Because as Vos and Klijn (2000) claims, these changes may cause a significant loss of the landscape diversity. Mono-functional agricultural landscapes evolved into multifunctional landscapes that are agrolandscapes with non-production functions such as biodiversity, housing and recreation that are combined with agriculture (Jellema et al., 2007). Villages with dispersed settlement in micro region Terchovská dolina are multifunctional landscapes and we should take that into account during landscape planning.

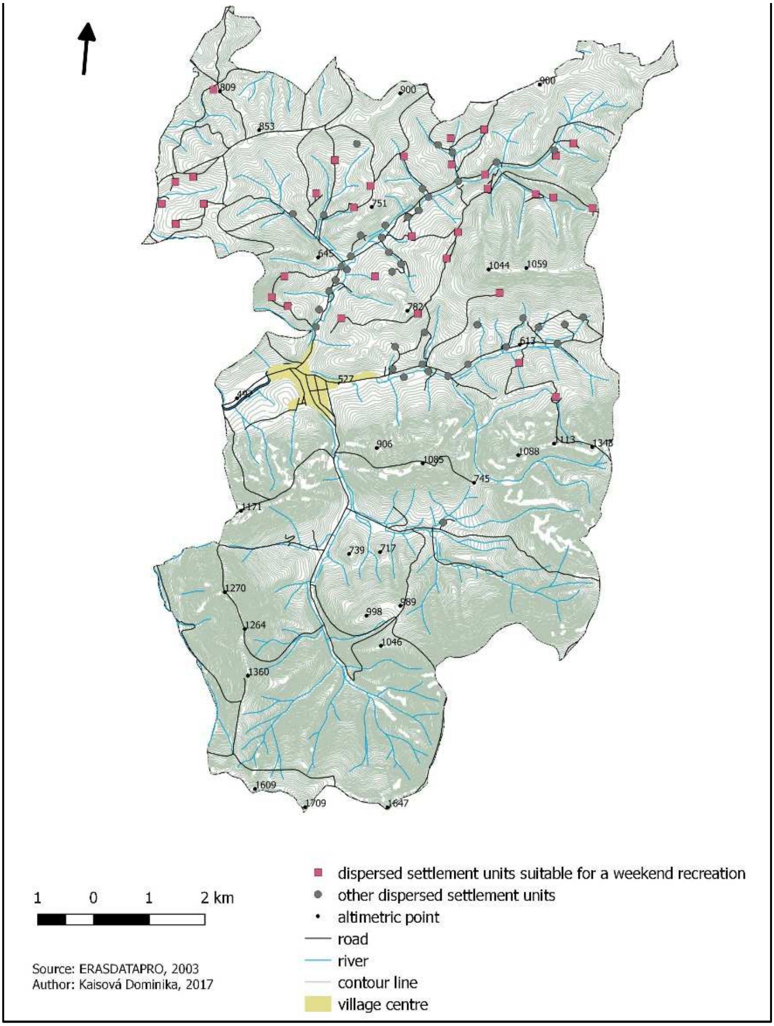


Fig. 3. Dispersed settlement units in Terchová.

4 CONCLUSION

Depopulated and remote dispersed settlement units will decline unless there will be someone willing to take care of them. Cottagers seems to be perfect solution for dispersed settlement preservation, mainly in remote parts of villages or cities that are not attractive for residents. These areas are very attractive for cottagers, mainly mosaic structure of the landscape with small fields, meadows, woods and small groups of houses. Extensive use of the landscape with dispersed settlement is necessary to preserve characteristic traits.

Besides cottagers, houses with traditional architecture placed in the landscape with characteristic traits could be attractive to other visitors. A lot of cycle routs and tourist trails lead through or near dispersed settlement units. Some of the bigger dispersed settlement units could be used even for agro tourism.

Acknowledgment: This research was accomplished thanks to project KEGA 025UKF-4/2015 and project VEGA no. 1/0496/16.

REFERENCES

Council of Europe (2000) Official text of the European Landscape Convention. Available online at: [http://www.coe.int/t/e/Cultural_Co-operation/Environment/Landscape/].

ĎURIŠOVÁ, A. 2004. Kopaničiarske osídlenie - sídelný fenomén. In *Sídlo-park-krajina 3: Krajinno-architektonická tvorba, vegetačné prvky v sídlach a krajine.* 1. vyd. Elektronický konferenčný zborník, Nitra: Slovenská poľnohospodárska univerzita, p. 135-138. ISBN 80-8069-457-5.

HORVÁTH, P. 1980. Historický prehľad vzniku a rozvoja chotárnych sídel v slovenskej časti Karpát. Slovenský národopis, 28, 1, SAV, Bratislava, p. 8-17.

HREŠKO, J., PETROVIČ, F., MIŠOVIČOVÁ, R. 2015. Mountain landscape archetypes of the Western Carpathians (Slovakia). In *Biodiversity and Conservation*, vol. 24, no. 13, p. 3269-3283.

JANČURA, P. BOHÁLOVÁ, I. 2010. Metodika identifikácie a hodnotenia charakteristického vzhľadu krajiny. In Enviromagazín (SAŽP, Banská Bystrica) 6/15. ISSN 1335-1877.P. 18-19.

JELLEMA, A. STOBBELAAR, D-J., GROOT, J.C.J., ROSSING, W.A.H. 2009. Landscape character assessment using region growing techniques in geographical information systems. In *Journal of Environmental Management*. 90, 2009, p. 161-174, DOI: 10.1016/j.jenvman.2008.11.031.

KAISOVÁ, D., JANČOVIČ, M, NOZDROVICKÁ J. 2017. Use of dispersed settlement for agricultural tourism in three towns in Čadca District. In *Public recreation and landscape protection - with nature hand in hand?: proceeding from 8th konference.* Brno: Mendel university, p. 449-454. ISBN 978-80-7509-487-2.

NAHÁLKA, P. ET AL. 1966. Výskum rozptýleného osídlenia na Slovensku. VÚPS SF SVŠT, Bratislava, 144 pp. + příloha.

ODE, Å., TVEIT, M.S., FRY, G. 2008. Capturing Landscape Visual Character Using Indicators: Touching Base with Landscape Aesthetic Theory. In *Landscape Research*, 33:1, p. 89-117, DOI: 10.1080/01426390701773854.

PETROVIČ, F. 2006. Changes of the landscape with dispersed settlement. In Ekologia (Bratislava), vol. 25. ISSN 1337-947X. P. 201-2011.

PETROVIČ, F., MUCHOVA, Z. 2013. The potential of the landscape with dispersed settlement. In. Public recreation and landscape protection–with man hand in hand: Brno: MU, 2013, p. 199–204. ISBN 978-80-7375-746-5.

SITÁR, E. 1967. Kopaničiarske osídlenie na Slovensku. In *Vlastivedný časopis.* 16:1, p. 125 - 135.

SWANWICK, C. 2002. Landscape Character Assessment: Guidance for England and Scotland (London: The Countryside Agency and Scottish Natural Heritage).

ŠUHAJHOVÁ L., HAMADA, M. 2011. Possibilities for utilization of the dispersed settlement potential of Nová Baňa "štál" area. In *MendelNet 2011. Proceedings of International Ph.D. Students Conference.* Brno: Mendel University, p. 531-538. ISBN 978-80-7375-563-538.

VEREŠÍK, J. 1974. Vidiecke sídla. In *Slovesko - Ľud – I. časť*. Obzor, Bratislava. 736 p.

VOS, W., KLIJN, J., 2000. Trends in European landscape development: prospects for a sustainable future. In: Klijn, J., Vos, W. (Eds.), From Landscape Ecology to Landscape Science. Kluwer Academic Publishers,Wageningen, pp. 13–30.

SHRNUTÍ

Rozptýlené osídlenie je sídelný fenomén, ktorého prežitie závisí na ľuďoch, ktorí sa starajú o pôvodnú architektúru drevených domov a tradičné obhospodarovanie okolitej krajiny, aby bol zachovaný krajinný ráz danej lokality. Rozptýlené osídlenie vo vzdialených častiach obcí a miest často krát trpí práve tým, že tieto oblasti sú bez trvalého obyvateľstva alebo tam žijú iba ľudia v dôchodkovom veku, ktorí nie sú schopní starať sa o drevenice a ich okolie. Obec Terchová, ktorá leží vo východnej časti mikroregiónu Terchovská dolina, je známa vysokým počtom osád a je centrom cestovného ruchu v regióne. Väčšina aktivít, týkajúca sa cestovného ruchu, je orientovaná na pohorie Malá Fatra, pričom ubytovacie zariadenia sú lokalizované v oblasti s rozptýleným osídlením, ktoré sa nachádza v blízkosti centra obce. Vzdialenejšie osady sú však často krát bez trvalých obyvateľov a vtedy prichádzajú na radu chalupári, ktorí sa starajú o tieto osady, ktoré sú pre nich príťažlivé hlavne kvôli atraktívnemu prostrediu, ktoré je typické striedaním políčok, lúk, lesov a ovocných sadov. Výskum v tejto oblasti ukázal, že osady nachádzajúce sa vo väčšej vzdialenosti od jadra obce majú zachovanejšiu tradičnú architektúru než osady bližšie k centru obce. Je to spôsobené tým, že chalupári sa snažia o zachovanie tradičného vzhľadu osád, pričom v blízkosti jadra obce pôsobia developerské tlaky na výstavbu rekreačných zariadení pre turistov. Krajina s rozptýleným osídlením nie je stavaná pre masový turizmus. Ten môže tejto krajine viac uškodiť ako pomôcť.

THE DESIGN OF A CYCLING ROUTE IN THE MODEL TERRITORY OF LEVICE AND ITS SURROUNDINGS

Tomáš Kováč, Martin Boltižiar

Department of Ecology and Environmental Sciences, Faculty of Natural Sciences, Constantine the Philosopher University in Nitra, Trieda A. Hlinku 1, 949 74 Nitra

tomas.kovac@ukf.sk

Department of Geography and Environmental Sciences, Faculty of Natural Sciences, Constantine the Philosopher University in Nitra, Trieda A. Hlinku 1, 949 74 Nitra

mboltiziar@ukf.sk

ABSTRACT: The importance of bicycle touring is currently getting more attention, mainly in other countries of the European Union, but recently also here in Slovakia. In the article, we focus on the impact of bicycle touring on tourism in Slovakia with its legislative provisions and on the design of new cycling routes. We pay special attention to the particular importance of bicycle touring in the town of Levice and the surrounding area. After analyzing and evaluating of the existing routes, we decide to propose two new ones, which could have a positive impact on the development of the territory. We designed the first route outside of the town of Levice (Levice-Dolná Seč-Vyšné nad Hronom-Žemliare-Jur nad Hronom-Starý Hrádok-Mýtne Ludany časť Dobogov - Levice) 29 km in length. We situated the second route in the built-up area of the town of Levice; its length is 6.9 km. Both proposed routes have “rekrea” difficulty, i.e., they are designed for families with children or cyclists with a lower fitness level.

Key words: bicycle touring, proposed route, Levice, development of the territory, municipality

INTRODUCTION

Nowadays, there is an increased interest in bicycle touring not just abroad but in Slovakia as well. One of the main documents, which covers the development of bicycle touring in Slovakia is National Strategy of Development of Cycling Transport and Cycle Touring in the Slovak Republic The main vision of this strategy is the effort to draw the rest of the European countries in the field of bicycle touring. This document also tries to ensure that cycling is recognized as respected means of transport and that it is equal to other types of transport. It also seeks to improve the perception of cyclists as fully-fledged participants in road traffic. The goal is also to boost cycling as an important segment of the tourism industry, with the potential, in particular for rural areas and their development, increasing employment and competitiveness in the context of sustainable development. Our proposed route should promote the main vision of the strategy and its goals, and the resulting positive effect not only on the development of bicycle touring routes, but also on the overall development of the region (www.telecom.gov.sk).

The territory is located in the southern regions of the Slovak Republic in the Nitra self-governing region. In the context of the region, it belongs to the territory of Levice district. In the territory of the city, it includes the town of Levice and the municipalities of Dolná Seč, Vyšné nad Hronom, Žemliare, Jur nad Hronom, Starý Hrádok, and Mýtne Ludňany časť Dobogov (fig. 1).

From the point of view of natural circumstances of the territory, it lies in the eastern part of the Danubian Lowland in the valley of the lower reaches of the Hron river. From the north and the northeast of the territory, it is surrounded by the volcanic mountain range of Štiavnické vrchy. The eastern border of the area is enclosed by Krupinská planina. The most significant water flow in the territory includes the river Hron. From the southern side of the volcanic mountain range it borders the Burda mountain (www.levice.sk, Hrnčiarová, T. red., 2002).

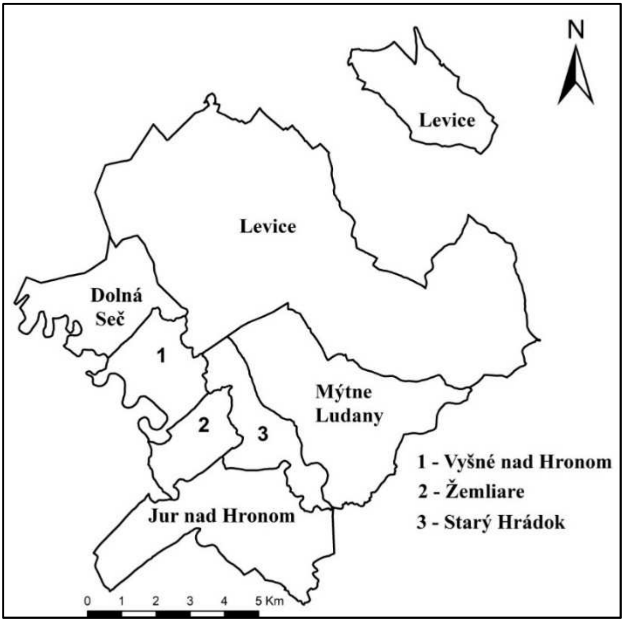


Fig. 1. The definition of the territory.
Source: ArcGIS 9.3, compiled by Tomáš Kováč (2017)

CURRENT CONDITIONS FOR BICYCLE TOURING IN THE TERRITORY

Natural and cultural policies in the territories with a focus on the development of bicycle touring

As was already mentioned above, in terms of natural circumstances of the territory, it is located on the extensive geomorphological area of. Danubian hills. That is why, in the territory, we only detect a minimal vertical altitude difference, namely 23 m. Because of this, the territory has a large potential for cycling and in terms of the intensity of all the possible routes it is possible to put them into the REKREA category (less challenging routes for beginners and occasional cyclists). The routes are suitable for beginners and families with children. Also in terms of climate conditions, the area clearly has positive conditions for bicycle touring development. In accordance with Lapin and co. (2002), we include the territory in the warm climate zone, resulting in up to 50 and more summer days in this area, and the average annual temperature being around 20 °C. Also in the territory, we observe completely clear days ranging between 50-60 annually. In the territory, the lowland precipitation type is prevalent, characterized by little rainfall. The annual precipitation is 600-650 mm. In summer, the west wind flow is prevailing. The territory for the development of bicycle touring is also supported by the landmarks from the point of view of nature conservation or cultural monuments. There are for example. the protected area Levické rybníky ponds, the protected area Levický park, the protected tree princesstree (*Paulownia tomentosa*) and others. Cultural attractions are represented by monuments of regional importance such as Tekovské múzeum museum, Klasicistický kostol sv. Michala archanjela church, and many others. The most important monument of supraregional significance is the Levický hrad castle, which is also the outpost of the international route of rivers Váh-Dunaj-Ipeľ (Žiaran, J. a kol., 2010, Cyklomapa euroregiónu Váh – Dunaj – Ipeľ).

Institutions that support bicycle touring

Several associations deal with the issue of bicycle touring. One of them is an Association of rural tourism Hron (ART-.HRON), founded by the municipalities of Starý Tekov, Kalná nad Hronom, Horná Seč and Jur nad Hronom in 1999. In 2006, the Association added the municipality of Dolná Seč, Vyšné nad Hronom, Tekovský Hrádok, Turá, Nový Tekov, Starý Hrádok and Žemliare. In the year 2010, municipalities of Mýtne Ludany and Veľké Kozmálovce joined the Association In 2011, another 13 municipalities joined the Association and together they created the Civic Association (CA) in the palm of the Hron (Občianske združenie (OZ v Dlani Hrona) which works on the Leader principle. Subsequently, in the year 2012, the CA in the palm of the Hron merged with CA Under the Slovak gate (OZ Pod Slovenskou bránou) and together they created CA Tekov - Hont. The cooperation arose from their historical, natural, and economic conditions. The aim of the Association is to create new job opportunities in the field of rural tourism, improve the quality of life of the population, as well as to promote the development of tourism and bicycle touring (www.dolnasec.sk, www.jur.sk, www.mytneludany.sk, www.staryhradok.sk, vysnenadhronom.webnode.sk, www.zemliare.sk).

In a given territory, the Regional Tourism Organization of Tekov also participates on the development of tourism and bicycle touring. Founding members of the Regional Tourism Organization of Tekov include: the towns of Nitra, Levice, and Želiezovce; municipalities of Kalná nad Hronom, Pukanec Bátovce, Santovka, Jur nad Hronom, Čajkov, Rybník, and the company Amalion, s.r.o. (Guest house Rekrea, restaurant Koliba), MORE-PJC, s.r.o. (guide services, RegionVINO). PaedDr. Ján Füri – JUROB (Camping Vodník Jur nad Hronom), Tekovské museum, Viale s.r.o. (Hotel Lev), OZ Terroir Tekov.

The municipalities themselves support the development of tourism and bicycle touring by various cultural events. The support of tourism and the bicycle touring itself in the area is encouraged by the Levice information agency which provides the tourists with interesting information about the region.

The main document, which in addition to the development of tourism also covers the development of cycling in the town of Levice is the Strategy for the development of tourism of the city of Levice for the years 2016-2020. It follows the Strategy for the development of tourism of the city of Levice for the years 2009-2015 and was made in accordance with strategic documents: Strategy for the development of tourism of the city of Levice by the year 2020, Strategic and marketing plan for the development of tourism in Nitra self-governing region in the years 2014-2020, Strategy for the development of bicycle routes in Nitra self-governing region in the years 2016-2020.

The above mentioned associations also contribute to the organization of different events. ART - HRON creates many events to support local development in the municipalities. It also supports the development of bicycle touring in the territory through the organization of various cycling events, such as: "Bicycle touring season start" in Jur nad Hronom, "Goodbye holiday event" and many others. In addition to the ART – HRON, the Regional Tourism Organization of Tekov or CA Tekov - Hont and the municipalities themselves are involved in the development of the territory by organizing various social and cultural events to promote tourism (Hlatký, J. a kol., 2014, Frtúsová, Z., 2009, www.telecom.gov.sk, Plesník, P. a kol, 2014, Obická, Z., 2016).

Assessment of the existing cycling routes

In the territory there is a major regional route Starý Tekov - Jur nad Hronom (Pohronská cycling route), built by the ART – HRON. It leads along the river Hron from Starý Tekov to Jur nad Hronom in a length of 27 km. Another important cycling route in the territory is the international route of the euroregion Váh – Dunaj - Ipeľ which passes through the town of Levice. The town of Levice, as the member of this euroregion was included in the project "Euroregion Váh – Dunaj - Ipeľ on wheels". Its goal was to create an attractive product in the field of tourism in the form of a cycling route. The project builds on the already existing project "Tourist route of the medieval castles of Euroregion Váh – Dunaj-Ipeľ" as a tourism product. The international route Euro Velo (Dunajská cycling route) and Čiernovodská cycling route also pass through the region (www.eurovelo.com www.nr.cykloportal.sk).

Regarding the quality of the marking of cycle routes, there is international marking present on the route of Starý Tekov-Jur nad Hronom (Pohronská cycling route). In the municipality of Vyšné nad Hronom, it is represented by markings with red colour. The marking of all of the existing cycling routes in the territory is at the appropriate level (Dubcová, A. – Kramáreková, H. red., 2011, Kramáreková a kol, 2014).

Aforementioned cycling routes have a positive impact on the development of tourism. International cycling route Váh - Dunaj - Ipeľ passes through the town of Levice and has a stop near the Levický hrad castle. In Levice, however, there is a missing cycling route which would inform cyclists about the attractions in the town and surrounding municipalities. Therefore, we would like to present the tourist other attractions of Levice and its surroundings so they would remain in the area for a longer time. The territory is also missing a link with the surrounding municipalities and the town of Levice which would lead directly from the town to the individual municipalities. Its creation would result in a number of positive impacts on the territory. One of them would be reduction of the number of vehicles in the town of Levice, and also a better connection to the citizens of the town and nearby municipalities. In this regard, we decided to propose a cycling route which is located in the town of Levice and would subsequently pass through the surrounding municipalities.

THE PROPOSED CYCLING ROUTE

In the northwestern part of the Levice district, we decided to design a cycling route (Levice - Jur nad Hronom - Levice) which would consist of two circuits. The route leads through the town of Levice to Jur nad Hronom and back to Levice. We designed the first route outside of the town of Levice (Levice-Dolná Seč-Vyšné nad Hronom-Žemliare-Jur nad Hronom-Starý Hrádok - Mýtne Ludany časť Dobogov - Levice) with the elevation level of 23m and lenght of 29km. The route is located in the range of altitudes of 165 m (Levický hrad castle) – 142 m (Jur nad Hronom). First we designed a circuit directly passing through the town of Levice (circuit no. 1 – Levice cycling route). The second circuit connects the town of Levice with the neighboring municipalities (Circuit No 2 – Levické rybníky ponds-Jur nad Hronom – Levické rybníky ponds. The entire route is set in the REKREA difficulty. The condition of the road surface is suitable because the proposed route passes through the town of Levice and then runs through the municipalities, whose accessibility is ensured by the roads of III class. The route is easily passable even for beginners therefore it is also suitable for parents with children (fig. 2, 3).

We used the following **methodological procedure** when designing the route. n the first phase we visited institutions such municipality office in Levice, the individual mayors of the municipalities, as well as Hron - Association of rural tourism and Regional Tourism Organisation of Tekov.

After gathering the information, we created a rough draft of the route, and we carried out field research in order to examine the state of the routes, together with photographic documentation of the proposed construction. In the design of the route, we took account of the following attributes: elevation of the route, availability, and its connection to other cycling routes. Subsequently, we created the graphic design using Adobe Photoshop CS6 and ArcGIS 9.3. software.

From the tourist point of view, the proposed route guarantees very good connectivity to the regional route Starý Tekov - Jur nad Hronom created by ART-HRON (Pohronská cycling route), which may be accessed in the municipalities of Dolná Seč, Vyšné nad Hronom, Žemliare and Jur nad Hronom. Cyclists can also access the international cycling route of the Euroregion Váh - Dunaj - Ipeľ neat the Levický hrad castle (Ručne maľovaná mapa regiónu TEKOV, Ručne maľovaná mapa Tekov:Pre cyklistov, Mapa okresov Slovenskej republiky okres Levice. 1: 50 000, Nitriansky kraj cyklomapa. 1: 100 000, Maľovaná mapa regiónu Dolné pohronie a Poiplie).

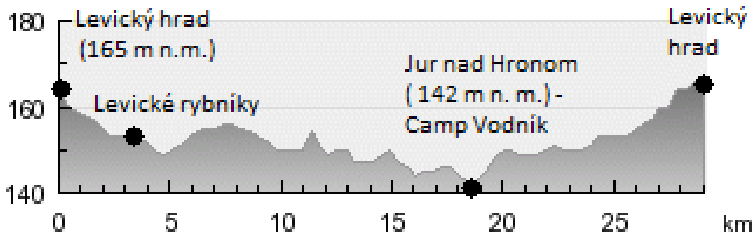


Fig. 2. Elevation profile: Levice – Jur nad Hronom – Levice.
Source: www.cykloserver.cz

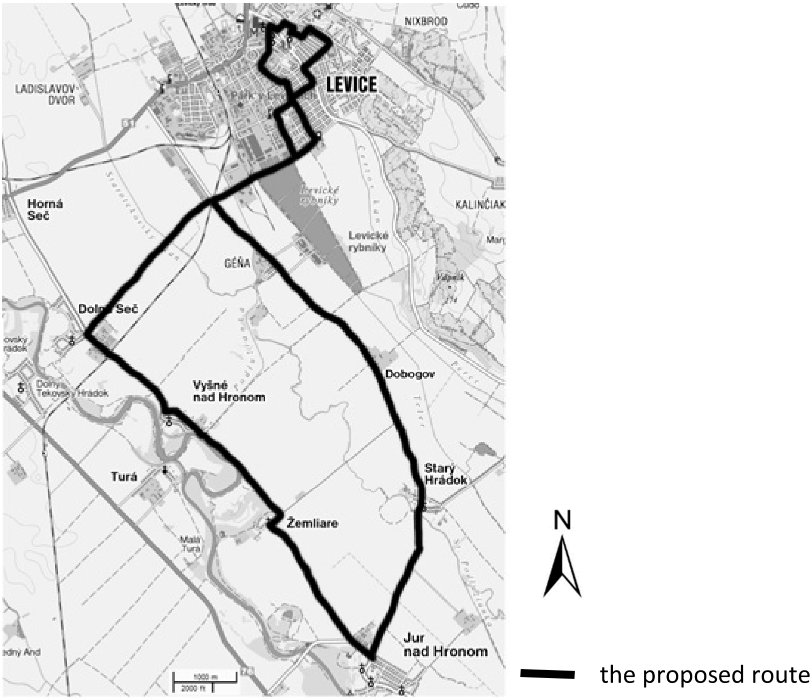


Fig. 3. Cycling route Levice – Jur nad Hronom – Levice.
Source: www.cykloserver.cz

Proposed route description: Circuit # 1- Cycling route Levice

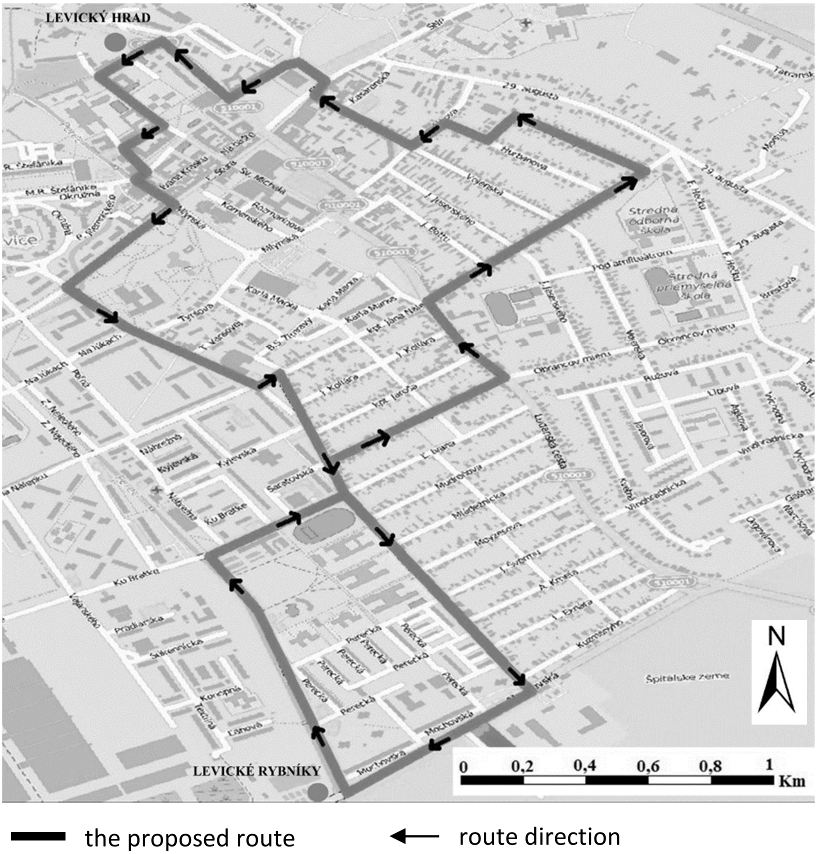


Fig. 4. Cycling route Levice.
Source: ArcGIS 9.3, compiled by Tomáš Kováč (2017)

The proposed cycling route of Levice is located directly in the town and is designed to create and integrated circuit withing the town itself. Its total length is 6.940 km and elevation does not exceed 12 m. The route starts at Levický hrad castle on Ulica Kálmána Kittenbergera street where the cyclists have the possibility to connect to the international cycling route Váh - Dunaj - Ipeľ which passes through the city. The route then continues along the streets of Ulica Svätého Michala, Záhradná, and Mlynská towards the town's park. The town cultural center is located nearby on the street of Ulica Andreja Sládkoviča. The route then continues towards Levické rybníky ponds providing a choice of further direction as it is possible to connect to the second circuit (Circuit no. 2 - Levické rybníky ponds - Jur nad Hronom - Levické rybníky ponds) which leads towards municipalities of

Dolná Seč - Vyšné nad Hronom - Žemliare - Jur nad Hronom - Starý Hrádok - Mýtne Ludany časť Dobogov and back to Levické rybníky ponds. It is also possible to continue the route within the town. The route continues from the Levické rybníky to the centre of the town to Námestie Hrdinov square. The square provides opportunities for relaxation and sightseeing. The route then continues North along Ulica Pavla Országha Hviezdoslava street to the Levický hrad castle, i.e. to the beginning of the route. When designing cycling route we take into account attributes, such as the safety of the cyclists and the number of places of interest along the route (natural and cultural). On the Levice route, the cyclist can see for example a Jewish synagogue, Kostol sv. Michala archanjela church, Kostol sv. Jozefa church, Levické rybníky ponds and many others. There are also food and drink opportunities on the route (fig. 4).

Proposed route description: Circuit no 2 – Levické rybníky ponds-Jur nad Hronom – Levické rybníky ponds

The route starts at Levické rybníky ponds, where it follows the route that we proposed within the town of Levice (Circuit no.1 - Levice cycling route). The route then continues from the Levické rybníky ponds along the third class road to the West to the municipality of Dolná Seč. In the municipalities of Dolná Seč, Vyšné nad Hronom and Jur nad Hronom, there is a possibility of accessing the regional cycling route Starý Tekov - Jur nad Hronom which goes along the river Hron. The route from the municipality of Dolná Seč continues to southernmost municipality on the route of Jur nad Hronom, and continues back to the Levické rybníky ponds. Its total length is 22.060 km and has elevation of 12 m. The surface along the entire length of the route is reinforced. Lot of natural and cultural attractions are present on the route. Jur nad Hronom features the most natural and cultural attractions among all the municipalities lying on the route: Rímskokatolícky kostol sv. Juraja church, Kalvínska zvonica belfry, Ľudový dom (house of folk art) and other attractions. In addition, there is also a campsite Vodník provides accommodation services. In addition to these services, the camp also offers rafting on the river Hron (Kalná nad Hronom - Jur nad Hronom) (Holbová, K. a i., 2012, www.hron.sk).

DESIGNS OF INFORMATION PRODUCTS TO PROMOTE THE ROUTE AND BICYCLE TOURING (LEVICE AND SURROUNDINGS)

The the promotion of our proposed route is important as well. For this reason, we decided to design an information board that will provide basic information of the route. Although we divided it into two circuits, we have only one common promotional product since the areas form one integral route. We designed an informative board of cycling route Levice - Jur nad Hronom-Levice (fig. 5), which runs through the town of Levice (there is also a separate circuit within the town, described above) to the municipalities of Dolná Seč, Vyšné nad Hronom, Žemliare, Jur nad Hronom, Starý Hrádok and Mýtne Ludany časť Dobogov, and back to the town of Levice. The board could thus contribute to greater promotion of the designed route.In order to receive sufficient information about attractions and in order to raise awareness about the board, we propose to install it on the seven places of the region. The two places being in the town of Levice itself (Levický hrad castle and Levické rybníky ponds).

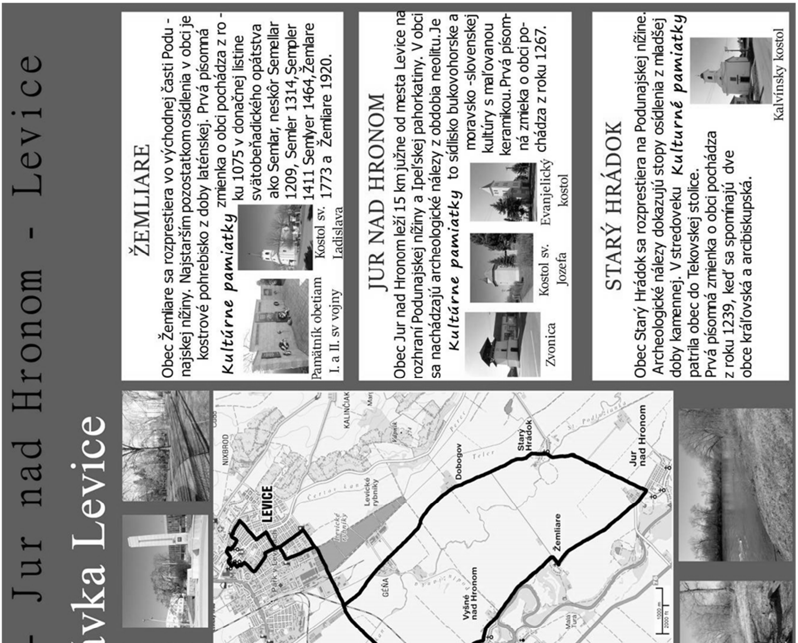


Fig. 5. The final visualization of the proposed information board.

CONCLUSION

Tourism is currently becoming one of the many alternative impulses of economic development in Slovakia. It has its own unique status within individual districts of Slovakia. Each district makes use of the potential of tourism differently. Bicycle touring does not need a large initial investment compared to the rest of the activities. It is based on the existing location and implementation assumptions that exist in each territory. This means that it is best developed where it has created good conditions for natural or cultural-historical assumptions. It often depends on the how local population is developing tourism, therefore its quality and quantity is obviously different in each region.

The territory of the town of Levice and surroundings in which we propose a cycling route, has a large number of natural and cultural-historical monuments, which means it has a great potential for the development of tourism and bicycle touring. The river Hron, which provides the possibility of water sports activities has a great impact on the development of bicycle touring and hiking in the territory. In the northern part of the territory lies the town of Levice, which has the most of historical, cultural and natural monuments from all over the region. Among the most famous monuments in the city includes the Levický hrad castle and its surroundings. Visitors of the region have the opportunity to explore, with the assistance of various events and tours of local customs and traditions, which the inhabitants of the territory has carried out by many centuries.

For the development of this area and the proposed cycling routes we have created promotional materials in the form of information sheets, and have chosen places for their optimal stocking. According to Kramárekovej et al. (2014), Nitra self-governing region (also our researched area) has at its disposal a lot of natural, cultural-historical, and implementing preconditions for the development of cycling tourism whilst containing the smallest amount of built cycling routes. From this point of view, we think that based on the potential of the territory, it is appropriate to build as many cycling routes in a given territory as possible. We believe that thanks to this kind of material we can promote and raise the profile not only of the proposed cycling route, but also the whole region and attract new visitors and cyclists in the area. New cyclists in the region would contribute to the improvement of the financial situation of the region and promote its development. Building cycling routes and their use not only by tourists, but also by the local residents would contribute to the reduction of transport and thus to improvement of the environment and air quality in the Levice district. These presumptions arise with individual preliminary surveys of the institutions operating in the field of tourism and cycling tourism. (Dubcová, A. – Kramáreková, H., 2011, Kramáreková a kol., 2014).

We hope that we can raise the profile of the studied territory submitted to the contribution, and attract cyclists and tourists from destinations. Raise the profile of cycling and its implementation could also help local associations such as the Regional Tourism Organization of Tekov The tourists can also enjoy the cultural and natural attractions offered by this admittedly interesting territory. As a result of the arrival of cyclists and tourists from a wide surrounding area, we improve the living standards of the territory, and we also assume the arrival of new investors which would have an impact on improving infrastructure at the site. In this analysis,we use the results of cycling routes in Mikroregión Radošinka microregion (Dubcová, A. – Kramáreková, H. 2011).

Acknowledgements: The paper was elaborated within the grant project VEGA 1/0934/17 "Land-use changes of Slovak cultural landscape over the past 250 years and prediction of its further development".

BIBLIOGRAPHY

Camp Vodník Jur nad Hronom. Available at: http://www.hron.sk/pages/sk/uvod.php [31. 10. 2017].

Creative Business Studio. *Ručne maľovaná mapa regiónu TEKOV*. Banská Bystrica. CBS spol, s.r.o.. 2012. 65x94. 1. ed.

Creative Business Studio. *Ručne maľovaná mapa Tekov: Pre cyklistov.* Banská Bystrica. CBS spol, s.r.o.. 2014. 60x84. 1. ed.

Cykloregión Nitra. Available at: http://www.nr.cykloportal.sk/ [31. 10. 2017].

Cykloserver. Available at: http://www.nr.cykloportal.sk/ [31. 10. 2017].

Dolná Seč. Available at: http://www.nr.cykloportal.sk/ [31. 10.2017].

Dubcová, A. – Kramáreková, H. red. *Štúdia rozmiestnenia cyklotrás v Nitrianskom samosprávnom kraji :I. Etapa.* 1. ed..Nitra: UKF, Katedra geografie a regionálneho rozvoja. 2011. 168 s.

Eurovelo the European cycle route network. Available at: http://www.eurovelo.com/en [31. 10. 2017].

Frtúsová, Z. *Stratégia rozvoja cestovného ruchu v meste Levice na roky 2009-2015.* Mestský úrad Levice. Available at: https://www.levice.sk/download_file_f.php? id = 78813 [sentiment. 31. 10. 2017].

Hlatký, J. a kol. *Stratégia rozvoja cyklotrás a cyklodopravy v NSK na roky 2016-2020.* Available at: https://www.unsk.sk/zobraz/obsah/8773 [the sentiment. 31. 10. 2017].

Holbová, K. a i.. *Dotyky Tekova a Hontu.* 1.ed. Horná Seč: Združenie vidieckeho turizmu Hron. 2012. 105 s.

Hrnčiarová, T. red. Atlas krajiny Slovenskej republiky. 1. ed. Banská Bystrica: MŽP SR, Slovenská agentúra životného prostredia, 2002. 341 s.

Jur nad Hronom. Available at: http://www.nr.cykloportal.sk/ [31. 10. 2017].

Kramáreková a kol. Cykloturistika v regionálnom rozvoji cestovného ruchu Nitrianskeho samosprávneho kraja. In: Klímová, V., Žítek, V. (eds.) XVII. International Colloquium on Regional Sciences. Conference Proceedings. Brno: Masarykova Univerzita, 2014. Pp. 11-5. ISBN 978-80-210-6840-7.

Lapin, M. a i., 2002. *Klimatické oblasti*. Mierka 1: 1 000 000. In: *Atlas krajiny Slovenskej republiky*. Hrnčiarová, T. red. 1. ed. Bratislava: MŽP SR; Banská Bystrica: Slovenská agentúra životného prostredia, 2002. 95 s. ISBN 80-88833-27-2

Levice oficiálne stránky mesta. Available at: https://www.levice.sk/ [31. 10. 2017].

Ministerstvo dopravy, výstavby a regionálneho rozvoja Slovenskej republiky. *Národná stratégia rozvoja cyklistickej dopravy a cykloturistiky v Slovenskej republike.* Available at: http://www.telecom.gov.sk/index/index.php? = [140565 ids. 31. 10. 2017].

Ministerstvo dopravy, výstavby a regionálneho rozvoja Slovenskej republiky. *Stratégia rozvoja cestovného ruchu do roku 2020*. Available at: http://www.telecom.gov.sk/index/index.php? = [140565 ids. 31. 10. 2017].

Obická, Z. *Stratégia rozvoja cestovného ruchu mesta Levice na roky 2016-2020.* Levice: Mestský úrad Levice. Available at: https://www.levice.sk/strategia-rozvoja-cestovneho-ruchu-.phtml?id3=49057 [the sentiment. 31. 10. 2017].

Oficiálne stránky obce Mýtne Ludany. Available at: http://www.mytneludany.sk/ [31. 10. 2017].

Plesník, P. a kol. *Strategický a marketingový plán rozvoja cestovného ruchu v NSK na roky 2014-2020.* Available at: https://www.unsk.sk/zobraz/obsah/8418 [the sentiment. 31. 10. 2017].

Región Dolné Pohronie a Poiplie. *Maľovaná mapa regiónu Dolné pohronie a Poiplie.* Veľký Krtíš. Cassovia Books. 2004. 95x65.

Regionálne združenie Váh – Dunaj – Ipeľ. *Cyklomapa euroregiónu Váh – Dunaj – Ipeľ.* 1:170 000. Nitra. MAPA Slovakia plus, s.r.o. 2010. 59x83.

Starý Hrádok. Available at: http://www.staryhradok.sk/ [31. 10. 2017].

Úrad geodézie, kartografie a katastra Slovenska. *Mapa okresov Slovenskej republiky okres Levice.* 1: 50 000. Vojenský kartografický ústav, š.p., Harmanec. 1999. 120x112. 7. ed.

Úrad Nitrianskeho samosprávneho kraja, odbor cestovného ruchu. *Nitriansky kraj cyklomapa.* 1: 100 000. Nitra. SHOCart, spol. s.r.o. 2017. 93x85.

Vyšné nad Hronom. Available at: http://vysnenadhronom.webnode.sk/ [31. 10. 2017].

Welcome to Žemliare. Available at: http://www.zemliare.sk/Pages/Info.aspx [31. 10. 2017].

Žiaran, J. a kol. *Územný plán mesta Levice.* Available at: http://www.levice.sk/uzemny-plan-mesta.phtml? = id3 27933 [31. 10. 2017].

TRADE AND ECONOMIC RELATIONS OF AGRICULTURAL COMPANIES IN THE SUBURBAN REGION

Ondřej Krejčí, Antonín Věžník

Department of Geography, Faculty of Science, Masaryk University, Kotlářská 2, 61137 Brno, Czech Republic

o.krejci@mail.muni.cz, veznik@mail.muni.cz

Abstract: Imports of food from abroad, especially quality and degree of self-sufficiency, is one of the crucial topics of the present public discussion. Food production is subsidized to provide affordable food for all residents and prevent any possible problems with food availability. The main objective of the submitted paper is to analyze food production in the suburban region in the agricultural and industrial sectors. For researched region had been chosen Brno-venkov district. In our paper emphasis is put on supply chains of the individual investigated subjects directly in the region and its surroundings. One of the objective is an ascertainment of influences agriculture companies on the region, possibly on its nearest neighbourhood.

Key words: agriculture, supply chains, Brno-venkov, trade relations

INTRODUCTION

Agriculture is one of the basic essential sector in in the Czech Republic. Significant changes have taken place in the past. These changes of ambience make relatively specific farms. Agriculture companies in the last 30 years had to get through series of transformations, most known as collectivisation, transformation and transition to free market principles in the 90th (I. Bičík, V. Jančák, 2005). Some changes were occured at the beginning of the new millennium when Czech Republic entered to the European Union. From this point of view, it´s very important to say that the agricultural companies have undergone these changes to varying degrees. We can find quite a wide range of companies in the Czech Republic that run their own business with very different styles.

Thus farmers have been challenged by increased competition created by the Common Agricultural Policy and the EU Single Market. As part of these changes and adaptations to the free market, there were also changes in the key role of agriculture. The era of productive agriculture, which were aimed primarily at increasing production yields, is suppressed today and replaced by the concept of postproductivist agriculture. This concept understands agriculture as a link between production and nonproduction outputs (Huylenbroeck and Durand, 2003). The whole concept of postproductivist agriculture is also seen as a new rural paradigm consisting of multifunctional agriculture (OECD, 2006), as part of the political outlook.

A major theme of post-productive agriculture in the context of global change is the commodity chain created by the trade relations (Dicken, 2011). Agricultural companies are changing their chains as respond to globalization which includes changes in transport charges and transformation in communication. According to empirical analyzes which were created not only on the territory of the Czech Republic (Cocks, J., Gow, H. R., 2003, Dicken, 2011), there are often extensive distances between producer and processor.

Commodity chains are focused on nonlinear flows of materials, semi-products, services and goods. Typical for these chains is that production is not fix in space and time. Their main principle for this is assumption of different subjects with different interests from different places, whose behaviour can have significant impacts. For example on economic or technological development in the locality in which subject operate. Concept focuses on networks of companies, in particular their impact on global and local organizations, distribution of power through chains of goods, creating added value and their impact on corporate strategies (Henderson et al., 2002).

Engaging of companies in large global food chains for the international market is demanding a great deal of investment and giving tremendous strength to multinational corporations and large retailers. Farms were not always participated in this chain. Participations of farms in these chains provides considerable opportunities for delivering a large amount of products. On the other hand involvement in these chains make considerable problems. Companies which are involved in these chains are often pushed to trade with minimal margins, excessive using of chemical fertilizers, using genetically modified foods and most of all, as a result of large-scale production, there is often a loss of quality of production (Dicken, 2011). This action raises considerable disagreement of end customers and leads to promotion of local food production even at the expense of higher costs (Mardsen et al, 2003).

Supply chains in the agro-food industry are extremely diverse. In grain production, there are simple models based on only a few subjects in the chain. Even so, these relationships are more complex in comparison to the past. For high added value foods, these chains are more complex (typically poultry products). There can be engage more than ten companies. It shows that agro-food industry has many integrated producers (Dicken, 2011).

In connection with growing distances in food production, it is interesting to observe the opposite phenomenon – concentration of production in some sectors. Some sectors of food production are largely concentrated and dominated by only a small number of corporations. For example, two thirds of the world's seed market are driven by the top 10 companies. Ten of the largest pesticide companies manage nearly 90 percent of the world's market of this commodity. And concentration is also in food packaging industry where 26 percent of the world food packaging market is managed by the top 10 companies. This fact confirms the high degree of globalization in these sectors, where there is a significant expansion of production but also the concentration of some parts of the production process.

The interconnection between agricultural and processing sector together with suppliers and purchasers creates complex which is in literature named as agro-business. In the Czechia, was topic of agro-business studied by for example Bečvářová (2005, 2008). In Slovakia, on the example of the Nitra District, by Németh (2009).

When analysing commodity chain, consumption create a very important role. There is a link to retail geography which deals also with consumption. In developed countries, the food consumption situation has changed and people spend only one tenth of their income on food products, compared to a third in 50-60 years ago. On the one hand, producers are striving to get the most customers and the biggest part of market with the best unified product. On the other hand, consumers have diverse requirements which are quite specific in some countries or regions. It means that one product can be successful in one region but same product can be refused by customers in other region. It follows that changing patterns in demand have larger role in production then total consumption (Dicken, 2011).

Within this framework of the multifunctional agriculture concept studied above. In the Czech Republic is also strengthening the processing capacity of agricultural holdings, which are growing year by year (Strategy of the MoA resort with a view to 2030).

Trade relations in agricultural companies, as in Brno-venkov district

Agricultural companies are a significant part of food chain which is dealt with in this paper. As such they have their specific inputs (seeds stock, industrial fertilizers, feed etc.) and specific outputs (commodities) that are resold. This paper above all, analyses selected companies of the inquired area from the point of their linking up into the chain of agricultural firms and tries to identify key suppliers and customers of agricultural raw materials. These business subjects are both directly and indirectly active in participation on overall food production in the studied region. One of the key determinants is the distance between cooperating entities or the form of their cooperation. The distance has increased recently, which resulted mainly in the final price of commodities.

METHODS

The trade relations within 24 agricultural companies have been analysed within the frame of this paper. Agricultural land is not limited by administrative units, therefore, in this paper are also studied agricultural companies which cultivate land in the district, but their headquarters are outside the studied territory. Trade relations were analyzed in 24 companies out of a total of 56 companies which cultivate land in the region Information about cultivated land is available on public Land Parcel Identification System (LPIS). Informations about trade relationship have been obtained mainly from own investigation. The sample was selected by the authors of the work and contains relationships in large and small-sized companies as well. Sample contains also representative companies dealing only with crop and with both types (crop and livestock) of production.

The results of the inquiry can be seen in Table 1 of the annex. Both the biggest producers in the district and small companies of regional significance can be found among the companies. The aim of research was also to cover companies operating in different types of agricultural production.

The range of supplier's activities of agricultural holdings in the Brno-venkov was partly dealt by Britan (2012). From his results it is only apparent that the studied subjects delivered their products mostly within the frame of national market (43% of the products) and 28% within the region Jihomoravský. A little less of total production is delivered abroad (22%) and only 7% of the products are sold within local community where agriculture subject operated.

RESULTS

From the results stated in Tab. 1 it is apparent that supply chain structure of the subjects is strongly influenced by property relations of individual entities. Some companies can specialize in a certain type of product that is sold to their owner. It occurs for example between GenAgro Říčany and ZEVO Střelice. ZEVO besides from their own crop production, aims at growing of feeding commodities for livestock farming in Říčany. This specialization may be advantageous in terms of increasing total revenues or improving customer possibilities. On the other hand, specialization only in a certain type of crop is not correct according to the principles of sustainability. The soil can be demoted by specialized production.

One common owner means in great majority of cases both common supplier and purchaser as well. Companies try to achieve larger volume of raw materials and arrange for better bargaining opportunities with customers. For example, Homolka (1995) considers capital relations between producer and processor positively. The cooperation gives the opportunity to involve agricultural companies into distribution network and leads to relation of corresponding shares on margins. Homolka finds the solution of the situation in the forming of sale cooperatives as another option.

If the company manages independently and have no big owner, it is in most cases closely linked up with the business company, alternatively with other companies. Differences can be seen in the range of used services of those companies. Business companies are the firms that ensure all inputs for their production (seeds, fertilizers, fuels, and possibly agricultural machinery). On the other side they ensure purchasing of commodities and their subsequent sale. Then after harvest, these subjects buy commodities from company and trade with this as intermediary between producer and processor. Differences can be seen in the extent to which these services are used.

Ensuring of the entire services can be seen as a positive part of this cooperation. Agricultural subjects can only concentrate on production to ensure a higher quality of their products. The cooperation can also bring a lower price of some inputs. Business companies tend to have contracted prices, that can be lower as result of the quantity of items. Marketing companies can have better overview about new technology or most preferable seeds. The lower purchase price of commodities counts among drawbacks of the cooperations. Businesses require certain provisions thanks to which farmers can sell some commodities at a lower price than it would be if the direct sales to processor was in question. These relationships create certain degree of dependence. And if business company failures it may lead to a distortion of sales and thus a disruption to the economic situation of agriculture companies.

Agriculture business companies

Among the main business companies operating in the Brno-venkov district ranks:

ELITA semenářská - The company is based in Brno Řečkovice and besides seeds it also provides pesticides and fertilizers.

OSEVA, AGRO Brno - The company came into being by privatization of the state owned company Oseva. Its specializes is selling seed stock, but it partly purchases and trade with agriculture commodities too.

NAVOS - An enterprise belonging to the Agrofert Group is based in Kroměříž. It aims more on commodity market than the previous ones. It offers also services, including seeds and fuel sale. Navos owns 18 farms in Czech Republic out of which ZEMOS operates in the Brno-venkov. In high-capacity silos it stores goods for the State Agricultural Intervention Fund and the State Material Reserves Administration.

Agroservis trading - It owns eight agricultural companies, four of which operate within the district area. It specializes in purchasing of wheat, barley, pea, rye, maize and soya. It offers drying and storing of agricultural commodities. It also ensures service of agricultural machinery.

Soufflet Agro - A company situated in Prostějov is a subsidiary of a French Groupe Soufflet. Specializes in purchase of barley for malting purposes.

ADW - It is based in Krahulov. It is a purely Czech subject. It operates above all in Třebíč district. In area of business activities, it operates in markets throughout Europe. In region it owns Klas Neslovice and out of region six other companies.

AGRO 2000 - The company from Třebíč provides facilities mainly for companies of Vysočina region. In studied region it is cooperating only Agromonet Moutnice.

The fact that crop production is traded exclusively by these organizations has, among others, the reason purely practical. Majority of the crop products must be cleaned and dried before processing. Most of agricultural companies do not have at their disposal such technologies to prepare commodities in the required quality. The business companies therefore aim at this part of processing. The direct sale of cereals to the mill is provided only by the biggest company Bonagro Blažovice

Due to the relatively wide range of commodities and their different processing the business companies specialize in purchasing of some commodities only. Each of the above stated companies trade with basic types of cereals or oilseeds. Soufflet Agro dominates in trade with barley. The similar situation is with poppy seeds dominated by ADW.

Sales cooperatives

The sale of agricultural companies was ensured through their cooperatives in the past. Those cooperatives connected individual subjects on local level and ensured a certain cooperations of farmers. Above all the biggest agricultural companies ran functioning of sales cooperatives. The trade of their own had for example Bonagro (sales cooperatives BONAMEAT), GenAgro Říčany (GenAgro - animal production GenAgro - sales), AGRO Ořechov, Agrodružstvo Brťov-Lipůvka (AGD Jatol, AGD Klas). Nowadays the sales cooperatives failed or are in liquidation. Throughout the Czech Republic there are only a few tens of sales cooperatives, mainly in sales of milk and livestock. A cooperative CZ -FRUIT has got the most members of the companies working in the studied district. It focuses mainly on fruits sales. It currently has 34 members. There are trade chains, wholesalers and fruit processors among the consumers. Agrodružstvo Brťov-Lipůvka and Zeas Lysice supply CZ FRUIT within the studied district.

Sales cooperatives mostly operate on national level. There is Agropork as the one of them. It is the biggest cooperative dealing with purchase of pork. It´s members are for example Agroservis Višňové and Bonagro in the past, that however finished pork production. The commodity of milk has its marketing cooperatives too. Typical example is Moravia where Zeas Lysice is a member. According to farmers themselves, the strong sales cooperatives operating with cereals and oil plants completely disappeared.

Direct sale

There are crop or livestock production that farmers sell directly to a consumer as a fruits and vegetables alternatively sugar beet. The difference in comparison with cereals is given thanks to easier processing of raw materials. While most of plant production is needed to be prepared before processing by means of drying or cleaning the preparation of sugar beet for processing is so specific that it is carried out directly in the sugar refinery.

The direct sale to processing is taking place in livestock too. None of the inquired companies sold the products of livestock to middleman trade company. This form of taking in is given above all physical qualities of the product. Cattle are necessary to be delivered to the slaughterhouse and best in the shortest time. As a sufficient processing capacity can be found in the district, the processing itself is carried out within the studied district. Only Agromonet Moutnice has its own facilities where the meat is divided into parts and consequently sold for other processing.

During the harvest producers of fruits and vegetables often choose an option so called “sale from the yard”. It means the sale of small amount of their own product form primary production directly to a consumer for consumption in their household. The advantage of this option is essentially minimalized expenses and a certain flexibility of a selling place. Relatively strict legislative measures and small economic efficiency are the disadvantages of the method. This situation was reported by all producers of fruits and vegetables.

Company stores

Company stores could be an independent chapter. This agriculture stores are run by agriculture companies themselves. They will be dealt shortly because it is rather treated as a rarity in agricultural companies. A shop of their own can be an interesting concept for farmers which can be with increasing popularity of regional food financially interesting. Four of the studied subjects run their own shop. They are Agromonet Moutnice, Agrodružstvo Brťov-Lipůvka, Agra Horní Dunajovice and Agro Měřín. The shop in Moutnice specializes in the sale of livestock production (milk, meat), the shop in Lipůvka offers mostly fruits grown in local orchards, alternatively fodder mixtures. Apples are sold in the biggest quantity. The sales are round 100 tonnes a year. A further advantage of the shop in Lipůvka is the cooperation with local small-scale producers who supply the shop with vegetables and must. The shop of Agra Horní Dunajovice is mainly grocery store of mixed goods, not a shop of the company's products. Agro Měřín has got the largest network of shops. The company operates totally twelve stores named Rynek located mostly in the Vysočina Region. They sell exclusively domestic food.

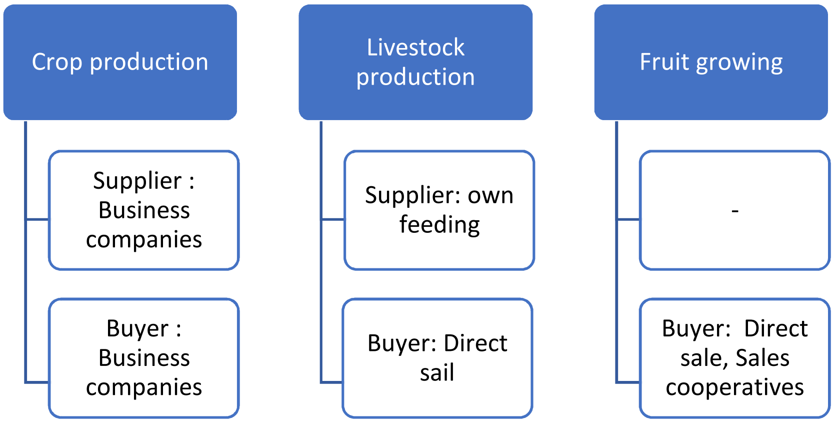


Fig. 1. Typical supplier-customer pattern at most frequent commodities.
Source: Own inquiry

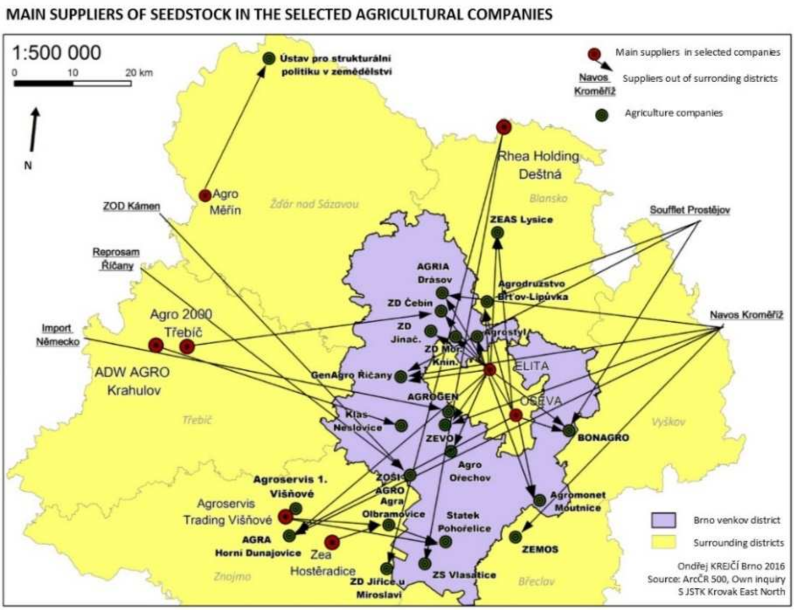


Fig. 2. Main suppliers of seed stock in the selected agricultural companies in 2015.
Source: Own inquiry

While comparing main map outputs showing supply chain relationships, it is apparent that there is much less competitive environment in case of suppliers. None of the seed suppliers located in the studied district and at the same time the suppliers are based in surrounding area and form a relatively closed region. Oseva and Elita are the biggest suppliers. Other agricultural companies withdraw for seed from their owner. Companies produce feed for livestock in greater part self-sufficiency. Nowadays the fact that feed does not play a great role in overall costs of a company confirms also the paper Měřínská (2013). In which the author sets out that expenses on feed has fallen sharply after 2007, when world markets reported increase in prices especially for wheat. Even since farms have aimed at their production of feed in greater amount.

The purchaser´s structures are already much more dispersed and create much wider region with farther interregional links originates. Under the given situation there are not sufficient processing capacities which would be able to process such a large amount of crop production.

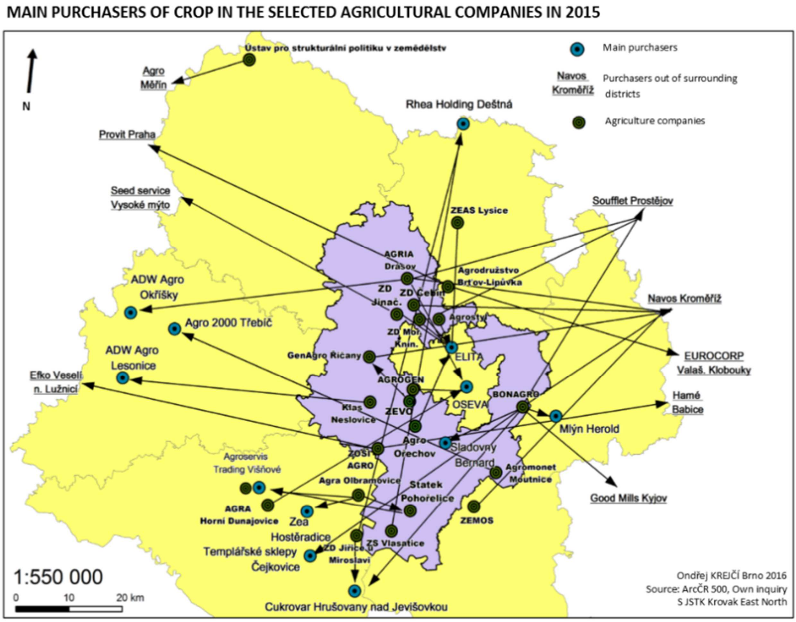


Fig. 3. Main purchasers of crop commodities in the selected agricultural companies in 2015.
Source: Own inquiry

Purchasers in livestock create narrower area then purchases in crop production. Livestock production is processed in small distance from point of produce. In figure 3 can be reported some regions where the processor withdraws the cattle. A processor Steinhauser Tišnov is dominantly in the northern part of the district. And the southern part of the district is controlled by slaughterhouses in Ivančice and Pohořelice. Milk is withdrawn by big dairies in surrounding districts incidentally regions.

MAIN PURCHASERS IN LIVESTOCK IN THE SELECTED AGRICULTURAL COMPANIES IN 2015

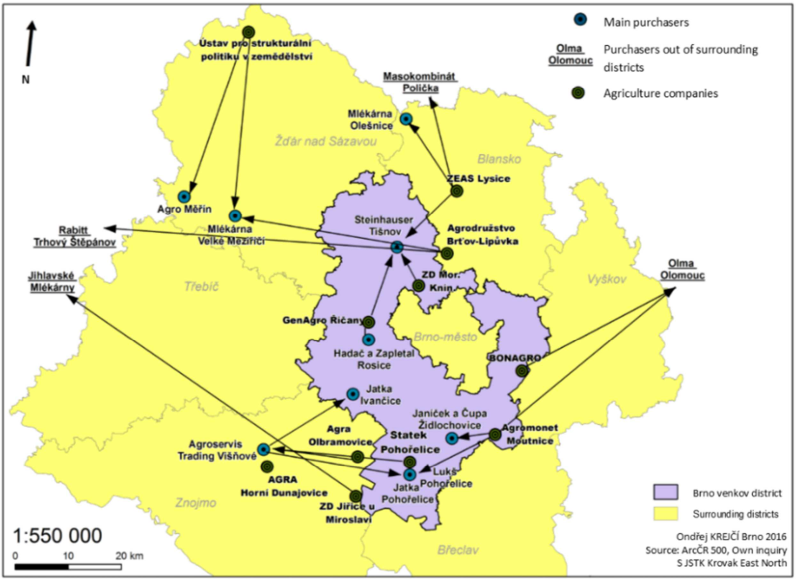


Fig. 4. Main purchasers of livestock production in the selected agricultural companies in 2015.
Source: Own inquiry

CONCLUSION

Agricultural companies in the region follow the agricultural production of the pre-transformation period. Most of the companies came into existance by the transformation of the agricultural cooperative or the privatization of the state companies in the 90th. The companies operating in Brno-venkov are in possession of executively domestic capital. The only exception is Granero Vlasatice, that is owned by Danish company Tjekkiet Invest.

Crop production namely wheat and malt barley are the main commodities. Cattle, pigs and poultry are main bred in livestock production. Breeding of poultry farming is so specific that it is carried out as dominant one, out of classical agricultural companies. The total crop and livestock production is adjusted to the market. There is apparent decline of sugar beet, fodder stock and vegetables. Decrease in production of sugar beet was a result of limitation on customer possibilities of sugar refineries, thanks to their complicated transformation and unfavourable price development in the market. The fodder recorded a decline above all due to the decline in livestock production throughout the Czech Republic. At the same time fodder crops play a very important part as a pre-product and it is proven that it helps increase the proportion of humus in the soil and thereby increase yields. Decrease of vegetables is connection with the increasing of the import of this commodity into the Czech Republic and increasing non-profitability of production, especially after our accession to the EU.

The natural conditions show less and less impact on overall composition of sowing. That fact we noticed for example in not completely corresponding agricultural production areas. Even in maize production area prevails cereal cultivation. All the same the natural conditions cannot be omitted as one of the main factors of agricultural production. The impact on diversification of production are also reflected in reforms of the EU Common Agricultural Policy where agricultural subsidies are not bound on production but on cultivated land. A greater emphasis is put on the sustainability of the landscape than on production itself.

From the point of view of supply chain pattern regarding crop production are the strongest ties with the business companies that help with post-harvest processing in crop production. On the opposite in livestock production, direct sale to slaughterhouses or dairy prevails. The main purchasers are derived according to the owner of the agricultural company and selling commodity.

The economic situation is changeable. Subsidies and greater focus on crop production helped companies to reach greater economic stability. Further possible improvement of the situation can occur with building of biogas powerplants. Farmers will receive financial means for their disposing of bio-waste and can draw means for this disposal. There is certainly a question whether a greater aiming at energetical lucrative crops is not only wasting of the soil fecundity which could be used for food utilizable commodities.

REFERENCES

BIČÍK, I. *Transformační procesy v českém zemědělství po roce 1990*. JANČÁK, V. Praha: Katedra sociální geografie a regionálního rozvoje Přírodovědecké fakulty Univerzity Karlovy, 2005, 103 s. ISBN 80-865-6119-4.

BRITAN, M. *Regionálně geografická analýza zemědělství v zázemí města Brna*. Masaryk university Brno, Department of geography. Diploma thesis, 2012. Supervisor doc. RNDr. Antonín Věžník CSc.

COCKS, J. *Supplier Relationship Development in the Food Industry of Transition Economies: The Case of Interbrew*. GOW H.R. Journal of Food Distribution Research, 2003. 34, č. 1, s. 63-68.

DICKEN, P. *Global shift: mapping the changing contours of the world economy*. New York: Guilford Press, 2011. 6th ed. ISBN 16-091-8006-2.

HENDERSON, J. *Global production networks and the analysis of economic development.* Review of International Political Economy, 2002. 9, č. 3, s. 436–464. https://doi.org/10.1080/09692290210150842

HOMOLKA, J. *Problematika potravinářského průmyslu a jeho vztah k zemědělské výrobě*. Praha: 1995. ČZU Praha.

MARSDEN. T. K. *Understanding alternative food networks: exploring the role of short food supply chains in rural development*. BANKS J. RENTING H. Environment and Planning, 2003. s. 393-411.

MARSDEN, T. K. *Food supply chain approaches: exploring their role in rural development* BANKSJ. BRISTOW G. Sociologia Ruralis, 2000. č. 40 s. 424-438.

MĚŘÍNSKÁ, P. Obchodní vztahy jako součást podnikatelského prostředí zemědělského podniku. Mendel university Brno. Diploma thesis, 2013. Supervisor prof. Ing. Věra Bečvářová, CSc.

NÉMETHOVÁ, J. *Agropotravinárské štruktury okresu Nitra*. Faculty of Natural Sciences Constantine the Philosopher University in Nitra: Nitra, 2009. 192 s., ISBN 978-80-8094-533-6.

Ministry of Agriculture*. Strategie resortu MZe s výhledem do roku 2030*. Praha: Ministry of Agriculture, 2016

Organisaton for economic co-operation and development. *OECD rural policy reviews*. Paris: OECD, 2006. ISBN 92-640-2391-7.

VAN HUYLENBROECK, G. *Multifunctional Agriculture: A New Paradigm for European Agriculture and Rural Development*, DURAND G. Aldershot; Burlington, 2003.

Annex

Tab. 1: Selected agricultural companies and their supplier-customer relations in 2015

	Company	Supplier	Purchaser
1	BONAGRO, a.s.	**Seed stock**: Elita Brno, Oseva Brno, Soufflet Prostějov Hnojiva: ACHP Slavkov **Feed:** Mikrop Čebín	**Crops:** Cereals: Mlýn Herold Slavkov u Brna, Mlýn Delta Kyjov, Barley: Soufflet Prostějov, Pivovar Bernard Sugar beet: Cukrovar Hruš. n. Jevišovkou, Grapes: Templářské sklepy Čejkovice, **Livestock:** Milk: Olma Olomouc
2	Statek Pohořelice ***Owner:*** *Agroservis Trading a.s. Višňové*	Agroservis Trading Višňové, Agra Olbramovice	**Crops:** Agroservis Trading Višňové
3	AGRO Ořechov, a.s. *Vlastník Elita Brno*	Elita Brno	**Crops:** Elita Brno
4	Agromonet Moutnice	**Seed stock**: Elita Brno, Oseva Brno **Feed**: Sano Domažlice	**Crops:** Agro 2000 Třebíč **Livestock**: Own slaughterhouse, direct sale to retail shops - Řeznictví Lukš Pohořelice, sale from the yard Milk: Olma Olomouc, sale from the yard

5	GenAgro Říčany, a.s.	**Seed stock**: Elita Brno, Navos, Soufflet **Feed:** Zevo Střelice, ZD Čebín, Mikrop Čebín	**Crops:** Navos Kroměříž, **Livestock:** Steinhauser Tišnov
6	AGRIA Drásov, spol. s r.o.	**Seed stock**: Oseva Brno, Elita Brno, Navos Kroměříž	**Crops:** Navos Kroměříž, Oseva Brno Sugar beet: Cukrovar Hruš. n. Jevišovkou Barley: Soufflet agro Maize: ZZN ve Svitavách Poppy: ADW Agro
7	AGROSERVIS 1. zemědělská a.s. Višňové ***Owner:*** *Agroservis trading a.s. Višňové*	**Seed stock**: Agroservis trading Višňové **Import of seed stock**: Germany, Austria, Netherlands	**Crops:** Agroservis trading Višňové Export: Germany Netherlands, Slovakia, Poland **Livestock:** Agroservis trading (Agropork)
8	ZEVO Střelice, a.s. ***Owner:*** *GenAgro Říčany, a.s.*	**Seed stock**: Elita Brno, Navos Kroměříž, Soufflet Prostějov	**Crops:** Genagro Říčany - sold through their structures
9	AGRODRUŽSTVO Brťov-Lipůvka	**Seed stock**: Soufflet Prostějov, Oseva Brno, Elita Brno, Agrokop Třebíč Fertilizers: Bor Choceň, Hokr Pardubice **Mineral Feed:** Mikrop Čebín	**Crops:** Eurocorp Valašské Klobouky, Provit Praha **Livestock:** Mléko-Mlékárna Velké Meziříčí Poultry: Rabitt Trhový Štěpánov **Fruits:** Sales Cooperative CZ-Fruit, Own shop
10	Zemědělské družstvo Jiřice u Miroslavi	Rhea Holding Dešná	**Crops:** Rhea holding Dešná Sugar beet: Cukrovar Hruš. n. Jevišovkou **Livestock:** Mléko-Jihlavské mlékárny Jihlava
11	ZD Čebín, družstvo	**Seed stock**: Elita Brno, Agrokop Třebíč, KWS V. Meziříčí **Fertilizers:** Elita Brno, Navos Kroměříž,	**Crops:** Navos Kroměříž, Elita Brno Agrokop Třebíč
12	Klas Neslovice, a.s. ***Owner:*** *ADW a.s.*	ADW AGRO Krahulov	**Crops:** ADW AGRO - Rolnická společnost Lesonice a.s.
13	AGRA Olbramovice, ***Owner:*** *Agroservis Trading a.s.*	Zea Hostěradice, Agroservis Trading Višňové	**Crops:** Statek Pohořelice, Zea Hostěradice Agroservis Trading Višňové **Livestock:** Agroservis Trading Višňové
15	AGRA Horní Dunajovice a.s.	Elita Brno, Oseva Brno, Navos Kroměříž	**Crops:** Elita Brno, Oseva Brno Export: Slovakia, Austria **Livestock:** Sale cooperatives animal cooperative
16	ZEMOS a.s. ***Owner:*** *Navos Kroměříž*	Navos Kroměříž	**Crops:** Navos Kroměříž **Livestock:** Olma Olomouc
17	AGROSTYL, spol. s.r.o.	Elita Brno	**Crops:** Elita Brno, Soufflet Prostějov

18	ZS Vlasatice s.r.o. ***Owner:** Rhea Holding*	Rhea Holding Dešná	**Crops:** Rhea Holding Dešná
19	ZOŠI AGRO, s.r.o.	**Seedling:** Reprosam Říčany ZOD Kámen **Fertilizers:** Pronachem Jiříkovice	**Vegetables:** Efko CZ Veselí nad Lužnicí, Kaufland, Hamé Babice Rapa Bzenec
20	Zemědělské družstvo Moravské Knínice	**Seed stock**: Elita Brno Hnojiva: Elita Brno **Mineral Feed:** Mikrop Čebín	**Crops:** Elita Brno **Livestock:** Steinhauser Tišnov
21	ZEAS Lysice, a.s.	**Seed stock**: Elita Brno, Oseva Brno, část vlastní produkce osiv **Fertilizers:** Lukrom Zlín, vlastní míchání krmiv	**Crops:** Elita Brno, Sugar beet: Cukrovar Hruš. n. Jevišovkou **Livestock:** Steinhauser Tišnov, Masokombinát Polička Milk: Mlékárna Olešnice, **Fruits:** CZ Fruit, own sale
22	AGROGEN s r.o.	**Import of seed stock:** Germany	**Crops:** Oseva Brno Export: Germany, Switzerland, Austria and Slovakia
23	ZD Jinačovice	**Seed stock**: Elita Brno hnojiva: Agrokop Třebíč, Czekopol Letovice	**Crops:** Elita Brno, Seed Service Vysoké Mýto
24	Ústav pro strukturální politiku v zemědělství a.s.	**Seed stock**: Agro Měřín	**Crops:** Agro Měřín **Livestock:** Polabské mlékárny, LACRUM Velké Meziříčí- Agro Měřín

Source: Own Inquiry

Shrnutí

Článek se týká výzkumu zemědělských společností se zaměřením na jejich obchodní vztahy. V okrese Brno venkov byly analyzovány dodavatelsko-odběratelské vztahy na příkladu 24 zemědělských společností. Zemědělské společnosti v okrese navazují na zemědělskou výrobu předtransformačního období. Většina společností v okrese vznikla transformací zemědělského družstva či privatizací státního podniku v 90. letech. Společnosti hospodařící v okrese Brno-venkov jsou vlastněny výhradně tuzemským kapitálem. Jedinou výjimku tvoří společnost Granero Vlasatice, která je vlastněna dánskou společností Tjekkiet Invest a.s. Ekonomická situace zemědělců je proměnlivá. Dotace a větší zaměření na rostlinnou výrobu pomohly společnostem k zisku větší ekonomické stability.

Mezi hlavní plodiny rostlinné výroby patří především obilniny, a to potravinářská pšenice a sladovnický ječmen. Z živočišné výroby je nejvíce chován skot, prasata a drůbež. Celková produkce rostlinné i živočišné výroby je více přizpůsobena trhu. U rostlinné výroby je v okrese patrný pokles produkce cukrovky, pícnin a zeleniny. Snížení stavů cukrovky došlo v důsledku omezení odběratelských možností cukrovarů, díky jejich komplikované transformaci a nepříznivým vývojem ceny cukru na trhu. Pícniny zaznamenaly pokles především z důvodu poklesu živočišné výroby v celé ČR. Přitom pícniny hrají velmi důležitou roli i jako předplodina a je prokázáno, že pomáhá k navyšování podílu humusu v půdě a tím i zvýšení výnosů. Vývoj pěstování zeleniny je spojen se zvyšujícím se dovozem této komodity do ČR a vzrůstající nerentabilitou pěstování, zejména po našem vstupu do EU.

Čím dál méně se v celkové skladbě osevu projevují přírodní podmínky. Což souvisí s větší mechanizací zemědělství a zapojením moderních technologií, které umožňují pěstování plodin i v méně příznivých podmínkách. Tento fakt můžeme pozorovat například na ne zcela odpovídajících zemědělských výrobních oblastech, kdy i v podnicích umístěných v kukuřičné výrobní oblasti převládá pěstování obilnin. Stále však přírodní podmínky nelze opominout jako jeden z hlavních faktorů zemědělské výroby. Vliv na diverzifikaci produkce mají také reformy Společné zemědělské politiky EU, kdy zemědělské dotace nejsou vázány na produkci, ale na obhospodařovanou půdu. Vyšší důraz je kladen stále více na trvalou udržitelnost krajiny.

Z hlediska dodavatelsko-odběratelské struktury rostlinné výroby jsou nejsilnější vazby s obchodními společnostmi, které pomáhají s posklizňovým zpracováním rostlinné výroby. Tento typ kooperac je pro velký počet zemědělských společností ekonomicky výhodný. Společnosti se mohou soustředit ouze na pěstování komodit a odpadají jim starosti s dodávkou surovin pro výrobu i starosti snásledným odkupem. Tento vzdah ale přináší určité stupně závislosti. V konečné fázi také přispívá k produkci převážně konomicky rentabilních plodin, což vede k monokulturalizaci. V živočišné výrobě na druhé straně převažuje přímý prodej na jatka či do mlékárny. Zpracování produktů živočišné výroby nadále zůstává zachyceno v regionu. Více se zde projevují silnější regionální vazby mezi producenty a zpracovateli. Hlavní odběratelé zemědělských společností především v rostlinné výrobě se odvíjí podle vlastníka zemědělské společnosti a podle prodávané komodity.

GEOTOURISM WITHIN URBAN AREAS: NEW WAYS OF PROMOTION OF NATURAL AND CULTURAL HERITAGE (CASE STUDY FROM BRNO CITY)

Lucie Kubalíková[1, 2], Aleš Bajer[1]

[1]Department of geology and pedology, Mendel University in Brno, Zemědělská 3, 613 00 Brno, Czech Republic

kubalikova@geonika.cz

[2] Institute of geonics, Czech Academy of Sciences, Drobného 28, 602 00 Brno, Czech Republic

bajer@mendelu.cz

Abstract: Geotourism is based especially on geodiversity, but it also uses the cultural-historical aspects of an area, it is linked to the education and counts with active engagement of local people. Currently, geotourism is developed mainly within rural areas, but there are activities that point on the geodiversity and its importance within urban areas.

Rational and sustainable use of geodiversity within urban areas can represent an alternative to the traditional tourist destinations and contributes to the understanding of the importance and necessity of protection of geodiversity itself. Geodiversity, respectively geoheritage within urban areas does not include only issues of primary (natural) geodiversity (substrate, landforms, soils), but also anthropogenic landforms and processes (secondary geodiversity), hydrological features (wells, millraces) and geodiversity ex-situ (museum collections, building material). The paper presents this new form of tourism and gives examples of selected geodiversity/geoheritage features within the Brno city.

Key words: geodiversity, geoheritage, urban geotourism, Brno

1 INTRODUCTION

Geotourism is defined as a form of nature tourism that focuses on landscape and geology, but also on the biotic and cultural features that are linked to the abiotic nature (Dowling 2013). Generally, geotourism should fulfill these criteria: it should be geologically based, environmentally educative, sustainable and locally beneficial and it should ensure tourist satisfaction (Dowling, Newsome eds., 2010). In the last few years, geotourism has shown a considerable growth all over the world and it is appreciated and accepted as a useful tool for promoting natural and cultural heritage and for fostering local and regional economic development especially within rural areas, however, Dowling (2011) says that geotourism may occur also in urban areas and gives the example of the Hong Kong Global Geopark. The role of urban geology was discussed even before (Hawley 1996, Hose 1996) and later for example by De Wever et al. (2016) especially in connection to the educational potential and tourism development.

Later, a new form of geotourism appeared, so called urban geotourism. Numerous case studies were introduced, e.g. Rodrigues et al. (2011), Reynard et al. (2015), Palacio Prieto (2015), Del Lama et al. (2015), Pica et al. (2016), Erikstad et al. (2017). An international workshop and conference on urban geotourism was held in Rome in October 2016, where another case studies from various towns and cities of Europe were presented (Kubalíková et al. 2017, Tičar et al. 2017, Zwoliński et al. 2017) and some methodological aspects were discussed (Reynard et al. 2017, Pica et al. 2017). Actually, urban geotourism is already accepted as one of the ways how to promote geoheritage within urban areas and how to use its educational and touristic potential.

As well as traditional geotourism, urban geotourism uses similar tools to promote geoheritage, e.g. geo-walks and geo-trails, however, the geotourist activities should not be done like isolated projects; if geotourism is considered to be environmentally educative, sustainable and locally beneficial and to cover tourist needs (according to the definition above), it should be framed by a conception, strategy or action plan how to treat geodiversity and geoheritage within urban areas in general. The role and importance of geodiversity action plans is presented and discussed for example in the Geodiversity charter for England (Natural England 2014), by Burek and Potter (2006) or Prosser et al. (2006).

Generally, the local and regional Geodiversity Action Plans fill these functions: they describe geodiversity and geoheritage of an area, they analyse their function and potential, they include particular activities that enhance the role of geodiversity and geoheritage and they also deal with local/regional/state policies and landscape planning. These Geodiversity Action Plans are generally made for larger areas, but also for towns and cities. Recently, London Geodiversity Action Plan for 2014 – 2018 was approved (London Geodiversity Partnership 2014) and it covers the above mentioned facts (it stresses the importance of geodiversity and geoheritage within the city, analyses its potential and functions and proposes particular activities to conserve the geoheritage and to promote it). It has to be said that in the UK, geoconservation has a long tradition and already in the 1980s there were activities to promote geoheritage in urban areas via geo-trails and geo-walks (Robinson 1982, 1984, 1985). Similar activities were later presented in other cities, e.g. in France – Balladés géologiques (Geologic walks, e.g. Baudin 2015, Billet et al. 2008) or in the Czech Republic (Chlupáč 1999, Bajer 2012).

The paper deals especially with the concept and general questions of the urban geodiversity and geotourism and it presents the guidelines and methods for identifying and assessment of the particular features of urban geodiversity with specific examples from Brno city.

2 WHY TO DEVELOP URBAN GEOTOURISM? AND WHAT SHOULD BE INCLUDED?

Gray (2013), London Geodiversity Partnership (2014), Reynard et al. (2017) and Pica et al. (2017) give reasons why the geodiversity in urban areas is so important, why the geoheritage should be promoted and why the urban geotourism should be developed. The main reasons are:

- provision of invaluable natural resources (materials) and contribution to the industry, mining, agricultural and other activities,
- basic role of landforms for the situation of the towns and cities themselves, for the localisation of main buildings and main communications,
- urban sprawl often interacts (and it is also limited) with geological and geomorphological features and processes (e.g. landslides),
- geological and geomorphological context of cities often represents their own image (landforms often represent urban landscape dominants, geodiversity contributes to the natural heritage of cities and it influences art, architecture or traditional building stone),
- potential for recreation, tourism, education (urban geotourism as an alternative to the “traditional” tourism or destinations: castles, sacral objects, important buildings; promoting geodiversity features can enrich the information about tourist objects, e.g. use of traditional dimension stone as an example of local building material),
- influence on biodiversity and localisation of parks and greenery, ecosystem functions,
- understanding the geodiversity and geoheritage can help the acceptation of its conservation and rational use,
- availability and accessibility to a large number of people.

It is obvious that geodiversity and geoheritage within urban areas have an important role. London Geodiversity Partnership (2014) and Reynard et al. (2017) present the main activities that should be developed to manage the geodiversity and geoheritage rationally and sustainably:

1) Understanding the geodiversity and geoheritage (analysis of existing sources – maps, monographies; mapping, identifying the objects geoheritage, comparison with archaeological or historical sources, review of historical iconography and consultation of historical press, photographs and landscape paintings, news about releases of major urban works)

2) Identify the geodiversity resources for specific activities (assessment of the geoheritage sites, analysis of their potential for geotourism, recreation and geoeducation)

3) Conserve and manage individual sites and wider places (proposals of management measures, particular activities for particular geoheritage features, include the promotion of geoheritage into the current tourist offer, other activities to support the geodiversity within urban areas and to support the conservation and rational use of the geoheritage sites)

4) Promotion of geodiversity and geoheritage – to support the wider involvement of people in geodiversity through accessible life-long learning, geotourism and conservation activities – it can help the better acceptation and better understanding of the need of geoconservation activities

5) Networking (cooperation between scientists, tourist offices, municipality and other stakeholders) and influencing regional planning, policy development and practice.

3 METHODS

The first step how to develop the geotourism and geoeducation activities within urban areas is to analyse historical and actual maps, literature and other sources about an area. These activities help to further identifying and inventorying the geoheritage features (not only sites, but also viewpoints or other geoheritage issues as dimension stone). Following list gives the guidelines what should be taken into account when identifying the geoheritage features of an urban area:

- geology (rocks) – description of lithological diversity, tectonic situation, geological evolution, palaeontology of specific rocks etc.
- landforms – natural and anthropogenic, processes, genesis of the relief, landforms as a factor for localisation of important buildings, communications and so on, geomorphological risks, how the landforms influenced the urban spreading, how the urban space and urban needs influence geomorphological features and geologic/soil features too,
- soils and how they influenced the urban spreading,
- hydrogeology (underground/hidden water resource – to stress an importance of water as an invaluable resource) and hydrologic features (rivers, streams, wells, mileraces…),
- geoheritage features in relation to architecture (building material, dimension stone, material used for monuments, statues, pavement, walls, ramparts…),
- museum collections (mineralogical, palaeontological, petrographical…),
- viewpoints (where a visitor can have an overview about large portion of urban landscape),
- geological gardens (open air) and other geoscience educational facilities (e.g. profiles or rock outcrops with an information panel about it) available to the wide public,
- geoheritage features in relation to the town/city appearance – the dominant hill, valley, typical building stone or other material (bricks, tiles),
- geoheritage features in relation to the toponyms (names of the streets, local names),

– geoheritage features in relation to other cultural/social/economic aspects (archaeology, geomythology), geoheritage features with geohistorical significance, geodiversity/geoheritage features reflected in the arts or in the design, local products related to or inspired by geodiversity, links between geodiversity and cultural/social events.

After identifying the above mentioned, a potential for the geotourism and geoeducation purposes can be specified. Assessment methodologies for geo(morpho)sites were already developed and used by various authors in various countries for various purposes (e. g. Panizza 2001; Coratza and Giusti 2005; Pralong 2005; Reynard et al. 2007; Reynard 2009; Pereira and Pereira 2010; Kubalíková 2013; Kubalíková and Kirchner 2016). For the assessment of geotourist potential of the sites within urban areas, Pica et al. (2014, 2017) propose these criteria: 1) representativeness (geoscientific, landscape evolution, city image), 2) visibility, 3) geohistorical reconstruction significance, 4) aesthetic peculiarity of the urbanized context, 5) touristic attractiveness. Total score (so called Value of a site for Geotourism (VSG index)) is represented by the sum of the above mentioned.

Another method for assessing the geotourist and geoeducation potential was presented by Pralong (2005) who takes into account following criteria: 1) scenic values (e.g. number of viewpoints, colour contrasts), 2) scientific values (e.g. representativeness, rarity, palaeogeographical importance), 3) cultural values (e.g. iconographic presentations, historical and religious relevance, cultural events), 4) economic values (e.g. accessibility, natural risks)

Kubalíková (2013), Bajer et al. (2015) and Kubalíková, Kirchner (2016) propose similar criteria: 1) scientific and intrinsic values (Earth-science importance, scientific knowledge, diversity of a site), 2) educational values (exemplarity and representativeness, presence of education facilities), 3) economical values (tourist services, accessibility, current tourist use of the site), 4) conservation values (legal protection, risks and threats, current status of the site), 5) added values (cultural, ecological and aesthetic value).

These methods can serve as a starting point to develop the assessment methodology suitable for evaluation of the geotourism and geoeducational potential of the particular geoheritage features within urban areas.

4 EXAMPLES OF URBAN GEOHERITAGE WITHIN BRNO CITY (PRELIMINAR RESULTS)

The Brno city is the second largest city in the Czech Republic (population approximately 380 000) and it is situated in the region of the South Moravia (south-eastern part of the Czech Rep.). It lies on the contact of the Bohemian Massif and Carpathian Foredeep, so the geology and geomorphology arrangement of the area is quite complicated and varied (Novák et al. 1991, Müller, Novák 2000, Demek, Mackovčin eds. 2014).

Currently, the analysis of the maps, literature and other sources is being processed. Geology and hydrogeological features are consulted in on-line maps (Czech Geological Survey – 1:25 000 and 1:50 000). Some geological features can be observed on numerous outcrops both in the city centre and city districts (e.g. Petrov – small outcrops of metabasalts), other sites where the typical lithological, tectonic or palaeontological features can be explored, are former quarries or pits (e.g. Černovice sand pit, Hády, Červený kopec). These objects of secondary geodiversity (Fig. 1) also have a considerable potential for tourism and education (Kubalíková et al. 2016, Kubalíková et al. 2017).

Fig. 1. The example of secondary geodiversity feature: Hády quarry.
A – Růženin lom with the tectonic thrust of the older rocks of Brno Massif on the younger Upper-Devonian and Lower-Carbon limestones of the Líšeň formation. The bottom is flooded with the lake which is important from the ecological point of view (occurrence of halophyts). B – Viewpoint: a large portion of urban landscape can be observed from the top of the bench. C – Upper bench of Hády quarry: the transgression of the Jura limestones on the folded Devonian limestones is well visible here.

Generally, the geomorphological features are analysed by using the maps and especially field work. Also, the database of the geolocalities (Czech Geologic Survey) represents an important source of information. Currently, some objects of secondary geodiversity, respectively anthropogenic landforms are mapped (Kubalíková et al. 2017) and some natural landforms are described within the terrain works and using the sources Bajer 2012, Vávra and Štelcl 2006, Database of geolocalities of Czech Geologic Survey.

Concerning hydrological features, the main source are the maps (both actual and historical), literature and old photographies. The most important part of the hydrological heritage of the city is represented by rivers Svratka, Svitava and Ponávka which significantly influenced the relief of the study area. Also, the old millraces (e.g. Svitavský or Svratecký, which was filled up in the 1960s) had an important role in the city development. The position of the hydrological features in the past is also documented in toponyms, e.g. Rybářská (Fisher) street, Vodní (Water) street (Kuča 2000).

Identification of the other urban geoheritage features (specific landforms, geo-architectonical heritage, museum collections, viewpoints, geological gardens and other facilities for geoeducation, dominants, toponyms, see examples in Fig. 2) is a subject of further analysis (detailed literature review, analysis of the maps, fieldwork).

Also, the assessment of urban geoheritage features for geotourism and geoeducation purposes has to be updated and improved as the methods mentioned in the part 3 are suitable mainly for landforms and it is problematic to apply it for other geoheritage features (e.g. dimension stone, building material) and for the overall assessment of the geoheritage of certain city/town. For these purposes, SWOT analysis can be used.

Fig. 2. The examples of other geodiversity features.
A – communication cutting in Jedovnická Street where the granodiorites of the Brno massif are displayed. Spectacular ones are up to 2cm long, bronz-brown, columnar biotites that can be collected here which has a significant educational potential. B – Červený kopec – an overview of Kamenná kolonie (old workers' quarter) and Old Red conglomerate quarries; the material was used for the construction of walls and ramparts in various parts of the city centre (see C). C – Old Red conglomerate used as building stone, Biskupská Street.

5 CONCLUSIONS

Geotourism is developed mainly within rural areas, however, in the last years, it appears also in the towns and cities. Geodiversity and geoheritage play an important role in the urban space and they have a high potential for urban geotourism and geoducation – the development of these activities can help the acceptation of geoconservation, it can be seen as an interesting opportunity how to promote natural and cultural heritage of the urban areas and it represents an alternative to the "traditional" destinations within urban areas. Urban geoheritage is also strongly linked to the cultural, historical, socio-economic and archaeological aspects of the towns and cities.

For sustainable management of these features, the geodiversity action plans are proposed; they include particular activities that should be developed. The elaboration, approval and especially implementation of such plan requires the cooperation between various subjects (geo-scientists from universities and other institutions, municipality officers, politicians, architects, historians, archaeologists, tourist offices).

Geodiversity and geoheritage within Brno represents an important resource for geotourism and geoeducation. The geological and geomorphological settings has influenced the development of the city, numerous geodiversity and geoheritage features are linked to architecture, archaeological, historical and cultural aspects. Also, the objects and phenomenons of secondary geodiversity possess a considerable potential for tourism, recreation and education activities. Nevertheless, this resource is not fully recognized and appreciated. To use rationally and to manage this important resource it is necessary to know it well, to understand it, to describe it, to analyse it, to identify and to assess it. Then, the particular activities (geo-walks, geo-trails, enriching the actual information about the traditional tourist destinations etc.) can be proposed.

Last but not least, it is desirable to analyse the perception of geodiversity by “normal” people (is geodiversity recognizable? is it considered important and interesting?). This could help to identify the specific geodiversity and geoheritage issues and to spread and increase the awareness of it.

REFERENCES

BAJER, A. *Geologické vycházky okolím Brna*. 1. vydání. Brno: Rezekvítek, 2012. 50 p. ISBN 978-80-86626-31-4.

BAJER, A., KIRCHN, K., KUBALÍKOVÁ, L. Geodiversity values as a basis for geosite and geomorphosite assessment: a case study from Žďárské Vrchy Highland. In: Lněnička L. (ed.) *Proceedings of 23rd Central European Conference Central Europe Area in View of Current Geography.* Brno: Masarykova univerzita, 2015, pp 56-69.

BAUDIN, F. *Geologic walk around La Défense.* Paris: Biotope Edition, Mèze—MNHN, 2015. 38 p. ISBN: 978-2366621686.

BILLET, G., Bonnefoy B., De Wever P., Houssaye A., Merle D. *Promenade géologique à Etampes*. Paris: Biotope Editions, Mèze—MNHN, 2009. 28 p. ISBN: 978-2914817301.

BUREK, C., POTTER, J. Local Geodiversity Action Plans - Setting the context for geological conservation. [Online]. Natural England, 2006 [26th October 2017], English Nature Research Reports, No 560. Available at publications.naturalengland.org.uk/file/127017

CHLUPÁČ, I. *Vycházky za geologickou minulostí Prahy a okolí*. Praha: Academia, 1999. 258 p. ISBN: 80-2000-0680-X.

CORATZA, P., GIUSTI, C. Methodological proposal for the assessment of the scientific quality of geomorphosites. *Il Quaternario, Italian Journal of Quaternary Sciences.* Rome: AIQUA - Italian Association for Quaternary Research, 2005, 18 (1), pp 305-313. ISSN: 0394-3356.

Czech Geological Survey. Geological maps. [Online]. Czech Geological Survey [26th October 2017]. Available at http://www.geology.cz/extranet/mapy

Czech Geological Survey. Significant geological localities of the Czech Republic. [Online]. Czech Geological Survey [26th October 2017]. Available at http://lokality.geology.cz.

DE WEVER, P., BAUDIN, F., PEREIRA, D. et al. The Importance of Geosites and Heritage Stones in Cities - a Review. [Online]. *Geoheritage*. Berlin Heidelberg: Springer, 2016, pp 1-15 [26th October 2017]. ISSN: 1867-2485. https://doi.org/10.1007/s12371-016-0210-3.

DEL LAMA, E. A., DE LA CORTE BACCI, D., MARTINS, L. et al. Urban Geotourism and the Old Centre of São Paulo City, Brazil. *Geoheritage*. Berlin Heidelberg: Springer, 2015, 7 (2), pp 147-164. ISSN: 1867-2477.

DOWLING, R. K. Geotourism's global growth. *Geoheritage*. Berlin Heidelberg: Springer, 2011, 3 (1), pp 1-13. ISSN: 1867-2477.

DOWLING, R. K. Global Geotourism – An emerging Form of sustainable tourism. *Czech Journal of Tourism.* Brno: Masaryk University, 2013, 2 (2), pp 59-79. ISSN: 1805-3580.

DOWLING, R. K., NEWSOME, D. (eds). *Geotourism. The tourism of Geology and Landscape.* Goodfellow Publishers Ltd., 2010. 246 p. ISBN: 978-1906884093.

ERIKSTAD, L., NAKREM, H. A., MARKUSSEN, J. A. Protected Geosites in an Urban Area of Norway, Inventories, Values, and Management. [Online]. *Geoheritage*. Berlin Heidelberg: Springer, 2017, pp 1-11 [26th October 2017]. ISSN: 1867-2485. https://doi.org/10.1007/s12371-017-0223-6.

GRAY, M. *Geodiversity: Valuing and Conserving Abiotic Nature.* 2nd Revised edition edition. Chichester: Wiley Blackwell, 2013. 495 p. ISBN: 978-0470742150.

HAWLEY, D. Urban geology and the national curriculum. In: Bennett M.R., Doyle P., Larwood J.G., Prosser C.D. (eds) *Geology on your doorstep.* Bath: The Geological Society, 1996, pp 155-162.

HOSE, T.A. Geotourism or can tourists become casual rock hounds. In: Bennett M.R., Doyle P., Larwood J.G., Prosser C.D. (eds) *Geology on your doorstep.* Bath: The Geological Society, 1996, pp 207-228

KUBALÍKOVÁ, L. Geomorphosite assessment for geotourism purposes. *Czech Journal of Tourism.* Brno: Masaryk University, 2013, 2 (2), pp 80-104. ISSN: 1805-3580.

KUBALÍKOVÁ, L., KIRCHNER, K. Geosite and Geomorphosite Assesment as a Tool for Geoconservation and Geotourism Purposes: a Case study from Vizovická vrchovina Highland (Eastern Part of the Czech Republic). *Geoheritage*. Berlin Heidelberg: Springer, 2016, 8 (2), pp 5-14. ISSN: 1867-2477.

KUBALÍKOVÁ, L., BAJER, A., KIRCHNER, K. Secondary geodiversity and its potential for geoeducation and geotourism: a case study from Brno city. In: Fialová J., Pernicová D. (eds) *Public recreation and landscape protection – with nature hand in hand… Brno:* Mendel University, 2016, pp 224-231.

KUBALÍKOVÁ, L., KIRCHNER, K., BAJER, A. Secondary geodiversity and its potential for urban geotourism: a case study from Brno city, Czech Republic. *Quaestiones Geographicae.* Poznań: Bogucki Wydawnictwo Naukowe, 2017, 36 (3), pp 63-73. ISSN: 2081-6383. https://doi.org/10.1515/quageo-2017-0024

KUČA, K. *Brno - vývoj města, předměstí a připojených vesnic.* Brno: Baset, 2000. 648 p. ISBN: 80-86223-11-6.

Natural England. Geodiversity Charter for England. [Online]. Natural England, 2014 [26th October 2017]. Available at (http://www.englishgeodiversityforum.org/Downloads/Geodiversity%20Charter%20for%20England.pdf.

MÜLLER, P., NOVÁK, Z. *Geologie Brna a okolí.* Praha: Český geologický ústav, 2000. 90 p. ISBN: 80-7075-416-8.

NOVÁK, Z. et al. *Geologická mapa, list 24-32 Brno.* 1:50 000. Praha: Český geologický ústav, 1991.

PALACIO-PRIETO, J. L. Geoheritage Within Cities: Urban Geosites in Mexico City. *Geoheritage*. Berlin Heidelberg: Springer, 2015, 7 (4), pp 365-373. ISSN: 1867-2477.

PANIZZA, M. Geomorphosites: concepts, methods and example of geomorphological survey. *Chinese Science Bulletin.* Chinese Academy of Sciences, 2001, 46 (1), pp 4-6. ISSN: 2095-9273.

PEREIRA, P., PEREIRA, D. Methodological guidelines for geomorphosite assessment. *Géomorphologie: relief, processus, environnement.* Lille: Groupe français de Géomorphologie, 2010, 5 (2), pp 215-222. ISSN: 1266-5304.

PICA, A., FREDI, P., DEL MONTE, M. The Ernici Mountains Geoheritage (Central Apennines, Italy): Assessment of the Geosites for Geotourism Development. *GeoJournal of Tourism and Geosites.* Oradea: University of Oradea, 2014, 7 (2), pp 193-206. ISSN: 2065-1198.

PICA, A., VERGARI, F., FREDI, P., DEL MONTE, M. (2016) The Aeterna Urbs geomorphological heritage (Rome, Italy). *Geoheritage*. Berlin Heidelberg: Springer, 2016, 8 (1), pp 31-42. ISSN: 1867-2477.

PICA, A., LUBERTI, G. M., VERGARI, F., FREDI, P., DEL MONTE, M., 2017. Contribution for an urban geomorphoheritage assessment method: proposal from three geomorphosites in Rome (Italy). *Quaestiones Geographicae.* Poznań: Bogucki Wydawnictwo Naukowe, 2017, 36 (3), pp 21-36. ISSN: 2081-6383. https://doi.org/10.1515/quageo-2017-0030

PRALONG, J. – P. A method for assessing tourist potential and use of geomorphological sites. *Géomorphologie: relief, processus, environnement.* Lille: Groupe français de Géomorphologie, 2005, 1 (3), pp 189-196. ISSN: 1266-5304.

PROSSER, C., MURPHY, M., LARWOOD, J. Geological conservation: a guide to good practice. [Online]. Natural England, 2006 [26th October 2017], drawn in part from work undertaken for English Nature by Capita Symonds. Available at http://publications.naturalengland.org.uk/publication/83048

REYNARD, E. et al. A method for assessing the scientific and additional values of geomorphosites. *Geographica Helvetica.* Göttingen: Copernicus, 2007, 62 (3), pp 148-158.

REYNARD, E. The assessment of geomorphosites. In: Reynard E., Coratza P., Regolini-Bissig, G. (eds) *Geomorphosites.* Munich: Verlag Dr. Friedrich Pfeil, 2009, pp 63-71. ISBN: 978-3899370942.

REYNARD, E., KAISER, C., MARTIN, S., REGOLINI, G. An application for geosciences communication by smartphones and tablets. In: Lollino G. et al (eds) *Engineering geology for society and territory.* Heidelberg: Springer, 2015, vol. 8, pp 265-268.

REYNARD, E., PICA, A., CORATZA, P., 2017. Urban geomorphological heritage. An overview. *Quaestiones Geographicae.* Poznań: Bogucki

Wydawnictwo Naukowe, 2017, 36 (3), pp 7-20. ISSN: 2081-6383. https://doi.org/10.1515/quageo-2017-0022

ROBINSON, E. *A geological walk around the City of London—royal exchange to Aldgate*. Proc Geol Assoc, 1982, 93, pp 225-246.

ROBINSON, E. *Illustrated geological walks, vol 1.* London: Scottish Academic Press, 1984. 98 p. ISBN: 978-0707303505.

ROBINSON, E. *Illustrated geological walks, vol 2.* London: Scottish Academic Press, 1985. 142 p. ISBN: 978-0707304168.

RODRIGUES M. L., MACHADO, C. R., FREIRE, E. Geotourism routes in urban areas: a preliminary approach to the Lisbon geoheritage survey. *GeoJournal of Tourism and Geosites.* Oradea: University of Oradea, 2011, 8 (2), pp 281-294. ISSN: 2065-1198.

London Geodiversity Partnership. London Geodiversity Action Plan 2014-2018. [Online]. Capita Symonds with assistance from the London Geodiversity Partnership and Natural England, 2014. [26th October 2017]. Available at *http://www.londongeopartnership.org.uk/downloads/LGAP%202014-2018.pdf*

TIČAR, J., KOMAC, B., ZORN, M., FERK, M., HRVATIN, M., CIGLIČ, R., 2017. From urban geodiversity to geoheritage: the case of Ljubljana (Slovenia). *Quaestiones Geographicae.* Poznań: Bogucki Wydawnictwo Naukowe, 2017, 36 (3), pp 37-50. ISSN: 2081-6383. https://doi.org/10.1515/quageo-2017-0023

VÁVRA, V., ŠTECL, J., *Významné geologické lokality Moravy a Slezska.* Brno: Masarykova Univerzita, 2014. 290 p. ISBN: 978-80-210-6715-8. https://doi.org/10.5817/CZ.MUNI.M210-6715-2014

ZWOLIŃSKI, Z., HILDEBRANDT-RADKE, I., MAZUREK, M., MAKOHONIENKO, M. Existing and proposed urban geosites values resulting from geodiversity of Poznań City. *Quaestiones Geographicae.* Poznań: Bogucki Wydawnictwo Naukowe, 2017, 36 (3), pp 125-149. ISSN: 2081-6383. https://doi.org/10.1515/quageo-2017-0031

Shrnutí

Geoturismus těží zejména z geodiverzity, avšak zároveň využívá i kulturně-historické prvky a živou přírodu dané oblasti, je propojen se vzděláváním a počítá s aktivním zapojením místních. V současnosti je rozvíjen hlavně ve venkovských oblastech, avšak objevují se i iniciativy, které upozorňují na geodiverzitu a její význam v rámci měst.

Racionální a udržitelné využití geodiverzity ve městech může tvořit alternativu pro tradiční turistické cíle a přispět k pochopení významu a nutnosti ochrany geodiverzity samotné. Geodiverzita, respektive geodědictví ve městech nezahrnuje pouze objekty a jevy primární (přirozené) geodiverzity (skalní podloží, tvary reliéfu, půdy), ale I antropogenní tvary a procesy (sekundární geodiverzita), hydrologické prvky (studny, náhony) a v neposlední řadě I geodiverzitu ex-situ (muzejní sbírky, stavební materiál). Příspěvek přibližuje tuto novou formu turismu a uvádí příklady geodiverzity/geodědictví v rámci města Brna.

EXPERIENCE TO APPLY THE METHOD OF ASSESSING THE RECREATIONAL POTENTIAL OF SUBURBAN FORESTS IN URBANIZED AREAS

Natálie Levandovská

Masarykova univerzita, Brno, Česká republika
nata99967@inbox.ru

Abstract: The purpose of the study was to determine the recreational potential a part of the suburban forests Sochi, Russia. The area of research contained 33 hectares and located inside the city quarters. In the study were used the taxation materials of the Sochi National Park. The research method included assessment of the forest in three groups of categories - attraction, comfort and stability. The method examines recreational forest from its attraction and comfort for visitors and tolerance (stability) to anthropogenic influence. The outcome of the evaluation is the Class of Recreational Value (CRV). The lowest results were registered among indices of attraction and comfort categories. This is mainly due to the large amount of debris – index "Sanitary conditions", the absence of the recreational reservoir – Index "Distance to recreational reservoir", and the proximity of large motor roads. At the same time, the indices of the Stability category are high. The method used previous researches of scientific works in area of urban recreational forests. However, some indices require verification, such as a moisture index. Perhaps it relevance is not significant. Present societies have a big demand of green areas and nature (Gadow 2002, Grahn&Stigsdotter 2003). The ongoing urbanization process in many countries and upspeeded by the modern lifestyle with the stress and stress-related illnesses (Ode & Fly 2002). In that case, outdoor recreation is concerned with the densely populated areas (Rydberg 1998 in Ode & Fly 2002) due to it "free nature" (Sandell 1993), opportunities for ameliorate injurious factors, restorative environments free from stress are provided (Bolshakov 2000, Grahn&Stigsdotter 2003). However, as a result of active use of forests for recreational purposes, their quality and ability to perform recreational functions are reduced. That is why important to estimate the ability of the forest, to resist influence of urban environment.

Keywords: recreation, recreational potential, visitors, attraction, comfort, stability, urban forest

STUDY AREA

The urban recreational forests under study are located on the territory of the Sochi National Park, with total area of 208,599.85 hectares. A significant part of this area is allocated as recreational forests. The park occupies the Greater Sochi area, from the border with the Tuapsinsky District, between the mouths of Shepsi River and Magri River in the north-west, to the border with Abkhazia along the Psou River in the south-east, and between the Black Sea to the water divide crest of the Greater Caucasus. This territory of the park does not include the areas of settlement, such as the city of Sochi and various urban and rural settlements, but some districts are situated inside the territory of the Park. Immediately to the north is the Caucasus Nature Reserve.

Forests adjoining to the city line and are used by city residents and visiting tourists as places for short-term daytime rest, while remote and hard-to-reach forests are not visited by tourists.

Types of short-term rest include:

- picnic rest, usually on the banks of streams, rivers, natural and artificial lakes with well-equipped areas and the necessary equipment for a picnic,
- gathering: picking berries, mushroom and nuts,
- visiting unique natural objects (waterfalls, caves, dolmens, rocky complexes and unique botanical objects),
- hiking. To a large extent, the possibility of recreational using forests in the region depends on the availability of a road-tropic network (availability factor), roads, as well as the terrain and its slope.

Areas with steep and very steep slopes in the southeastern part of the coast occupy over 60% of the territory NP, and in the northwest – a little over 30%. Recreational loads on the forests are distributed very unevenly, which adversely affects the state of forest ecosystems in the zone of active visits.

Modern methods in the analysis of cartographic data make it possible to exclude field work virtually. I would like to note the materials of the forest inventory of Sochi NP, containing data in electronic form, and allowing analysis with GIS.

The total numbers of units studied, according to the taxation materials, were 56. It were units located only inside the city.

Fig. 1. National park of Sochi - location of the research.
Source: Open Street Map

MEANING OF "RECREATIONAL POTENTIAL" TERM

The investigation of "recreational value" of forest area by itself could be adequate in description of several components of forest landscape, which can be appreciated by visitors, but at the same time it will not show if the environment could be "pleasant to invite visitors" to. Different types of forest have a different sensitiveness to recreational utilization and could be negatively affected, changed and finally damaged by anthropogenic pressure (Repshas 1994, Drobyshev 2000, Rysin&Rysin 2003, Rysin 2006).

According to aforementioned, we could say that sustainable recreation utilization will take place when conditions of recreational forest area will be estimated from people preferences aspects and from biological aspect of forests.

The "recreational potential" is a term used in this study, which is resulting from aggregate of social and biological evaluated aspects.

Recreational potential of landscape is a "degree of possibility to perform its recreational functions conditioned by its nature features as well as results of human activities" (Rysin 2003).

STRUCTURE OF THE METHOD

The evaluation of recreational potential comprises of three main categories (three groups of evaluation indices):

- Decorative effect ("Attraction"),
- Comfort for visitors ("Comfort"),
- Stability (tolerance) of the forest to recreational influence ("Stability").

These categories include different amount of specific indices (*Figure 1*)

Tab. 1: Categories and indices for evaluation Recreational potential of urban forests

ATTRACTION	COMFORT	STABILITY
Age of forest	Relief	Degree of digression
Species composition	Distance from roads	Brushwood presence
Height of stand	Pathway network conditions	Viable undergrowth presence
Objects of attraction	Distance to recreational reservoir	Grading of soil
Patchiness (horizontal structure) Decorative effect (contrast)	Soil moisture	The status of territory according to the functional zoning NP
Story composition (vertical structure)		
"man-caused" objects		
Sanitary conditions		

Each index should be evaluated by expert from "0" up to "2" score. The maximal sum of scores for the "attraction" category is 16, since 8 different indices are evaluated by this category. Then the calculated sum of scores has to be compared to the maximal possible sum for every category.

For the next step, to make the data clear and understandable for further analyzing certain coefficients have to be used according to the method. Due to an aggregative processing of scores noted in checking form and method's formula we get coefficients CA, CC and CS correspondingly for every observed unit in "attraction", "comfort" and "stability" categories:

$$\boxed{\mathbf{CN = SSn/SMn}}$$

where CN – corresponding coefficient (CA (attraction), CC (comfort) are CS (stability)); SSn – sum of scores according to N category; SMn – maximal possible sum of scores.

To generalize the evaluation of recreational potential, plantations are divided into three Class of Recreational Value (CRV).

- If at least one of the coefficients is lower than 0.34, the observed area (stand) corresponds to CRV III.

Then the recreational utilization can't be managed without any significant management for recreational potential enhancement.

- If at least one of the coefficients are between 0.34 up to 0.66 and the others are higher than 0.34.

Then the observed area (stand) corresponds to CRV II. Then the recreational utilization could be managed only with some limitations.

- If at least one of the coefficients is ≥ 0.67, the observed area (stand) corresponds to CRV I.

Then the recreational utilization could be managed without any significance changes.

RESULTS

There are not only final integral results of recreation condition, but also specific indices and conditions quite significant and could be compared, analyzed and emphasized

The estimation of the "attraction" category has general average estimate 0.44. (Figure 2)

The lowest score as a result of the research was obtained by the indexes of "objects of attraction", "species composition", "sanitary conditions" and "man-caused objects".

In this example, the absence of water bodies and the presence of a high-speed motorway are having a great impact. After construction speedway quite large areas are without any vegetation.

Foto 1: River Matsesta."Objects of attraction"

Foto 2: Composition of species. Grab and Fágus sylvática

Foto 3: Speedway Adler – Krasnaya Polyana "man-caused objects"

The estimation of the "comfort" category has general average estimate 0.28. (Figure 3)

This category shows how convenient it to use forests for visitors.

In this group, the lowest score of the research was obtained by the indexes of "pathway network conditions". In the lower level of the forest there are usually dense thickets of blackberry and lianas, so the presence of paths and the possibility of movement are of great importance to visitors.

The index "relief" is also very important because of the steep gradients terrain. Slope more than 20 degrees does not allow moving. The presence of highways is highly appreciated, although in this case this factor is questionable, as large highways reduce the attraction factor.

The estimation of the "stability" category has general average estimate 0.47. (Figure 4)

In this group, medium evaluations obtained the indices "degree of digression" and "status of the territory according to the functional zone NP". "Grading of soil" also has a medium value, because the soils are represented mainly by loams. Despite the fact that the index "degree of digression" is middle appreciated, there is no viable undergrowth presence in the plantations. This is a sign of instability the ecosystems. This suggests that the possible degradation process has just begun.

To calculate the Class of Recreational Value (CRV), I used the method, described above. The obtained results showed that the forest stands, located within the city have II and III CRV. Despite the high values of such indices as "age of forest", "degree of digression", Class Recreational Value is low because of the uncomfortable visitors there.

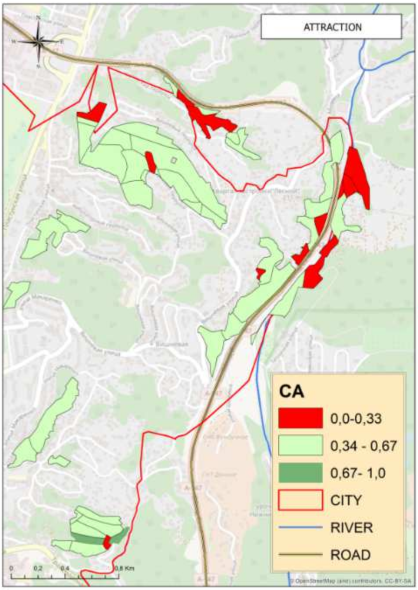


Fig. 2. Estimation of the locality attraction.

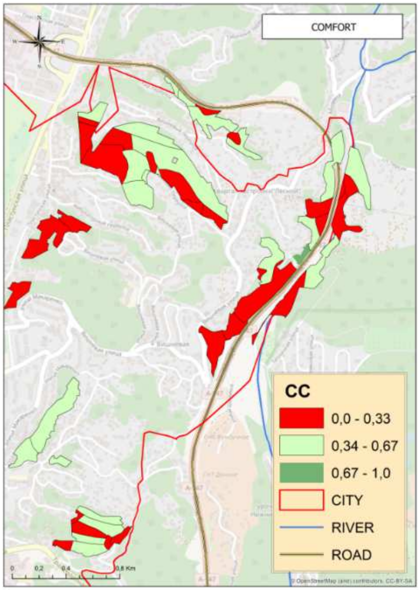


Fig. 3. Estimation of the locality comfort.

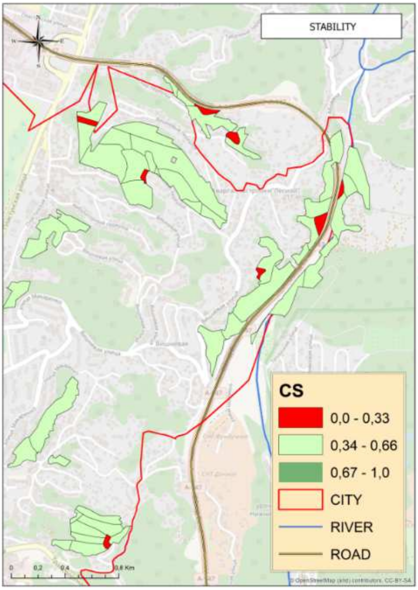


Fig. 4. Estimation of the locality stability.

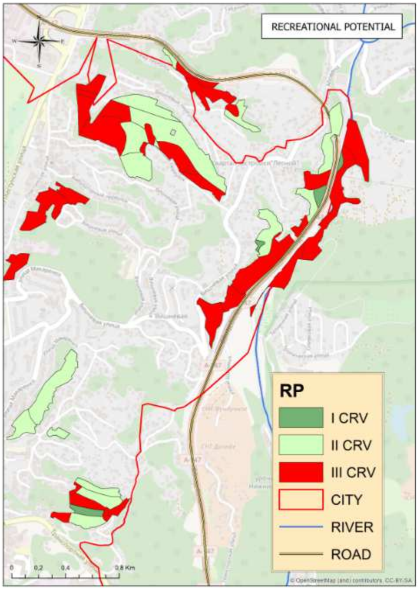


Fig. 5. Estimation of the locality recreational potential.

Due to the analyzing of the results obtained and literature study we could say that the tested method could be considered as quite objective and reliable. Mainly because of literature statements of Russian and European scientists quite well reflected and confirmed by the method. The hypothesis about the crucial importance of the Attraction and Comfort evaluation of forest ecosystem for the recreational potential evaluation was confirmed as well.

The lowest values of the "comfort" in most cases determine as a limitative factor the recreational potential of those forests. Moreover, the analysis of the results shows that each natural (unartificial) forest ecosystem is quite sensitive towards recreation activities and always under the risk of damage. Nevertheless, there are some places in each category of the method which have to be analyzed more carefully. The needs for further modifications, changing the meaning of indices or exclusion some of them exist, as described above.

REFERENCES

BOLSHAKOV, N. M. 2000. Rekreacionnaya rol lesov (the recreational role of forests). Lesnoe hozyajstvo I lesnye resursy respubliki Komi. M.: Izd-vo "Dizajn.Informaciya.Kartografiya". s.203-244.

DROBYSHEV, Y. I. 2000. Metodika izucheniya rekreacionnyh lesov. Posobie dlya nachinayushih issledovatele jprirody (methods of recreational forest investigation. Manual for beginners in nature researches). Moskva. In Russian

GADOW, K. 2002. Adapting silvicultural management systems to urban forests. Urban forestry &Urban greening. № 1. ISSN 1618-8667

GRAHN, P. & STIGSDOTTER, U.A. 2003. Landscape planning and stress. Urban forestry &Urban greening. № 2. ISSN 1618-8667

IVONIN V. M., SAMSONOV S.D. Kriterii I indicatory otsenki rekreatsionnogo potentsiala gornyh lesov severnogo Kavkaza // V.M. Ivonin, S.D. Samsonov / Melioratsija I vodnoe hozjajstvo, 2011. № 4.s.32-35.

ODE, Å.K. & FLY, G. L.A. 2002. Visual aspects in urban woodland management. Urban forestry &Urban greening. № 1. ISSN: 1618-8667

REPSHAS, E. 1994. Organizaciya rekreacionnogo lesopolzovaniya, na primere Litvy (Organization of forest recreational utilization by the example of Lithuania). Moskva. Nauka.240 s. in Russian.

RYSIN, S.L. 2003. Rekreacionnyj potencial lesoparkovyh landshaftov I metodika ego izucheniya (Recreational potential of urban forest landscapes and its study method). Lesohozyajstvennaya informaciya. №1. s.17-27. in Russian.

RYSIN S. L., LEPESHKIN E. A. Opyt otsenki rekreatsionnogo potentsiala lesov na urbanizirovannyh territorijah // Lesnye ekosistemy I urbanizatsija. M.: Tovarischestvo nauchnyh izdanij, 2008. s. 183-208.

CITY SPATIAL STRUCTURE IN CASE STUDY OF THE RUSSIAN CITIES PERM AND SAMARA

Libor Lněnička

Department of Geography, Faculty of Education, Masaryk University in Brno
Poříčí 7, 603 00 Brno, Czech Republic
lnenicka@ped.muni.cz

Abstract: The Russian Federation, after decline of the Soviet Union in 1991, has changed in many political, economic, socio-cultural and environmental aspects. These changes are visible in morpho-genetic structure of Russian cities. This paper presents a comparison study of two cities located in the European part of the Russian Federation – Perm and Samara. Both cities have many common aspects of historical development. The comparison study describes a sectoral model on demonstration of the development of residential, industrial and leisure time functions. The main objective is to prove joint development of both cities, the biggest flourishing which was the era of the Soviet Union.

Key words: City structure, case study, city quarter, Russia, Perm, Samara

INTRODUCTION AND METHODS

Development of the current postmodern society is moving forward very quickly. From the sociology point of view, we can speak about a strong resocialization of society, which is based on state-of-the-art developmental trends, e.g. in the field of information technology. Development of society is also linked to increased demands for space, either urban or rural. Most changes can be found in urban environments where there is a greater concentration of population in small spaces. As a result, such changes are more visible and more descriptive. The growth and development associated with the spatial growth of the area of the city can be witnessed not only in the expansion of the industrial revolution, but also after the Second World War. The processes of urbanization, suburbanization, citadelization, commercialization, residential housing, significant for many cities in the western part of Europe (e.g. London, Paris, Brussels), have gradually spread to the eastern European part, to Belarus, Ukraine and Russia. The current post-Soviet space has gone through significant changes in the urban and spatial structure of large cities since collapse of the Soviet Union in 1991. Urbanization processes typical for "western" cities are becoming common in many Russian cities. For local inhabitants these cities mean a new era of residential and commercial suburbanization linked to the creation of new residential or commercial zones on the outskirts of the city.

The aim of the paper is to describe historical and urban development of selected Russian cities and to identify causes and consequences of new development trends. Apart from descriptive methods, comparative methods of common functional elements are deployed as well. The actual comparison is made according to the sectoral model on the demonstration of development of residential, industrial and leisure time functions. The main objective is to prove the common development of both cities, using selected geographic and urban concepts typical for the 20´s and 30´s of the last century.

THEORETICAL BASIS AND THESIS

The main authors dealing with the Russian Federation on national level, or their federated republics or selected regions are Baar (2002; 2005; 2010), Skokan (2005). Up to the present, I have not met any Czech authors narrowly focusing on the geography of Russian cities, their internal structure and functional links. Therefore, this case study is one of the first experiments. Czech geographers dealing with urban issues, including their functions and internal structure, focus on the home environment (Ouředníček and Sýkora, 2002, Sýkora, 2007, 2008, 2009, Kubeš, 2009, Kubeš 2009, Ouředníček and Temelová, 2012; Sýkora and Mulíček, 2014; Sýkora, 2014; Mulíček, Osman and Seidenglanz, 2016). There are articles on the comparison of post-socialist space in Central and Eastern Europe – Stalinov, Sýkora, 2012; Stalinov, Sýkora, 2014; Bouzarovski, Sýkora and Matoušek, 2016. In articles by foreign, authors, Russian cities are noticed much more. E.g. in 2005 a study on the development of the urban population in Russia and the Soviet Union between 1900-2000 was published by authors of Afontsev, Kessler, Markevich, Tyazhel'nik and Valetov. The authors describe not only the population development, but also analyze the inner city structure.

The only papers published about the urban space and its population are for example Lehmann and Ruble (1997) – Case study of city Jaroslavli, Andrienko (1997) – Case study of city Kazan, Yakovlev (1998) – Case study of city Tver or Volchkov (1998) – case study of city Samara. Other authors Lappo, Polyan (1999), Hill, Gaddy (2003), Polyan, Selivanov (2007), Molodikova, Makhrova (2007) or Kolomak (2012). The papers mentioned above generally deal with the development of Russian cities. It would not be very pragmatic to list all contributions and articles published about Russian cities, but the previous review shows the considerable interest of foreign authors in the issue.

DESCRIPTION OF STUDY AREA (CITIES)

For the comparative study two Russian cities – Samara and Perm have been selected. Both cities have many common aspects of development (historical, political, administrative, geographic, urban or environmental). For the following text of the paper the only important aspects such as "consistency" or "similarity" of both cities are to be discussed. Certainly, other aspects of similar development of the two cities described (e. g. environmental, social, etc.) could be discussed as well, but it is not useful to explore them further. The reason for selecting these cities was a personal visit of the author during the study stays at universities in 2014 and 2016. The position of the two cities in the European part of Russia is illustrated in Figure 1. Another reason is the relatively small involvement of Czech geographers in the territory of the Russian Federation.

Fig. 1. Localization of Cities Samara and Perm in European part of Europe.
Source: http://d-maps.com/carte.php?num_car=30394&lang=en, edited by the author.

The main common aspects of urban development:

Geographical – both described cities are located in the European part of the Russian Federation. The absolute geographical location is different, but from a relative position point of view, many common geographic features can be found. Samara lies in southern European part of Russia, Perm in eastern part. Geographic coordinates are: Samara – 53°11' N, 50° 7' E and Perm – 58°0'50" N, 56°14'56" E. An important common element for both of the cities is the rivers – in Samaria the Volga River and in the case of Perm the Kama River. Both rivers belong to important watercourses of Russia either from the watery point of view or the use for river transport. Samara is situated on the left bank of the Volga River, which flows through the Zhiguli Mountains in its middle part and creates a specific landscape called Samarskaya Luka. The largest left-hand infix of the Volga is the Kama River. Moreover, on its left bank the present city of Perm is to be found. Both rivers also serve as a reservoir for drinking water for both of the cities. Large reservoirs (Kuibyšev reservoir, Saratov reservoir on Volga, and Kamska reservoir on Kama) are located in the vicinity of both cities. Only a partial similarity can be found in comparison of the relief. Near the two cities there is a mountain range (Zhiguli Mountains and Central Ural), but there is a considerable variation from the vertical fragmentation point of view.

Demographic – Samara and Perm are important cities of the Russian Federation. Their population rate is relatively similar and yet they are regional capital cities with a population of about 1 million. To compare the population growth, years, which meant a significant increase or decrease of population (eg 1923, 1979, 1989 or 2002), have been selected. Comparison of the population development is shown in Figure 2.

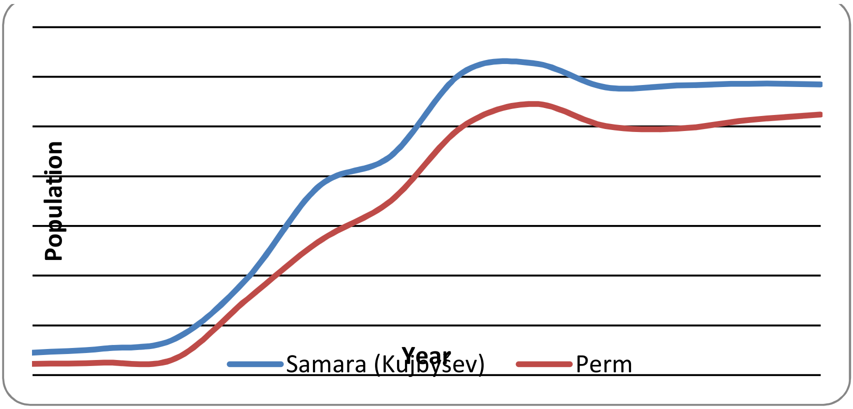


Fig. 2. Population development of Russian cities Samara and Perm in selected years (from year 1897).
Source: http://www.gks.ru/wps/wcm/connect/rosstat_main/rosstat/ru/statistics/population/demography/#

Transports – a major development period brought about the development of the railways. The construction of the Transsiberian railway meant the industrial development of the city of Perm. The city became an important stop on the railway, the last in the European part of Russia. Samara gained its connection with Moscow thanks to the construction of Kujbyšev Railway. Those significant railway constructions took place in the second half of the 19th century. Both cities also have direct road connections to Moscow – from Samara Federal Road M5 and from Perm International Road E22. Air traffic is provided by an international airport near both cities (Perm-Bol'shoye Savino and Samara-Kurumoch). However, there is no direct air connection between the two cities. River shipping is also important. Both cities have their river ports located in the centre.

Political – the essential period for both cities was Soviet Union era. Both cities were renamed as a result of a central political decision. Perm bore the name Molotov in 1940–1958 after a Soviet politician Vjačeslav Molotov. Samara bore the name Kujbyšev again in 1935–1990 after a Soviet politician Valerian Kujbyšev. During the World War II Samara was meant to be the surrogate capital of Russia, in the case of the prolonged expansion of German troops to Russian territory. During the era of Soviet

Union the role of heavy arms industry was strengthened. Permanent aircraft and missile engines were located in Perm, and intercontinental ballistic missiles had also been produced until 2015. The design office and production facility CSKB-Progress, which manufactured the first generation R-7 and R-7A Soviet intercontinental ballistic missiles in the 1950s and 1960s, were located in Samara. For this reason, Samara was completely inaccessible to foreigners. The plant still works to date and it is a manufacturer of Soyuz and Molnija carrier rockets.

Administrative – administrative importance is related to the historical division of the Russian Empire (so-called gubernia). Perm was a regional seat of the Permanent Governance from 1797, Samara from 1851. In the 1920s, a new administrative division of the state into regions, counties, autonomous regions, national and Soviet republics were established in the later Soviet Soviet Federal Socialist Federal Republic. After various administrative changes, both cities are regional centres. Perm has been the regional centre of the Perm region, since it was established on 1 December 2005, by merging the Perm region with the Komi-Permiack Autonomous Circle. Samara is the regional center of the Samara region. Both cities are internally divided into urban areas called raiones. Samara is divided into 9 dictricts, Perm into 7. Some dictricts have common names, eg Kirovsky or Leninsky.

The next part of the paper seeks to find common aspects of the geographic, urban and political-administrative development of the morphological structure of both selected cities, which show signs of the Hoyt (1939) sectoral model.

CITY STRUCTURE AS A CASE STUDY OF PERM AND SAMARA

In comparison with the historical development of Samara and Perm, both cities considering either their population or development of the strategic industry in Soviet Union, have many common elements. From urban point of view, these are basic sectors (central, service, residential, industrial and recreational). The individual sectors are determined by the gradual growth of the city around the historic centre along the main communication axes, which are called prospectuses or boulevards in Russia. Samara and Perm are historic cities founded in the 16th (Samara) or 17th century (Perm), urban rights were acquired in 1688 by Samara and 1723 by Perm. The subsequent development of the towns is connected with the imperator Peter I the Great, the establishment of the governor's seat (Perm in 1797, Samara in 1851). The oldest places of the two cities are historical centers, which from the urban point of view are in the form of preserved cultural monuments - defensive fortresses, wooden slums, workers' houses or open public spaces (squares, parks, etc.). The Samara Centre, in the form of a separate sector (the Leninsky and the Samarsky district), forms a comprehensive set of residential, administrative and service functions today. The main city centre (central city) is limited by the flow of Volga and Samara rivers. The mouth of Samara River in the Volga in today's Kujishevsky district creates a peninsula in the shape of a gradually emerging triangle. It was in the mouth of both rivers that a defensive fortress was established in 1586 against the raids of the Tatars. Today the oldest place in Samara is commemorated by memorial plaque and reconstructed wooden defensive tower of fortress. Further development of city was so limited by watercourses and proceeded further from the center in only one direction (northeast) along major communication axes in the form of magnificent boulevards. The boulevards were almost parallel to the Volga River and originated historically from the banks of the Volga River on the terraces, which fulfil, among other things, a protective function against the flood. Today, these boulevards are visible in the structure of the city (such as Moscow, Novosad, or Karl Marx), stretching across the city from the banks of the Samara River to the border of Samara (about 20 km). The boulevards thus form the basic communication infrastructure of the city, presenting major transport arteries today, and alongside them the residential and service sector are located around the historical centre. The connections between boulevards are provided by vertical streets, prospectuses. Towards the banks of Volga River, these leaflets extend in the perpendicular direction to the southern (southeast) part of the city, today's Železnogorodsky, Soviet and Kirovsky district. The southern and southeastern part of the city, limited by the Samara River, forms a large industrial sector.

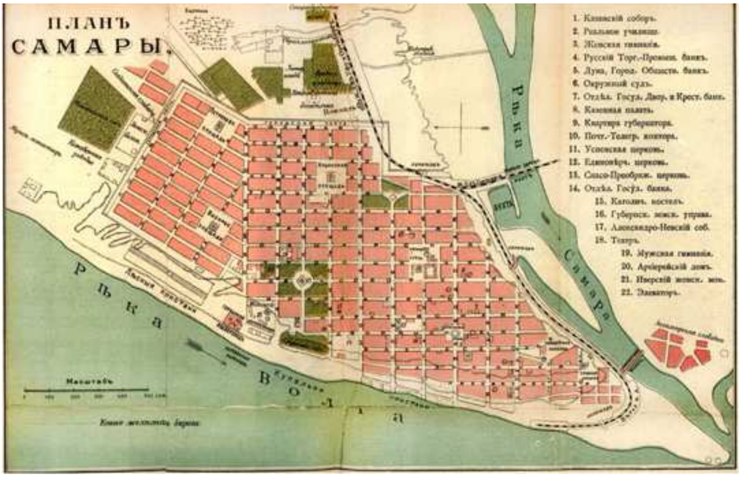


Fig. 3. Historical map of city Samara from 1903.
Source: http://old-maps.livejournal.com/26989.html

The industry in Samara has a great tradition, the largest boom in this sector reaches back to 1880. The city established multinational companies operating in heavy industry (eg Kenitser Macaroni Factory). New elements of buildings – high-rise skyscraper buildings – became a part of the city's urban structure. Private residential estates, office buildings (Trading Houses of the Subbotins, Kurlins, Shikhobalovs, and Smirnovs-founders), business areas and the purely industrial sector began to change along the Aurora Street and the Kirova backcloth into the commercial sector. Such growth was typical for North American cities, so Samara was named

“Russian New Orleans” and “Russian Chicago”. Traffic servicing localized businesses was been provided and in fact is still provided by the railways. It is the southern branch of the trans-Siberian railway running to the Ural. Further development of the southern city industry (the urban area of the administrative part of the Soviet and Kirovskyy rayons) in the first half of the 20th century meant a sharp increase in the city's population. It was necessary to deal with housing construction quickly. The space between the southern part of the town and the Volha river was gradually built up along the Aurora, Soviet Army and Kirova with construction of apartment houses (1950s) in the socialist style of worker colonies and eventually completed in the 60s and 70s with the traditional Soviet housing estates Bezbymijnka or Severnij).

Administrative structures of the city, districts of industrialny and Kirovsky were newly formed, and for almost 30 years they formed the periphery of the city. The area of Kirovsky rajon is now the 2nd largest city district. Part of the district is also a large-scale forest park, which separates the continuous build-up of intravilan from the suburban sector. Joining the semipermeable sector with suburban sector is provided by Moscow, Novosad and Karl Marx boulevards. The outskirts of the city began to be built up after 1991, first in the south-eastern part of the city, in connection with the industrial sector of North and South cities. In 1991–1995 the residential complex Zubčaninovka (family and apartment buildings) was built under the railway line. In the north-eastern part of the city along the Moscow Boulevard, the town of Mechhozavod was connected to the town. A large shopping zone (Megakomplex Moscow) was established in 2007 between the old city and Mehochozavod. Extending the Moscow boulevard on the outskirts of the city, the Krasnoglinsky district (nowadays the largest urban raion – 147 km^2) was administratively established. It was named after nearby village Krasna Glinka. In the area of the suburban district Kozelki residential complex (apartment houses completed with elements of civic amenities – schools, playgrounds, Orthodox church and Mega shopping zone) was built in 2000–2006. The shopping area was built in 2007 including hypermarkets (IKEA, Ashan, etc.), cinemas and relaxation zones.

In the territory between Kirovsky district boundary and the Kozelki district the city's major recreation zone – Gardening Colony is located. In the suburban zone it is possible to find typical elements of residential suburbanization. The concentration of richer populations is typical for the Ozerki district, which meets elements of typical gated community zone. After that, the area passes into free countryside, and the administrative borders of the city of Samara end here. There are also independent municipalities Novosemenko, Petra Dubrava, etc. The development of the town does not only occur in the northeastern part of the town, but early in the 1950s the area of marginal parts south of the historical center on the left bank of Samara River expanded. In Kujbyšev a new part Sočgorod district was created, which is currently a rapidly growing suburban part of the city. It is possible to see here a mix of old family houses and housing estates built in 1990s. Since it is the main connection road south to Uralsk and Novokujbyševsk, there are also lucrative building sites. In the intravilan of city many public spaces are located (in the historical center Revolution or Kujbyšev square); large parks (botanical parks, Maxim Gorky Park, Jurij Gagarin Park, etc.) in the residential areas of Kirovsky, Oktobrjsky and Sovetsky district. And, of course, sports grounds – stadiums, sports halls, etc., all that must be a necessary part of a modern city.

Unlike Samara, Perm has a great advantage in the gradual expansion of the city outside the central historic center. Comparing the size, the area of Perm is bigger (799.68 km^2). Samara occupies an area of only 466 km^2. The limiting element in Perm is only the natural flow of Kama River in the west part of the city. The eastern part extends to a smaller terrace, which gradually passes in foothills of Middle Urals. Along the left bank of Kama there was a city that could easily be divided into two parts – Perm I and Perm II. This division is also evident from the location of railway stations. Perm is an important transport hub on the Trans-Siberian railway and the Ural regional railways. The base of the city of Perm forms the communication axis (Ekaterinburg Boulevard) in the north-south direction along Kama River, which passes to the Solikamsky boulevard in the northern part of the city. Parallel with this street there are also "supplementary" streets (such as Lenin, Pushkin, Petropavlovska streets etc.) along which the service sector is concentrated (shops, offices etc. Vertically on these streets from Kama River prospectuses (Popova, Komsomolská etc.) are situated. The ground base of the central city thus creates a chessboard network of boulevards and prospectuses. The central administrative city belongs to the Leninsky district.

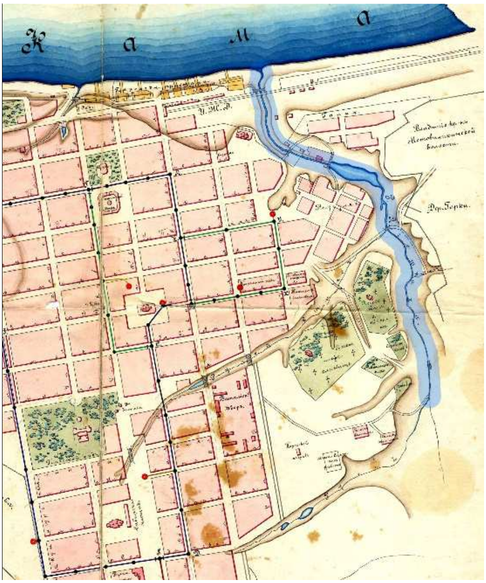


Fig. 4. Historical map of city Perm and Yagoshikha settlement from 1898.
Source: https://kids.kiddle.co/Perm

The administrative division consists of 7 districts. Compared with Samara, Perm is located on the second (right) bank of Kama River. On the right bank of Kama River there is the whole territory of Kirovsky, Leninski district, part of Kamska dolina, Studgorodok, part of Verkniy Kurij in Motovilikhinsky district, Zaozerje Ordzhonikidze and Ganva. Parts of the city on the right bank of the river in "suburban" sector have a rural character. A part of Kamska Valley is considered to be a residential area. The advantage is location on the Kama bank with views of the central part of the city. On the other side of this city part, there is an extensive forest park, which later passes into the forest. The main recreational area in the city is the Central Park of Culture and Rest on the Dzerzhinsky and Industrialny district. The central district is connected with the other bank of the river by two bridges (Kommunalny bridge and the railway bridge). Another possibility to cross the river is in Kirovsky (in the south) and Ordzhonikidevsky (in the north) district. The largest area according to the area is Ordzhonikidevsky district (178,5 km^2) in the northern part of the city. It is a marginal district in a suburban city comprised of several smaller geographically separated parts (Golovanovo, Levšino, etc.). The area of individual (family houses) prevails here. Most residential buildings are located in the close proximity of the central city (Lenisky, Motovilikhinsky or Sverdlovsky district).

The industrial sector of Perm consists 3 separate sectors, located in the Motovilikhinsky, Dzerzhinsky and Sverdlovsky district. The largest areas are stretched along the banks of the Kama River, including the Krasnij Oktojbri, Zaimka and Vyška parts. North from the central part of the city air, ship and chemical plants and factories are to be found. A major industrial enterprise of Perm is Motovilikha faktory, a metallurgical and military industrial plant producing aircraft and rocket engines since 1736. From the central city it is 3 km away. The space between the central city and industrial sector is made up of workers' wooden houses from the end of 19th century (Slavijnova Street), which are gradually absorbed by more modern housing and administrative buildings. In the 60's of the 20th century a new Vyshka I and Vyshka II settlements in the area along the "northern" industrial zone were built. The population (almost 180 thousand) is among the largest in the city. However, by the number of inhabitants, the Sverdlovsky district (219 115 inhabitants to 1st January 2017) is the largest city. Housing estates such as Krochaleva, Jubilejski or Vladimirski) are located there.

The central city of Perm has a concentric character. Due to a rather large area and possibilities of expansion in the suburban zone, new development projects in city parts are being introduced. These are administrative parts of the city, but have a purely rural character. From the city center they are geographically separated (even in the order of tens of kilometres) and form separate city quarters. These are units on the right bank of Kama River (eg Khimiki, Nalimicha, Kirova, Zaozerje, etc.), where availability and connection with the center is limited to only 3 bridges. In the northern part of the city, where the administrative border can be found, Kamska reservoir is located, stretching over a total length of 272 km, to the cities of Bezerinki and Solikamsk.

The southern part of the city gradually turns into a rural area and the area begins to grow together with surrounding villages.

SUMMARY AND CONSLUSION

Comparison of the urban development of both cities (Perm and Samara) was carried out based on a field survey of the territory, an analysis of map data and available literature. Looking at satellite images of both cities, common elements can be found in the form of rivers, similar relative altitude and the character of buildings. From a personal perspective, Samara is a nicer city than Perm based on historical foundations. While Perm is a modern cosmopolitan city whose "historical" foundations are industrial traditions. Common transport, political and administrative aspects of the city development demonstrate the importance of both cities within structure of the Russian Federation. Urban development during the era of Soviet Union has created new elements in the structure of the city – housing construction of housing estates, construction of new administrative buildings (administrative, regional/ministerial sites, etc.). The ground plan of both cities is a chessboard street network composed of main communication axes (backcloth/ boulevards). The main feature of both cities is a visible breakdown into functional sectors according to the Hoyt model typical for American cities. According to Hoyt (1939), sectors are concentrated from the historic centre of the city along major communication axes. Along these, important industrial, industrial and partly residential areas of the city are concentrated.

REFERENCES

AFONTSEV, S., KESSLER, G., MARKEVICH, A., TYAZHEL'NIKOVA, V. and VALETOV, T. Urban Households in Russia and the Soviet Union, 1900-2000. Size, Structure and Composition. IISH-RESEARCH PAPER 44. Amsterdam, 2005.

ANDRIENKO, Y. 1997. "*Case Study of Kazan*". The New Economics School, Moscow. Mimeo, 1997.

BAAR, V. *Národy na prahu 21. století – Emancipace nebo nacionalismus?* 2. vyd. Ostravská univerzita (Ostrava): Tilia, Šenov, 2002. 415 s. ISBN 80-86101-66-5.

BAAR, V. *Decentralizační a dezintegrační procesy v Ruské federaci v 90. letech minulého století.* 1.vyd. Ostrava: Ostravská univerzita, 2005. 231 s. ISBN 80-7368-141-2.

BAAR, V. Postsovětský prostor po dvaceti letech. *Geografické rozhledy*. 2010, roč. 19, s. 9-10. ISSN 1210-3004.

BOUZAROVSKI, S., SÝKORA, L. and Matoušek, R. Locked-in post-socialism: rolling path dependencies in Liberec's district heating system, *Eurasian Geogr. and Economics*. 2016, 57, 4-5, 624-642.

HILL, F. and GADDY, C. *The Siberian Curse: How Communist Planners Left Russia out in the Cold*, Washington: The Brookings Institution, 2003.

HOYT, H. 1939: The structure and growth of residential neighborhoods in American cities. Washington, DC: Federal Housing Administration. Published In Adams John S. *Progress in human Geography 29.* 2005, 3, pp. 321–325.

KOLOMAK, E. Assessment of the urbanization impact on economic growth in Russia. *Regional research RUSSIA*, 2012, VOL. 2, NO. 4, PP. 292–299.

KRÁLOVÁ, I. Urbanistická a funkční struktura města Plzně. In Matušková, Alena – Novotná, Marie (edd.), *Geografie města Plzně*, Plzeň 2007. ISBN 978-80-7043-558-8. Plzeň: Západočeská univerzita v Plzni, 2007.

KUBEŠ, J. a kol. *Urbánní geografie Českých Budějovic a Českobudějovické aglomerace I.* Vydal: Ústav vedy a výskumu Univerzity Mateja Bela v Banskej Bystrici, 2009. 166 s. + přílohy. ISBN: 978-80-8083-733-4.

KUBEŠ, J. a kol. *Urbánní geografie Českých Budějovic a Českobudějovické aglomerace II.* Vydal: Ústav vedy a výskumu Univerzity Mateja Bela v Banskej Bystrici, 2009. 189 s. ISBN: 978-80-8083-734-1.

LAPPO, G. M. and POLYAN, P. M. Urbanization in Russia by the End of XX Century, *Mir Rossii*, 1999, no. 4, pp. 35–47.

Lehmann, S. G. and Ruble, B. A. From 'Soviet' to 'European' Yaroslavl: Changing neighbourhood structure in post-soviet Russian cities. Urban Studies, 1997, Vol. 34, No. 7, pp. 1085-1107.
https://doi.org/10.1080/0042098975745

MOLODIKOVA, I. and MAKHROVA, A. Urbanization patterns in Russia in the post-Soviet era. In Stalinov, Kiril. *The Post-Socialist City*, Springer 2007, pp 53-70.

MULÍČEK, O., OSMAN, R. a SEIDENGLANZ, D. Time-space Rhythms of the City – The Industrial and Post-industrial Brno. *Environment and Planning A*, SAGE, 2016, roč. 48, č. 1, s. 115-131. ISSN 0308-518X. https://doi.org/10.1177/0308518X15594809.

OUŘEDNÍČEK, M. a TEMELOVÁ, J. eds. *Sociální proměny pražských čtvrtí*. Academia, Praha, 2012. ISBN: 978-80-200-2064-2.

OUŘEDNÍČEK, M. a SÝKORA, L. Současné změny v rozmístění obyvatelstva a v sociálně prostorové struktuře Prahy. *Demografie*. 2002, 44, č. 4, str. 270-272. ISSN 0011-8265.

POLYAN, P. M. and SELIVANOVA, T. I. Metropolitan areas of Russia and the new trends of their network (1989-2002). RAS Bulletin (Izvestia RAN), Geography series. 2007. № 5. pp. 18-26.

SKOKAN, L. *Rusko. Geografický přehled*. 1.vyd. Ústí nad Labem: Univerzita J. E. Purkyně, 2005. 215 s. ISBN 80-7044-647-1.

STANILOV, K. and SÝKORA, L. Planning, markets and patterns of residential growth in post-socialist metropolitan Prague. *Journal of Architectural and Planning Research*. 2012, 29 (4), 278-291.

SÝKORA, L. a MULÍČEK, O. Prague: Urban Growth and Regional Sprawl. In: Stanilov, K. and Sýkora, L., eds. 2014. *Confronting Suburbanization: Urban Decentralization in Postsocialist Central and Eastern Europe*, pp. 133-162. Studies in Urban and Social Change, Wiley-Blackwell.

SÝKORA, L. and STANILOV, K. The Challenge of Post-socialist Suburbanization. In: Stanilov, K. and Sýkora, L., eds, 2014, *Confronting Suburbanization: Urban Decentralization in Postsocialist Central and Eastern Europe*, pp. 1-32. Studies in Urban and Social Change, Wiley-Blackwell.

SÝKORA, L. Post-Socialist Cities. In: Kitchin. R.. Thrift. N. eds. *International Encyclopedia of Human Geography*. 2009, Volume 8, pp. 387-395. Oxford, Elsevier.

SÝKORA, L. Revolutionary change, evolutionary adaptation and new path dependencies: socialism, capitalism and transformations in urban spatial organizations. In: Strubelt. W.. Gorzelak. G.. eds. City and Region. *Papers in Honour of Jiří Musil*, 2008, p. 283-295. Budrich UniPress, Leverkusen Opladen.

SÝKORA, L. Výzvy postsocialistického města. *Era*. 2007, 21, č. 2, s. 54-57.

VOLCHKOVA, N. "*Case Study of Samara*". The New Economics School, Moscow. Mimeo, 1997.

YAKOVLEVA, N. 1998. "*Case Study of Tver*". The New Economics School, Moscow. Mimeo, 1998.

Shrnutí

Ruská federace po rozpadu Sovětského svazu v roce 1991 prošla mnohými politickými, ekonomickými, socio-kulturními i environmentálními změnami. Tyto změny se mj. odrážejí i ve vzhledu ruských měst. Příspěvek přináší srovnání dvou měst nacházejících se v evropské části Ruské federace – Permu a Samary. Obě města mají mnoho společných aspektů historického vývoje. Vlastní srovnání je provedeno podle sektorového modelu podle Hoyta (1939) na ukázce vývoje obytných, průmyslových a volnočasových funkcí. Hlavním cílem je dokázat na společný vývoj obou měst, jejichž největší rozkvět byl za éry Sovětského svazu.

Společné dopravní, politické a administrativní aspekty vývoje města dokládají důležitost obou měst v rámci sídlení struktury Ruské federace. Urbanistický vývoj během éry Sovětského svazu zapříčinil ve struktuře města výskyt nových prvků – bytové výstavby sídlištního typu, výstavba nových administrativních budov (sídla administrativy, kraje/oblasti, ministerské budovy apod.). Půdorysný základ obou měst tvoří šachovnicová uliční síť složená z hlavních komunikačních os (prospektů/bulvárů). Hlavním rysem obou měst je viditelné členění na funkční sektory podle Hoytova modelu typického pro americká města. Podle Hoyta (1939) jsou sektory (výseče) koncentrovány od historického středu města podél hlavních komunikačních os. Podél nich jsou koncentrovány významné obslužné, průmyslové a částečně obytné sektory města.

NITRA WINE REGION – THE MOST DIVERSE WINE REGION IN SLOVAKIA

Jana Némethová, Marek Civáň

Department of Geography and Regional Development, Faculty of Natural Sciences, Constantine the Philosopher University in Nitra, Trieda A. Hlinku 1, 949 74 Nitra, Slovakia

jnemethova@ukf.sk

Abstract: Viniculture and wine-making belong to the traditional production sectors in Slovakia. Their development has been closely associated with the economic and cultural progress in the particular regions along with the ecological figuration of landscape. In the first part, the paper deals with the whole Slovak wine area that does not represent the most important one from the worldwide point of view. Its internal structure is presented along with the particular wine regions and their districts. There are pointed out natural conditions determining the variety of grape in Slovakia. The core part of the paper pays attention to the Nitra wine region, although it is not the most significant one within the Slovak wine area, but it belongs to the most perspective areas due to its development potential in wine production and wine tourism. Viniculture has a strong tradition there; hence it represents a contribution to the development of rural economy.

Key words: Slovak wine area, viniculture region, varietal structure, wine routes, wine tourism

1 INTRODUCTION

Slovak natural conditions predestine our terroir especially to cultivation of white varieties of grape vine, but the remarkable notes are registered also within the red varieties. Slovak viniculture and its wines have been increasingly promoting at international events and markets. Right because of this tendency, there comes up a demand for monitoring of wine regions and their districts in order to reach the production of grape of the highest quality (Karlík, Charvát, 2014). Slovakia got 11 gold and 37 silver medals at the 23rd Vinalies Internationales Competition 2017 that was held in Paris, France. Even 214 Slovak wines took part in the aforementioned event (Denník Pravda, 2017), thus Slovakia confirmed an originality of national wines within the strong global competition.

Before 2009, viniculture in Slovakia was mainly affected by German viniculture school that put emphasis on the variety of grape vine. That situation changed in 2009 through the reform of law and therefore the Slovak viniculture switched to French system, also called “terroir school”, which pays attention to the origin of grape vine that is reflected in the label on bottle and it points out a relation of wine to its region. Since 1989, Slovakia has undergone many structural changes within the scope of large-area production of grape vine. Viniculture and wine-making has rarely remained as a stabile component of large agricultural enterprises. The period of transformation was typical by separation of wine-making apart from the large-scale production, while new smaller entities with legal form were usually introduced. The conditions for cultivation of grape vine along with the wine-making sector in Slovakia – after its accessing to the EU – are specified in the Act No 182/2005 on viniculture and wine-making, which took into a consideration quality and quantity of viticulture and wine-making production that has been required by current worldwide trends. These changes were stipulated within its novelization in the Act No. 238/2007 as well as in the EU Council Regulation No 479/2008 Coll. on the common organisation of the market in wine, which is included in the Common Agricultural Policy of the EU. Based on that, the Ordinance of the Government of the Slovak Republic No. 341/2008 Coll. on the conditions for granting aid for the permanent cessation of planting of vineyards was released. It was supported by the Ordinance of the Government of the Slovak Republic No. 340/2008 Coll. on the conditions for granting aid for the common organisation of wine market (Habán et al., 2010). Economy of production in viniculture and wine-making sector has undergone many development stages, which foreshadowed a switchover from quantitative to qualitative production (Dougherty, 2003, Jones, 2003). Altogether, those facts lead to the efforts of particular wine-making enterprises in Slovakia to the continuous improvement of production technology in order to offer high quality products at national market, which would direct Slovak customers to buy and consume just Slovak products (Korgó, Zentková, 2010). The specific features of viniculture and wine-making in the particular Slovak regions were the matter of studies by geographers, such as Spišiak (2002), who was concentrated on viniculture in the Little Carpathian wine region; Spišiak (2010) was focused on the Tokaj wine region, while Némethová (2013) paid attention to the Nitra wine region. The mentioned issues were also explored abroad, for example in Croatia, where some studies were published by Smrkulj and Njavro (2016).

2 METHODS AND DATA

The aim of the paper is to introduce the specific features of the Slovak wine area with the closer focus on the Nitra wine region, due to its high diversity in natural conditions amongst the all regions in Slovakia, while the current wine routes may help sustain the cultivation and processing of grape vine not only in the target region, but in the Slovakia as a whole. Wine tourism – as a form of rural tourism and agritourism – is becoming a suitable additional activity for cultivators of grape and wine-makers in the target area. The participants of tourism usually travel through particular municipalities of such wine region and they get in touch with countryside and may contribute to its further development.

The paper is based on the data analysis coming from the various sources, such as the Situation and Outlook Reports on grape vine by the National Agricultural and Food Centre in Slovakia, Central Control and Testing Institute in Agriculture in Slovakia along with the field survey realized in

2016. The secondary source of data was represented by the analysis of information from the scientific and research literature focused on the selected topic and issues. In order to come up with relevant comparisons and results, there were used standard research methods and techniques based on the comparative analysis of statistical data as well as on the cartographic depiction.

3 SLOVAK WINE AREA

The gradual interannual decrease of vineyards was registered in Slovakia during the period of transformation of agriculture in the 90's. In 1998, the total area of vineyards reached 22,809 ha, while the bearing vineyards were recorded within the area of 19,518 ha. The total area of vineyards fell down by more than a half (12,009 ha) till the end of 2016. The size of bearing vineyards was reduced by 10,646 ha (tab. 1). In the year of Slovakia's accession to the EU, there were 12,248 ha of bearing vineyards, whilst their area decreased by 27.6% compared to 2016. In the mentioned year, just 10,800 ha of vineyards were registered in Slovakia (thence 8,872 ha of bearing ones that represents 82.1% of the total vineyards). The positive fact is that, their share slowly raised from 77.4% in 2004. Data focusing on the bearing vineyards are concerned about the vineyards older than 4 years (tab. 1).

Tab. 1: Structure of vineyard areas in Slovakia [ha]

Year	Total area of vineyards	Non-bearing vineyards	Bearing vineyards
1998	22,809	3,291	19,518
2000	22,227	4,696	17,531
2003	17,551	4,479	13,072
2004	15,831	3,583	12,248
2005	16,772	3,343	13,429
2006	16,262	4,118	12,145
2007	15,903	4,059	11,844
2008	15,722	5,742	9,980
2009	14,876	5,282	9,594
2010	14,475	5,249	9,225
2011	13,954	3,727	10,226
2012	12,616	2,003	10,612
2013	11,773	1,432	10,341
2014	11,074	2,135	8,939
2015	11,159	2,286	8,873
2016	10,800	1,928	8,872
Decline	-31.8%	-46.2%	-27.6%

Source: Šajbidorová, 2007, 2011, 2012, Meravá, 2016, 2017
Note: Decline between the year 2016 and 2004 [%]

In 1998, the harvest of grape in Slovak Republic reached 75,592 tons, while the yield was at the level of 3.95 ton per hectare. Till 2016, the production of grape declined to 37,832 tons. On the other hand, there is a positive finding that the yield increased to 4.34 t/ha (tab. 2). Within the comparison of the years 2016 and 2004, there is recorded a decrease not only in the total area of bearing vineyards (-27.4%), but also in the production (-33.1%) and yield (-7.9%). From the viewpoint of the structure of grape, the vast majority (99.0%) was represented by must varieties. In 2016, they covered the area of 8,872 ha (96.7%), while table grapes occupied just 182 ha (2%) and the rest (1.3%) consisted of hybrids of the all varieties (Meravá, 2017).

Tab. 2: Development of harvest areas of bearing vineyards, their production and yield in Slovakia

Year	Area [ha]	Production [t]	Yield [t/ha]
1998	19,518	75,592	3.95
2000	17,531	61,092	3.50
2004	12,003	56,537	4.71
2005	13,130	54,103	4.12
2008	9,650	51,617	5.35
2010	8,152	21,120	2.59
2011	9,930	49,015	4.94
2012	10,492	52,209	4.98
2013	10,039	53,227	5.30
2014	8,757	38,450	4.40
2015	8,803	50,158	5.70
2016	8,712	37,832	4.34
Decline	-27.4	-33.1	-7.9

Source: Šajbidorová, 2007, 2011, 2012, Meravá, 2016, 2017
Note: Decline between the year 2016 and 2004 [%]

A consumption of wine in Slovakia has gradually decreased, especially due to the notably subsidized wines that come mostly from the Southern Europe states. In 2015, the total consumption reached 80,210 litres, while the consumption per capita was at the level of 14.8 l, representing a decline in comparison with 2014 (18.6 l) (Meravá, 2017). Production of wine from grape grown in Slovakia is significantly lower than the total level of consumption. During the last 10 years, Slovak production has covered approximately 50% of national demand for wine. The volume of annual production has been changing because of climate conditions during the particular year. Slovakia is not a self-sufficient country within the wine production, thus the import is focused on the cheaper and poor-quality wines from abroad. The field of viniculture is undergoing many qualitative changes not only in Slovakia, but also in the Czech Republic. There are registered changes in consumption habits of population, while the demand for high-quality wines especially from domestic provenance is on the increase. Naturally, that cannot be successfully done without a thorough care of vineyards during the whole vegetation period (Svobodová, Věžník, Král, 2014).

Import of wines, musts and juice to Slovakia reached the highest value (1,037 thousand of hectolitres) in 2014/2015 (tab. 3). On the other side, Slovakia has only a minor position within the international export of wines or musts. In the period 2002 – 2017, average volume of export reached just 140,000 hectolitres per year. Slovakia is typical for import of table grape wines that prevailed over the must wines. Generally, import of table grape into Slovakia has been about 13,000 tons (annually) during the last five years. Within the foreign trade with wine and grape, Slovakia has registered a negative balance in the long-term period. The most significant importers of table grape are Italy and Germany, while Hungary has a major position in the import of must. Slovakia exports a must grape mostly to the Czech Republic and table grape to Hungary. Within the comparison with neighbouring countries in the wine year 2014/2015, Slovakia produced 294,000 hectolitres of wine, while Czech Republic 536,000 hectolitres and Hungary even 2,773,000 hectolitres of wine (Meravá, 2017).

Tab. 3: Balance of sources of wine and its consumption in Slovakia

Season	A	B	C	D
2002/03	270	340	629	129
2003/04	128	515	583	72
2004/05	226	409	554	99
2005/06	355	302	551	115
2006/07	418	328	602	128
2007/08	432	358	594	129
2008/09	374	433	638	94
2009/10	440	346	666	128
2010/11	709	207	757	91
2011/12	663	369	716	168
2012/13	580	325	694	168
2013/14	902	373	731	201
2014/15	1,037	294	1,010	180
2015/16	740	376	802	209
2016/17	576	310	*638	184
Change	154.8	-24.2	15.2	85.9

Source: Šajbidorová, 2007, 2011, 2012, Meravá, 2016, 2017
Explanatory notes: A – Import of wines, must and juice; B – Production of wine from national grape; C – National consumption of wine; D – Export of wines and musts [thousands of hl]
Notes: Change between the season 2016/2017 and 2004/2005 [%]; * – estimated

Wine regions in Slovakia belong to the "B" zone according to the European regionalisation. Summarily, in Slovakia there are 6 wine regions that consist of 40 districts located in 603 municipalities (Fig. 1).

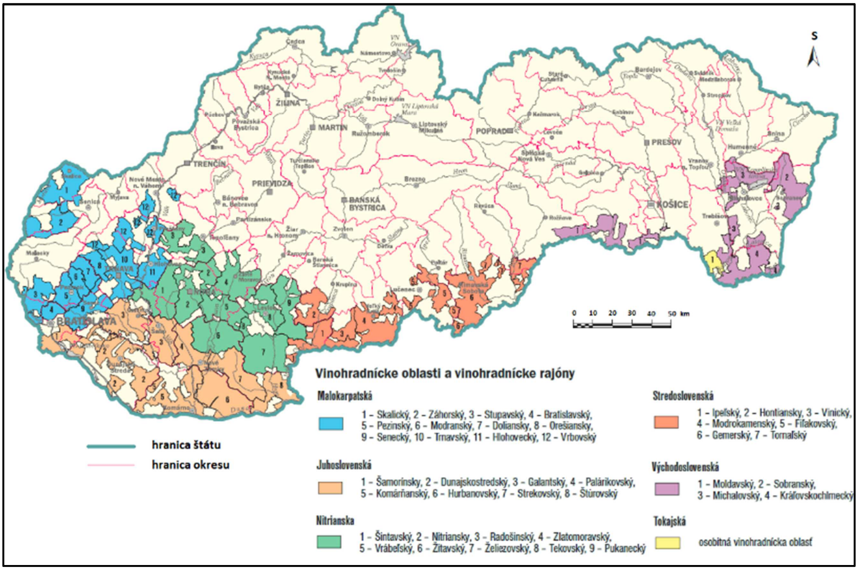


Fig. 1. Slovak wine area including particular regions and districts.
Source: Viticultural Regions, Landscape Atlas of the Slovak Republic, 2002

The Southern Slovakian wine region is the largest Slovak wine region, since it occupies 5,031 ha (28.6% of the all regions). The second one is the Little Carpathian wine region that covers 5,004 ha (28.4%) (data valid in 2016). The Nitra wine region, the target area, consists of vineyards, which summarily cover 3,182 hectares (18.1%), the Central Slovakian wine region occupies the area of 2,163 ha (12.3%), while the Eastern Slovakian wine region covers just 1,132 ha (6.4%) and the smallest one is the Tokaj wine region consisting of 1,086 hectares (6.2%) (Meravá, 2016). Almost 80% of vineyards are located in the Western Slovakia, 13% are situated in the central part of the country and the rest (7%) is located on the east. In accordance with Šima (2006), Slovakia has a rich tradition in viticulture and winery, especially in areas located on south, where the most traditional regions are situated. Each of the wine regions has its own natural conditions that may have a significant influence on the production of grape as well as the quality of wine. Slovak wine regions are located on (or very close to) the northern borderline of cultivation of grape vine in Europe. Long-term natural conditions do not enable to reach harvests and yields comparable with the other regions in southern parts of Europe with higher average temperatures and precipitation. A geological substrate of Slovak wine regions is very different. On the one hand there are crystalline rocks, limestones, volcanic rocks, but fluvial or eolian sediments on the other hand. The mentioned diversity is underlined by high level of topo-climatic variability that creates a large potential in terms of typicalness of Slovak wines (Slovenská agentúra pre cestovný ruch, 2015). The optimal combination of physical-geographical elements of landscape with consequential application to the conditions of viticulture represents terroir of Slovak wines. In Slovakia, the cultivation of must varieties prevails over the table ones. Currently, there are approximately 37 varieties of grape vine of which are produced high quality wines. In Slovakia, there are cultivated varieties typical for the whole region of Central Europe, such as Welschriesling (Rizling vlasšský), Riesling Weiss (Rizling rýnsky), Müller Thurgau, Veltliner Gruen, Chardonnay, Pinot blanc, noir, gris, Sauvignon and Traminer Rot. From the red must varieties, in Slovakia are mostly known Blaufrauenkisch (Frankovka modrá), Saint Laurent (Svätovavrinecké), while planting of some varieties (Cabernet Sauvignon, Alibernet, Portugeiser blau (Modrý Portugal) or André) increased during the last years. In Slovakia, there are cultivated varieties typical for the whole Central Europe, such as Welschriesling, Riesling Weiss, Müller Thurgau or Veltliner Gruen. Their quality is comparable with the wines coming from neighbouring countries – Austria, Czech Republic or Hungary. From the viewpoint of varietal composition of grapevine in Slovakia (valid in 2016), the most widespread variety is Veltliner Gruen (15.1%) followed by Welschriesling (13.3%), Blaufrauenkisch (9.1%) Müller Thurgau (6.7%), Saint Laurent (6.7%) and Riesling Weiss (5.4%). The rest (43.7%) is represented by other varieties (Ústredný kontrolný a skúšobný ústav poľnohospodársky, 2017). The most typical Tokaj varieties include Furmint, Harslevelue (Lipovina) and also a new Zeta. The significant Slovak contribution to international originality of wine is represented by newly cultivated varieties that were created especially because of Slovak geographical conditions. The most favourite white varieties are Devín, Noria, Milia, while the red ones are represented by Dunaj, Hron, Nitria, Rudava, Váh and Rosa (Odrody pestované na Slovensku, 2017). A wide range and offer of foreign wines along with the increased demand of Slovak customers for high quality wines exert a pressure in order to improve the level of quality of grapevine cultivation and its processing.

4 NITRA WINE REGION

It is assumed that the foundation of the Nitra wine region was formed by Benedictine monks of Zobor Abbey dedicated to Hippolytus of Rome in 9^{th} century. From the administrative point of view, the target territory is situated in the northern part of the Nitra Self-Governing Region and a small part of the Trnava Self-Governing Region (Fig. 1). Vineyards are cultivated along the hillsides of Považský Inovec and Tribeč and also by loessal uplands of the Danubian Lowland (Podunajská nížina). These soils are known for high proportion of skeleton and special mineral basis, what together create a great assumption for production of wines typical for their variety and high quality. The majority of vineyards are oriented on the southern, respectively south-eastern side that ensures sufficient amount of sunshine throughout the whole year. Grapevine is usually cultivated on chernozems or luvisols. Within the soil texture, the most often soils are loamy soils (almost 60%), while the share of other soils (especially sandy or clayey) is significantly lower. Vineyards are usually located at the landscape from 100 to 350 m a.s.l. Inclination of relief reaches values up to 15°. The total amount of precipitation during a vegetative period usually achieves

570 mm, while the average temperature gets approximately 18°C. The length of sunshine during a vegetative period reaches 3,200 hrs. Districts belonging to the Nitra wine region are classified into B1 or B2 category. The total area of official registered vineyards was 4,029 ha (in 2004), what represented 19.1% share of the all registered vineyards in Slovakia. In 2015, there are registered vineyards covering just 3,391 ha that make 18.4% share of all registered Slovak vineyards (18,437 ha). The four places known for rich wine-making tradition are located here – Nitra, Vráble, Sereď and Topoľčianky. The Nitra wine region includes 9 wine districts formed by 158 wine municipalities. In terms of varieties, the majority (74.7%) is represented by white varieties and the rest (25.3%) belongs to the red ones. Among the white must varieties, there are much known Welschriesling, Riesling Weiss, Traminer Rot, Pinot blanc and gris, Chardonnay, Sauvignon, while in the less extent Veltiner Gruen, Müller Thurgau. From the red varieties, the most favourite ones are Cabernet Sauvignon, Blaufrauenkisch, Saint Laurent or Pinot noir. Other less known varieties are on the increase of popularity, such as Devín, Dunaj and Hron.

The Nitra wine region is known for some significant producers of wine or cultivators of grapevine. From the Nitra wine district, there are examples represented by VÍNO Nitra, Agricultural Cooperatives in Mojmírovce and Ivanka pri Nitre, Ing. Peter Belan from Mojmírovce, Ladislav Trnovec from Nitra. From the Radošina wine district, well known is the Agricultural Cooperative Radošinka in Veľké Ripňany, followed by Pivnica Radošina and SHR VÍNO Viliam Uhlár in Tesáre. From the Šintava wine district, there are producers such as HUBERT J. E. in Sereď, Vinidi located in the municipality of Báb, Šintavan from Šintava, TERRA WYLAK from Veľké Zálužie or Ing. Milan Chudý, the owner of VÍNNA PIVNICA in Vinohrady nad Váhom. In the Vráble wine district, there is a wine-producing company TAJNÁ in the municipality of the same name, VINANZA in Vráble, TRITICUM that is also from the small town Vráble, AGROVINOL from the municipality of Vinodol, AGROPEST in Veľký Cetín and the wine-maker Marián Čajkovič from Vráble. The Tekov wine district is known thanks to the company Víno Levice located in the Levice town, Muráni Víno Čajkov in the municipality of Čajkov, Frtus Winery in Levice and the wine-maker Branislav Nichta – VÍNO NICHTA from Čajkov. The Žitava wine district is represented by Víno VELKEER 1113 situated in the municipality of Veľký Kýr or Agricultural Cooperative in Dolný Ohaj. There is just one significant producer in the Želiezovce wine district that is called BIOCENTRUM from Želiezovce (field survey, 2016). According to the currently unfavourable situation of viticulture and wine-making, the result is that the number of small producers in various parts of Slovakia is on the decrease, especially due to a low ratio of profitability of production, difficulties with sale of the final production and also because of a high pressure coming from imported cheap wines. A low rate of the saleability of final products and relatively hard conditions to succeed at the market, usually force small producers to make wines of such quality that is competitive with various larger companies from Slovakia as well as foreign producers. At least they want to get similar parameters of wine, which are typical for many international producers, mostly because of continual technological progress (Korgó, Zentková, 2010). Wines produced in the Nitra wine region are sold not only at specialized shops, but also at supermarkets throughout the whole country. Producers of wine have their irreplaceable position in the field of wine tourism and promotion of wine routes that are linked with the particular region, district or municipality.

The perspective for sustaining of employment in Slovak countryside lies in the effective realization and propagation of wine tourism and wine routes. Wine tourism is popular in Slovakia mostly in different tourism regions (hereinafter referred to as "TR"), such as Bratislava TR, Záhorie TR, Lower Váh River TR, Nitra TR, Upper Nitra TR, Ipeľ River TR and Dolný Zemplín TR (Habán et al., 2010). In Slovakia, there are currently various public wine routes (hereinafter referred to as "WR") that are used for promotion of wine tourism, e.g. Little Carpathian WR, Nitra Royal WR, Tokaj WR, WR of Záhorie, Hont WR, Kamenín WR, WR of Modrý Kameň, WR of Požitavie, Turňa WR, Strekov WR and Záhorie WR. In general, they promote wine-making, viniculture and wine tourism along with the traditional crafts and local gastronomy. Wine tourism has potential to contribute to eliminate social and cultural differentiations among various Slovak regions; therefore these activities are often supported by local and regional authorities. Large positive economic impacts of wine tourism in Lednice-Valtice Cultural Landscape are strongly highlighted in the paper by Šauer and Repík (2014). This paper is focused on the wine routes within the Nitra wine region, especially on the Nitra Royal Wine Route (hereinafter referred to as "NRWR") and the Wine Route of Požitavie. The first one is the longest and largest within the comparison with other routes in Slovakia. It was registered in 2003 as a voluntary association of natural and legal persons. The NRWR comes through the climatically warmest wine regions – Nitra and Southern Slovakian. It has 4 separate branches that come together in the city of Nitra. The Upper Nitra branch is located near the spring of the Nitra River (Fačkovské sedlo), the Tekov branch is set from Topoľčianky and Pukanec, while the Southern Slovakian branch comes from Dunaj (Mužľa) and Váh branch is situated by Vrbové and Sereď (Haban et al., 2010). It comes through four self-governing regions of Slovakia, while the Nitra Self-Governing Region is the only one that is suitable for cultivation of grapevine almost in the whole extent. The NRWR is mainly devoted to the restoration of old festivities and ceremonies typical for harvest of grape, such as Nitra Wine Festival at the Svätopluk Square, Zobor Wine Festival at the park in the Sihoť city district, Lucy's sorcery by the wine, a traditional wine festival in the municipality of Topoľčianky, Vráble festival of grape harvest, Open Day at the Chateau Topoľčianky that includes public degustation of various wines, Saint Urban Day – patron of wine-makers, wine dedication, or other small events focused on degustation or various tastings of wines along with their evaluation at cultural, social and folk events. Visitors can degust products also at manifold craft fairs or feasts (field survey, 2016). Some of them take place in nature – right in vineyards; others are realized at castles or mansions, social and cultural rooms or typical old wine cellars. The Wine Route of Požitavie was founded at the beginning of 2009 in respect of an agreement between the Požitavie Region and 74 municipalities including the Zlaté Moravce, Vráble and Želiezovce wine districts. Different wine traditions are associated with the openings of wine cellars on St. Urban Day in the Vráble town and the municipality of Dolný Ohaj. Víno Vráble organizes an exhibition focused on wine degustation, while there is an event called “Vráble festival of grape harvest”. Events on Saint Urban Day usually take place in each wine municipality belonging to the Wine Route of Požitavie (field survey, 2016). During every year, many municipalities organize various events that are associated with wine, such as local exhibitions and tastings, dancing balls, which enable promotion of wine and wine-makers. Wine routes and products of wine tourism that are organized within the Nitra wine region present a very strong perspective for sale of wine to tourists as well as a good chance for sustaining of employment in the rural parts of region. The term “wine tourism” does not include only tastings, sittings and routes, but it covers more activities that are often sought in the particular wine areas. Some of them are represented by recognizing of local gastronomy and traditional food typical for municipality, town or region. There are other new opportunities that are going to reach more popularity, e.g. wine cycle-routes, which enable not only degustation, but active life style associated with sightseeing of important cultural and historical places.

5 CONCLUSION

Currently, the quality of wine is preferred to its quantity production. The viticulture and wine-making industry in Slovakia are wending this way. There are very good natural conditions for cultivation of grapevine, which create possibilities to enlarge areas of vineyards within the particular wine areas in Slovakia. The size of vineyards would rise along with the amount of produced wine that would strengthen self-sufficiency of Slovakia in its production. Taking into account the former development of viniculture and wine-making in Slovakia that brought a significant decline of vineyard areas by more than 50%, the future may bring another reduction of areas together with the drop in the amount of cultivated grapevine and produced wine. A favourable development of viniculture and wine-making industry in Slovakia may be achieved through production of wine with a designation of origin. Currently, especially cheaper wines from abroad are more available for Slovak customers. On the other hand, wines made in Slovakia are often typical for higher quality, but inputs are higher, while subsidies are lower, what is reflected in more expensive price. The Nitra wine region produces original wines that may help this region become attractive place for wine tourism in Slovakia. Presently, there is a growing interest for wine routes and wine tourism within the Nitra wine region, what is confirmed by various organized events and a high rate of public attendance. There are usually sold products from local and regional producers and wine-makers coming from this wine region, what brings them an appreciable income that may be reinvested into other future improvements.

The paper was elaborated within the project VEGA 1/0934/17 Land-use changes of Slovak cultural landscape over the past 250 years and prediction of its further development

REFERENCES

CENTRAL CONTROL AND TESTING INSTITUTE IN AGRICULTURE IN SLOVAKIA, 2017.

DOUGHERTY, P. H. eds. 2012. *The Geography of Wine: Regions, Terroir and Techniques*. Springer. 255 pp.

HABÁN, M., OTEPKA, P., HABÁNOVÁ, M., POLÁČEK, M. 2010. *Vidiecky turizmus na vínnych cestách Slovenska*. Trenčianske Teplice: III. Fórum vinárov a vinohradníkov, 2010.

JONES, A. 2003. *Power in Place: Viticulture spatialities of globalization and community empowerment in the Languedoc*. Transactions of the Institute of British Geographers. 27, 11-29.

KARLÍK, L., CHARVÁT, T. 2014. Fyzicko-geografická analýza modranského vinohradníckeho rajónu s ohľadom na pestovanie viniča. *Geografická revue.* 2014, 10(1), 16-38.

KORGÓ, L., ZENTKOVÁ, I. 2010. *Ekonomika výroby vína u vybraných malopestovateľov viniča v Nitrianskej vinohradníckej oblasti*. Trenčianske Teplice: III. Fórum vinárov a vinohradníkov, 2010.

MERAVÁ, E. 2016. Vinič hroznorodý, hroznové víno. (Situation and Outlook Report k 31. 7. 2016). Bratislava: VÚEPP, MPRV SR. Ročník XVIII, 2016. 47 s. ISSN 1339-0937.

MERAVÁ, E. 2017. Vinič hroznorodý, hroznové víno. (Situation and Outlook Report k 31. 7. 2017). Bratislava: VÚEPP, MPRV SR. Ročník XIV, 2017. 49 s. ISSN 1339-0937.

NÉMETHOVÁ, J. 2013. Špecifiká Nitrianskej vinohradníckej oblasti. *Geografické informácie.* 17(2), 93-109.

ODRODY PESTOVANÉ NA SLOVENSKU, 2017. [online]. [cit. 2017-03-10]. Dostupné z http://slovakiawines.com/vinohradnictvo/pestovane-odrody/.

SLOVENSKÁ AGENTÚRA PRE CESTOVNÝ RUCH. 2015. *Slovensko – krajina vína: História.* [online]. [cit. 2016-04-16]. Dostupné z http://www.sacr.sk/uploads/tx_publications/sk_Vino.pdf.

SMRKULJ, H., NJAVRO, M. 2016. Risk management on the winegrowing farms at Northwest Croatia Upravljanje rizikom na vinarsko-vinogradarskim gospodarstvima Sjeverozapadne Hrvatske. *Journal of Central European Agriculture.* 17(1), 221-235. https://doi.org/10.5513/JCEA01/17.1.1693

SPIŠIAK, P. 2010. Tokajská vinohradnícka oblasť na Slovensku. In: *Geografické poznatky bez hraníc: výber z maďarských a slovenských príspevkov z fyzickej a humánnej geografie*. Košice: UPJŠ, 2010, 224-229.
SPIŠIAK, P. 2002. Vinohradníctvo Malých Karpát. *Acta Geographica.* 42, 179-196.

SVOBODOVÁ, I., VĚŽNÍK, A., KRÁL, M. 2014. Viticulture in the Czech Republic: Some spatio-temporal trends. *Moravian Geographical Reports.* 22(1), 2-14. https://doi.org/10.2478/mgr-2014-0001

ŠAJBIDOROVÁ, V. 2007. *Vinič hroznorodý, hroznové víno*. (Situačná a výhľadová správa k 31. 7. 2007). Bratislava: VÚEPP, MP SR, 2007. 47 s.

ŠAJBIDOROVÁ, V. 2011. *Vinič hroznorodý, hroznové víno*. (Situačná a výhľadová správa k 31. 7. 2011). Bratislava: VÚEPP, MPRV SR, 2011. 41 s.

ŠAJBIDOROVÁ, V. 2012. Vinič hroznorodý, hroznové víno. (Situačná a výhľadová správa k 31. 7. 2012). Bratislava: VÚEPP, MPRV SR, 2012. 12 s.

ŠAUER, M., REPÍK, O. 2014. Ekonomické dopady vinařského cestovního ruchu v turistické oblasti Lednicko-Valtický areál. In: Klímová, V., Žítek, V. (eds.) *XVII. mezinárodní kolokvium o regionálních vědách. Sborník příspěvků.* Brno: Masarykova univerzita, 2014. 824-834.

ŠIMO, D. 2006. *Agrárny marketing*. 1. vyd. Nitra: SPU, 2006, 321 s.

VINOHRADNÍCKE OBLASTI. Mierka mapy 1:2 000 000. In: Atlas krajiny SR, 2002. Bratislava: MŽP SR, 2002, s. 139.

Shrnutí

V současnosti se při produkci hroznů a výrobě vína více upřednostňuje kvalita. Tímto směrem se ubírá i vinohradnictví a vinařství Slovenska. Jsou zde velmi vhodné přírodní podmínky pro pěstování vinné révy, které by se v budoucnu mohly odrazit v rozšiřování ploch vinic v rámci vinařských oblastí Slovenska. Tím by nejen vzrostla plocha vinic, ale zvýšilo by se i množství vyrobeného vína a zlepšila by se soběstačnost Slovenska v produkci hroznů a výrobě vína. Ale pokud vycházíme z předchozího vývoje vína Slovenska, který přinesl značný propad ploch vinic víc než o polovinu, může přijít v budoucnu k dalšímu snižování ploch vinic a následnému poklesu sklizených hroznů či vyrobeného vína. Pro příznivý vývoj vína na Slovensku je nejdůležitější produkce vín s chráněným zeměpisným označením. V současnosti jsou pro konzumenty vína cenově dostupnější vína zejména ze zahraničí. Vína vyrobená na Slovensku jsou však kvalitnější, ale vstupy do výroby jsou vyšší, dotace nižší, a proto je i cena vína vyšší. Nitranská vinařská oblast produkuje originální vína, které mohou této oblasti pomoci, aby se stala atraktivní oblastí vinařského turismu Slovenska. V současnosti je o vinné cesty a vinařský turismus v Nitranské vinařské oblasti velký zájem o čemž svědčí několik pořádané akce a poměrně velká účast veřejnosti na těchto akcích, kde se prodává víno výlučně producenty z této vinařské oblasti, což pro poskytovatele těchto služeb a samotnou oblast představuje nezanedbatelný příjem.

UNRECOGNIZED STATE ENTITIES IN THE (GEO)POLITICAL SPACE OF THE 21ST CENTURY

Štěpán Podhrázský

Geografický ústav, Přírodovědecká fakulta Masarykovy univerzity, Kotlářská 267/2, 611 37 Brno

s.podhrazsky@gmail.com

Abstract: A significant part of the international community of states is struggling with an erosion of the basic attributes of statehood and is no longer able to effectively control its own territory. At the same time new entities are emerging in the political space, seeking for the autonomy or even the independence. These entities, known as “unrecognized state entities”, represent “gaps” in the current perception of the political space in which they are not officially identified, despite of their physical presence. Many unrecognized state entities not only fulfill the attributes of statehood and effectively control their territory but they are also able to exceed established states in other characteristics. Nevertheless, the international community of states is often reluctant to their existence. The aim of the paper is to introduce the issue of unrecognized state entities from the point of view of internal and external factors in a broader context.

Key words: state, quasi-state, deviant forms, unrecognized state entities

1 INTRODUCTION

It is nearly impossible to follow all the changes of individual states and connections between them in the political space of the 21st century. Many states are disintegrating and are no longer (or never have been) able to provide even basic services and security for their own population. These states, referred to as “weak”, “failing” or “falling” (Rotberg, 2004) are becoming more and more of the interest not only of the academic community. This is not because of their absence in the past, but rather as a consequence of the change in the perception of the world after 2001 and the declaration of the war on terror. Disintegrated states have become a potential space for establishing of extremist groups, against which the international community, led by the US, along with the promotion of its own interests, in the long term seeks to prevent. The abovementioned terms, which are only a short outline of the whole issue, can generally be summarized as “deviant forms of the state”.

On the other hand, in the political space new entities are emerging. Some of these entities are not only able to provide security of the population, but also functionally fully replace established states. Despite their functionality and physical presence in political space, international community of states is officially refusing to recognize them as states and seeks to preserve the current political division of the world.

The aforementioned issues have already been addressed by a number of important authors on the border of sociology, political science and geography. It is worth mentioning above all Kolstø (2006), Sørensen (2005), Rotberg (2004) and from Czech authors Vaďura (2009) or Riegl (2010). The aim of the authors was to create the most accurate terminology. However, the result is a number of mutually unclear terms which, in my opinion, often do not reflect the qualitative disparity between non-functioning states and newly created functional entities. The aim of the paper is therefore to present these qualitative disparities and to simplify the confusing terminology, especially from the point of view of emerging entities.

2 STATE

Before start working with deviant forms of the state it is necessary to define ideal sovereign state. However, its definition is not the main goal of this article, so it will be simplified and based primarily on classical theories including the Montevideo Convention on Rights and Duties of States. At the same time, it will be taken into account the political-geographic aspect of international recognition, which was brought to the issue by Glassner (1988). The use of the criteria contained in the Montevidean Convention is supported by Kreijen (2004), who considers them to be the "core of the state". He further stated that although the criteria are important for the emergence of the state, we must not forget their importance for its extinction. As a sovereign state, we can, in the scope of this article, consider those political-geographic entities that fulfill the characteristics of territory, population, inner sovereignty and external sovereignty.

- The Territory is a basic spatial framework for the emergence of the state. Except for extreme exceptions, there can be no state without its own territory. Under international law, there is a close link between the territory and the population.
- The population is generally perceived as a social structure that has a settled and permanent character. International law does not allow the creation of a sovereign state without a population. Without population, it would not be possible to exercise public authority within the claimed territory.
- Internal sovereignty is a monopoly of legitimate violence. It represents internally effective entities that have a functioning government which controls and enforces the right of the population inhabiting the territory of the state. At the same time, the entity is able to provide basic services.
- External sovereignty is an international recognition of the independence that Glassner has brought to the issue.

Territory and population, which we also refer to as the geographic aspect of the state, are a mandatory component of every entity claiming status of state. Internal and external sovereignty is a significant qualitative deviation between entities. Entity that has been granted external sovereignty by the international community of states can be officially called as "State". By this act they gain recognition of membership rights in international organizations as well. On the contrary, internal sovereignty represents internal functionality in terms of population and territory control and the provision of basic state services. An entity can be recognized as a state, but it does not have to function internally. It is these entities that are referred to as the “deviant form of the state”. On the hand, internally functional entities without international recognition represent “holes” or “black spots” in the political space, as they do not officially exist. In doing so, they claim and effectively control territories assigned to another entity with recognized state status. They been labeled by many different terms based on minor variations. Therefore, I believe that their collective terminological distinction in the form of “unrecognized state entities” is necessary.

3 DEVIANT FORMS OF THE STATE

The basic factor in evaluating the degree of deviation is ability of the state to provide basic services to the population, to defend their own sovereignty and application the monopoly of legitimate violence within the claimed territory. A special terms used by authors precisely reflects this ability of service fulfilling. Concepts such as juridical statehood (Jackson, Rosberg, 1982), post-colonial state (Sørensen, 2005, p. 75-77), weak state, fragile, failing state, failed state, collapsed state (Rotberg, 2004, Zartmann, 1995), quasi-state (Kolstø, 2006) are again only short list of them. However, when examining the terms in detail, we find that they often refer not only to deviant forms of the state but also to unrecognized state entities (eg Kolstø, 2006), which fulfill completely different characteristics (external sovereignty vs, internal sovereignty) and claim territory at the expense of the deviant forms of the state. Currently fairly successful evaluating of the deviation of the state based on the social, economic and political characteristics called “fragile state index” provides organization called THE FUND FOR PEACE. Nonetheless, I believe that it would be appropriate to include in the evaluation criteria also a separate category of geographical characteristics partly already contained in the political characteristics, mainly because they form the mandatory part of any entity claiming status of the state.

4 UNRECOGNIZED STATE ENTITIES

As previously noted, unrecognized state entities represents “holes” in the current political area where they are not officially present as long as they have not been granted state status. The creation of an unrecognized state entity is conditioned by the geographic characteristics of the state, while at the same time fulfilling the internal sovereignty and trying to gain external sovereignty. In the political space, there may be rebel regions that only demand a higher degree of autonomy or carry out illegal activity without seeking independence. Such regions cannot be titled as unrecognized state entities. The formation of unrecognized state entities is always at the expense of an already established state. Due to the fulfillment of the internal sovereignty of the unrecognized state unit, the original state loses its control over part of the territory and thus the internal sovereignty and becomes the deviant form of the state. Thus, it can be said that the emergence of an unrecognized state entity always creates a deviant form of the state. However, the state may suffer a certain degree of deviation even without the existence of an unrecognized state unit on its territory. These are the rebel regions, or other economic or political problems in the country. Therefore, it is wrong to consistently designate deviant forms of the state and unrecognized state entities.

5 FACTORS AFFECTING THE STATUS OF UNRECOGNIZED STATE ENTITIES

The status and development of unrecognized state entities is influenced by internal and external factors. Internal factors mean the entity's ability to establish itself in political space at the expense of the original sovereign, and also its ability to effectively manage the claimed territory. External factors represent the relationship of the newly established entity to the original sovereign, the international community of the states and regional/global powers.

Status of the entity is always the result of combination of internal and external factors. Internal factor of the entity's ability to establish itself can be partially replaced by external factors, especially by support from the regional/global power, as is shown by current events in South Ossetia, Abkhazia or the Turkish Republic of the Northern Cyprus. The approach of the central government of the original sovereign to the emergence of a new entity is, with exceptions, always negative, as its position is weakened. The sovereign's functional status plays an important role. It is easier for new entity to establish itself in the area of non-functional state which was unable to control its territory even before appearance of the entity. In the case of the creation of several entities within a single state, their chances for establishment are increased. An example of the state facing such problems is Federal republic of Somalia, where a number of entities headed by Republic of Somaliland and Puntland State of Somalia have been established. The relationships between the factors affecting the entities, their combinations and the anticipated development of the entities are summarized in table 1.

Since the beginning of the 21st century, many entities have been trying to establish themselves in the political space. To achieve the geographical characteristics of the state and at least partially to fulfill the internal sovereignty, only about 20 of them succeeded. These entities represent a table 2, which further analyzes their expected development, due to the internal and external factors summarized in Table 1. The degree of fulfillment of factors cannot be determined unequivocally in some specific cases. In such situations, the factor is considered negative. The most common causes of this condition are:

- internal sovereignty – the entity effectively controls only part of the claimed territory, controlled borders are highly variable,
- external sovereignty – the entity was recognized only by a part of the international community of the states,
- central government – the territory of the entity does not claim a different state/entity was perceived as a state, but it is losing its position in the long term,

- international community of the states – the approval by the international community is inconsistent. An entity is supported by significant number of states, including global or regional powers,
- regional/global power – the entity is supported only by an unofficial path. At the same time, global/regional power does not guarantee the existence of an entity.

Both internal and external factors are subject to change over time. Therefore, it is possible that in the future entities which, based on the present conditions are predetermined to elimination, will be recognized as sovereign states and vice versa. As can be seen from Table 2, the most unrecognized state entities are created in the political space without external support and their gradual elimination can be assumed. The second most common type of unrecognized state entities is those supported by the regional/global power. The existence of an entity can be assumed at least during the period of support. The primary prerequisite for this type of unrecognized state entity is the stronger position of the guarantor over the sovereign. At the same time, it can be expected that entity will enhance the control over the claimed territory. Unrecognized state entities supported by a significant part of the international community are in fact functioning as independent states. Their overall acceptance often hinders the (geo) political interests of the global powers as can be seen in case of the Republic of Kosovo.

6 CONCLUSION

Unrecognized state entities represent qualitatively different units as opposed to deviant forms of the state, mainly because of their genesis and their ability to fulfill the different characteristics of the state. The basis of both categories is the fulfillment of mandatory geographical characteristics in terms of territory and population, but the deviant form of the state has been officially recognized by the international community. On the other hand, the deviant form of the state lacks internal functionality. Thus, it is unable to secure one or more characteristics or services of the state. An unrecognized state entity is, on the contrary, capable of providing internal functionality, but it lacks international recognition, also referred to as external sovereignty. The existence of an unrecognized state entity is always at the expense of an established state, from which it forms a deviant form of the state, as it takes effective control over part of the territory. The emergence of a deviant form of the state is not conditioned by the emergence of an unrecognized state entity, because deviations may be caused by different factors. Unrecognized state entities in the political space of the 21st Century illustrated the Table 2 including their predicted development based on internal and external factors that influence their development. The future development of the most widely represented type of unrecognized government departments is elimination due to insufficient support from external factors. However, individual influences are subject to change over time. Therefore, the future establishment of certain entities in the international community of states cannot be ruled out.

Tab. 1: Relationships between the factors affecting the entities, their combinations and the anticipated development of the entities claiming status of sovereign state

Type of the entity	Sovereignty		Supported by: Central government	Supported by: International community	Supported by: Regional (global) power	Predicted entity status
Internationally unrecognized and non-functioning entities	Inner	NO	NO	NO	YES	Unrecognized state entity, internally inefficient
					NO	Elimination
	Outer	NO	YES	NO	YES	Unrecognized state entity, internally inefficient
					NO	Elimination or unrecognized state entity, internally inefficient*
Non-functioning entities	Inner	NO	-	YES	YES	Internationally recognized sovereign state, internally inefficient
					NO	
	Outer	YES	-	YES	YES	
					NO	
Internationally unrecognized entities	Inner	YES	YES	NO	YES	Unrecognized state entity, internally efficient
					NO	Elimination or unrecognized state entity, internally efficient*
	Outer	NO	NO	NO	YES	Unrecognized state entity, internally efficient
					NO	Elimination
Internationally recognized and functioning entities	Inner	YES	-	YES	YES	Sovereign state, internally efficient
	Outer	YES	-	YES	NO	

*** depending on the power of central government**

Source: by Štěpán Podhrázský

Tab. 2: List of unrecognized state entities existing in the 21st century and their relation to internal and external factors, assumed development and their current status

Entity	Inner sovereignty	Outer sovereignty	Central government	International community	Regional (global) power	Predicted entity status	Entity status
Abkhazia	YES	NO	NO	NO	YES	Unrecognized state entity, internally efficient	Existing
Aceh	Partly	NO	NO	NO	NO	Elimination	Eliminated
Anjouan	NO	NO	NO	NO	NO	Elimination	Eliminated
Azawad	Partly	NO	NO	NO	NO	Elimination	Eliminated
Cabinda	NO	NO	NO	NO	NO	Elimination	Eliminated
Casamance	Partly	NO	NO	NO	Partly	Elimination	Eliminated
Democratic Federation of Northern Syria	YES	NO	NO	NO	Partly	Elimination	Existing
Donetsk People's Republic	Partly	NO	NO	NO	YES	Unrecognized state entity, internally inefficient	Existing
Iraqi Kurdistan (Bashur)	YES	NO	NO	NO	Partly	Elimination	Existing
Islamic Emirate of Afghanistan	YES	Partly	-	Partly	NO	Elimination	Eliminated
Islamic State of Iraq and the Levant	YES	NO	NO	NO	NO	Elimination	Existing
Jubaland (Azania)	YES	NO	NO	NO	NO	Elimination	Existing
Luhansk People's Republic	Partly	NO	NO	NO	YES	Unrecognized state entity, internally inefficient	Existing
Maakhir State of Somalia	YES	NO	NO	NO	NO	Elimination	Annexed
Nagorno-Karabakh	YES	NO	NO	NO	YES	Unrecognized state entity, internally efficient	Existing
Pridnestrovian Moldavian Republic	YES	NO	NO	NO	YES	Unrecognized state entity, internally efficient	Existing
Puntland State of Somalia	YES	NO	NO	NO	NO	Elimination	Existing

Entity	Inner sovereignty	Outer sovereignty	Central government	International community	Regional (global) power	Predicted entity status	Entity status
Republic of China (Taiwan)	YES	Partly	-	Partly	NO	Unrecognized state entity, internally efficient	Existing
Republic of Kosovo	YES	Mostly	NO	Mostly	YES	Sovereign state, internally efficient	Existing
Republic of Somaliland	YES	NO	NO	NO	NO	Elimination	Existing
Sahrawi Arab Democratic Republic	YES	NO	NO	Partly	YES	Unrecognized state entity, internally efficient	Existing
South Ossetia	YES	NO	NO	NO	YES	Unrecognized state entity, internally efficient	Existing
State of Palestine	YES	Mostly	NO	Mostly	YES	Sovereign state, internally efficient	Existing
Tamil Eelam	Partly	NO	NO	NO	NO	Elimination	Eliminated
Turkish Republic of Northern Cyprus	YES	NO	NO	NO	YES	Unrecognized state entity, internally efficient	Existing

Source: by Štěpán Podhrázský

REFERENCES

GLASSNER, M. I. a H. J. DE BLIJ. Systematic political geography. 4th ed. New York: Wiley, c1988, xii, 617, p. 6. ISBN 04-716-3583-9.

JACKSON, R. H., C. G. ROSBERG. Why Africa's Weak States Persist: The Empirical and the Juridical in Statehood. In: World Politics. 1982, p. 1-24. vol. 32, no. 1. https://doi.org/10.2307/2010277

KOLSTØ, P. Journal of Peace Research: The Sustainability and Future of Unrecognized Quasi-States. Journal of peace research. Oslo: Universitetsforlaget, 2006, vol. 43, n. 6, p. 723 -740. https://doi.org/10.1177/0022343306068102

KREIJEN, Gerard. State failure, sovereignty and effectiveness: legal lessons from the decolonization of Sub-Saharan Africa. [Leiden: Leiden University, 2003]. ISBN 9789004139657.

RIEGL, M. Quasi-states terminology. In: Acta Politologica. Praha: Karlova univerzita, 2010, p. 57 - 71. ISSN 1803-8220.

ROTBERG, R. I. Weak and Failinig States: Critical New Security Issues. In: Turkish Policy Quarterly. Istanbul, 2004, p. 57 - 69. ISSN 1773-0546.

SØRENSEN, G. Stát a mezinárodní vztahy. Vyd. 1. Translation: Ladislav Cabada. Praha: Portál, 2005, p. 237, ISBN 80-717-8910-0.

VAĎURA, T. a V. ŠMÍD. Teoretické vymezení a konceptualizace fenoménu slabých a selhávajících států. In: Mezinárodní vztahy. 2009, p. 44 - 64. vol. 44. ISSN 0323-1844.

ZARTMAN, W. Collapsed states: the disintegration and restoration of legitimate authority. Editor I Zartman. Boulder: L. Rienner Publishers, 1995, vii, 303 p. SAIS African studies library (Boulder, Colo.). ISBN 15-558-7560-2.

Shrnutí

Neuznané státní útvary představují kvalitativně odlišné entity oproti deviantním formám státu. Nejen z důvodu jejich geneze, ale i schopnosti naplnit rozdílné charakteristiky státu. Základem obou kategorií je naplnění povinných geografických charakteristik v podobě teritoria a obyvatelstva, avšak deviantní forma státu byla dále oficiálně uznána mezinárodním společenstvím států. Na druhou stranu deviantní forma státu postrádá vnitřní funkčnost. Není tedy schopna zabezpečit jednu nebo více charakteristik nebo služeb státu. Neuznaný státní útvar je naopak schopen zabezpečit vnitřní funkčnost, avšak pozbývá mezinárodního uznání, též označovaného jako vnější suverenita. Existence neuznaného státního útvaru je vždy na úkor etablovaného státu, ze kterého vytváří deviantní formu, neboť přebírá efektivní kontrolu nad částí území. Vznik deviantní formy státu není podmíněn vznikem neuznaného státního útvaru, neboť deviace může být zapříčiněna odlišnými faktory. Z výše uvedeného vyplývá, že je mylné považovat oba typy entit za totožné a terminologicky je shrnovat do jedné kategorie. Neuznané státní útvary vyskytující se v politickém prostoru 21. století názorně představila tab. 2 včetně jejich předpokládaného vývoje na základě vnitřních a vnějších faktorů, jež ovlivňují jejich vývoj. Budoucí vývoj nejčastěji zastoupeného typu neuznaných státních útvarů je eliminace z důvodů nedostatečné podpory ze strany vnějších faktorů. Nicméně, jednotlivé vlivy podléhají v čase změnám. Nelze tedy vyloučit budoucí etablování některých entit do mezinárodního společenství států.

QUALITY OF LIFE EVALUATION IN THE MUNICIPALITY WITH A GREAT EMPLOYER: CASE STUDY OF THE MÍROV MUNICIPALITY

Zdeněk Šilhan[1], Hana Svobodová[2]

[1]Masaryk University, Faculty of Economics and Administration, Department of Regional Economics and Administration, Lipová 41a, 602 00 Brno, Czech Republic

z.silhan@mail.muni.cz

[2]Masaryk University, Faculty of Education, Department of Geography, Poříčí 7, 603 00 Brno, Czech Republic

67632@mail.muni.cz

Abstract: The municipality of Mírov has 385 inhabitants, it is a small number in conditions of the Czech Republic. There is a high security prison with nationwide significance which employs more than 200 employees. The presence of such a large employer brings to the municipality and its inhabitants a number of advantages but also disadvantages. The goal of the paper is to discuss the influence of the large employer to the municipality and the conditions for life. A questionnaire survey among inhabitants, discuss meeting with the inhabitants using participatory methods of working with the public and a semi-structured interview with the mayor and municipal representative were conducted. The paper contains a summary of the main factors that are related to the presence of the large employer and affect the municipality and its inhabitants. A combination of quantitative and qualitative methods was used to achieve the goal.

Key words: quality of live, questionnaire survey, small municipality, large local employer.

1 INTRODUCTION

One of the key factors for the quality of life in a municipality is the presence of employers offering enough employment opportunities. The presence of the employer may have a positive effect on the municipality’s economy. On the other hand, it may put a burden on local residents, for example, by reducing the quality of the environment, by worsening security situation, etc.

The evaluation of the impact of large employers on the development of regions and municipalities was dealt with by many Czech and foreign authors. At the level of the regions, Kunc (2006) and Novák (2007) evaluated Bosch Diesel's influence on commuting and labour market in the Vysočina Region; at the municipal level, Osman and Šerý (2013) compared the town of Komořany, where EDP company operates, to Springfield, a fictional town in American animated sitcom The Simpsons, where the local business employs majority of the city's inhabitants. Similar towns and cities can be found in the Czech Republic, but the municipality of Mírov, on which this paper focuses, is rather specific.

There are 385 inhabitants in Mírov, which ranks it as a small municipality in the Czech Republic. There is located a high-security prison of nationwide significance. This institution employs more than 250 employees, making it an unusually large local employer when taking into consideration the number of Mírov inhabitants. The presence of such a large employer brings the municipality and locals many advantages and disadvantages.

Work opportunity is for local inhabitants only one aspect of quality of life. Quality of life is a subjective evaluation of the social, economic and technical aspects in the municipality. The indicators of quality of life are defined different by different authors. For example, Babinčák (2013) defines quality of life according to satisfaction of inhabitants and their evaluation of different aspects in the municipality of the scale form good to bad. Similar evaluation was done in the Mírov municipality.

2 OBJECTIVES AND METHODS

The aim of this paper is to discuss the impact of the large employer on the municipality and on the living conditions of the local population. To obtain the documents for the evaluation of the influence of the large employer, the following was done in the municipality:

- a questionnaire survey among residents,
- discussion meetings with citizens using participative methods of working with the public, and
- a semi-structured interview with the mayor and a municipal representative.

All the partial steps were taken in the scope of the municipality’s strategic development plan, which is the main tool for municipal development management. It formulates ideas about the future of the community and suggests ways to achieve these ideas. Local development and employers' influence are also the subject of regionalists (e.g. Bellandi 2001, Ježek 2013, Řehoř 2010, and others).

To achieve the goal, an evaluation of the above-mentioned activities was performed. Based on the carried-out evaluations, the paper summarizes the main factors that are related to the large employer and which influence the municipality and its inhabitants.

A questionnaire survey among the inhabitants of Mírov took place during the summer 2017. Citizens had the possibility to fill in the questionnaire either electronically using Google Forms or in a paper form. There were no criteria for the respondents’ selection except to be older than 15 years and to have permanent residence in Mírov or the ownership of a real estate on the cadastral territory of the municipality (to involve cottage owners as well). A common demand for gender, age, education, or family status was not considered in the investigation. The questionnaire contained a total of 20 questions, of which 16 were concerned with the development of the municipality and 4 were identifying. The questions were discussed and supplemented by citizens on the basis of the discussion meeting conclusion and of a semi-structured interview with the mayor and a municipal representative.

For the purpose of this paper, questions on the quality of life in the village and issues related directly or indirectly to the presence of a large employer in the municipality were evaluated. The first question stated “How good are living conditions in the village?”. Citizens could choose: very good, rather good, neutral, rather bad, and very bad. Another area was concerned with a matrix of questions about the evaluation of the environment and services in the municipality. Citizens were marking 27 areas in scale 1 (the best) to 5 (the worst) (see the third part Results). The following, open, question was formulated as “What specifically do you miss in the village?”. The questionnaire also included the question “Imagine that you can decide how to use public funds of the municipality. What kind of investments would you prefer?” Citizens had the opportunity to write down their own ideas or to choose from the following list: restoration of local sights, extension/improvement of public greenery, improvement of waste disposal, safety increase, development of tourism, reconstruction/construction of space for cultural and social activities, revitalization of greenery in the local area of Kolonie, new parking places, completion/reconstruction of local roads and pavements, reconstruction/construction of sport facilities, improving the appearance of the municipality, community house for seniors, investment in lido, and housing support. They could select up to 4 options. The paper evaluated this question as safety increase, green revitalization and new parking spaces are directly related to the impact of a large employer in the municipality. Citizens had the opportunity to express themselves freely on other topics or make comments.

Discussion meetings with citizens, while utilizing participative methods, took place before the questionnaire survey and was conducted in May 2017. In particular, elements of community vision, human focused design, future workshop and world café were used (for details see http://www.participativnimetody.cz). All areas related to life in the village were covered: opportunities for young people, families with children, elderly, community associations and cooperation with them, shops and services in the village, transport service, state of the technical infrastructure, municipal waste disposal, and availability of education, health and social care, community life, environment, and communication with authorities. In the paper, there is an evaluation of the main problems in the village and viable solutions for development opportunities for the future.

A semi-structured interview with the mayor and municipal representative consisted in finding the municipality's management opinion on the same topics as discussed with residents, supplemented with questions about information, which is not publicly available (municipal property, kindergarten capacity, planned investments, etc.).

3 RESULTS

3.1 Major employer in Mírov – Mírov prison

In the municipality of Mírov, as of June 2011, there were 222 economically active inhabitants, out of which 25 were unemployed. According to the statistical yearbook of the prison service, the Mírov prison employed 274 employees in 2011. According to the census conducted in 2011, 199 people were commuting to the village, most of them from Mohelnice (60 employees), Zábřeh (32 employees), and Loštice (10 employees). On the other hand, 63 people were commuting out of Mírov. Mostly to Mohelnice (47 employees in total). If the prison employed 274 employees and, for simplification, it is assumed that all commuters to the Mírov municipality would work in prison (199 employees in total), it is estimated that 75 citizens of Mírov would be working in the prison, which accounts for more than 35% of the economically active population. The relevance of statistics may be limited by the fact that not all prison staff are located in the Mírov municipality. Additionally, not all employees who commute to Mírov mentioned this information in questionnaire. In fact, more people can commute to the prison than the statistics indicates, and therefore, the number of employed citizens of Mírov in the prison may be actually lower. A brief analysis of the available data suggests the great economic importance of the prison for the inhabitants of Mírov and the large number of commuters to a relatively small community.

The prison significance for the economy of the municipality is confirmed by employment data. Compared with other municipalities in the administrative district of Mohelnice (see Table 1), the highest share of the number of employees with the place of work in the municipality is the Mírov municipality (index 139). The number of employees with place of work in the municipality also includes working prisoners. There were 208 of these according to the statistical yearbook of prison service in 2016. If the the statistics did not include working prisoners, then the index of the number of employees to the total population would be 85, which is comparable with the town of Mohelnice. Winter and summer unemployment in the municipality is lower than the surrounding municipalities and upper territorial units.

Tab. 1: Employment in Mírov municipality compared to surrounding municipalities and upper territorial units

	No. of inhabitants (01/01/2017)	No. of employees (01/01/2017)	(Employees / inhabitants) * 100	Share of the unemployed	
				12/2016	06/2017
Klopina	595	371	62	3.6	1.4
Police	218	33	15	5.3	2.7
Krchleby	179	49	27	8.7	2.4
Mohelnice	9,232	7,767	84	5.4	4.5
Stavenice	138	15	11	3.1	3.3
Líšnice	343	28	8	3.6	3.5
Moravičany	1,300	234	18	3.8	3.5
Třeština	384	51	13	2.7	3.8
Loštice	3,023	1,187	39	4.1	3.5
Palonín	334	43	13	4.8	3.3
Úsov	1,180	113	10	6.7	5.5

Maletín	382	33	9	10.7	6.7
Pavlov	612	77	13	2.7	1.7
Mírov	385	537	139	3.3	3.4
Okres Šumperk	121,288	50,127	41	6.2	4.5
Olomoucký kraj	633,925	289,577	46	5.9	4.4
ČR	10,578,820	5,242,520	50	5.2	4.0

Source: Czech Statistical Office, Czech Ministry of Labour and Social Affairs, Act No. 276/2017

3.2 Evaluation of selected questionnaire questions among residents

There were 102 out of a total of 384 inhabitants of Mírov, who participated in the questionnaire survey (with return of 26.5%). There were 39 men and 61 women. At the age of 15–29: 28 people, at the age 30–49: 33 people, at the age of 50–64: 24 people, and at the age over 65: 16 people filled the questionnaire. Majority of respondents were spouses/partners living with a child (44 cases) or their children had already moved (27 cases).

The question "How good are living conditions in the village?" was answered as "good" by 73% of the respondents (14% answered as "very good" and 59% answered as "rather good"). 23% of the population answered as "neutral". There were 4% of respondents, who answered as "rather bad". No one answered as "very bad".

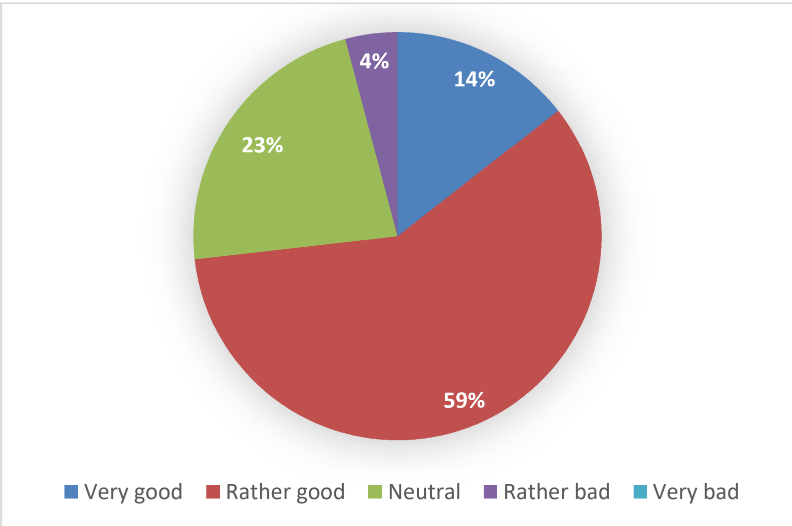


Fig. 1. Answer to question "How good are living conditions in the village?"
Source: questionnaire survey with inhabitants of the Mírov municipality
Note: no answer „Very bad"

Another question evaluated the quality of environment and services in the city on a scale of 1 to 5, with 1 being the best and 5 worst. In total, 27 areas were evaluated. The best rating was reached by “nursery school availability” with the average mark of 1.5. The second best, “Level of technical infrastructure (drainage, water, gas, and electricity)”, with the average mark of 1.7. Then followed “tap water quality” reaching 2.0. A good evaluation of the technical infrastructure may be related to the presence of a prison. Research of other authors suggests, that high quality of technical or transport infrastructure is usually the biggest problem in municipalities, as its construction and maintenance is expensive.

On the other hand, the worst result with the average mark of 4.3, reached the “business opportunity” area. The impact of a large employer may be counterproductive for the development of business – people are not interested in doing business if there is a strong and stable employer in the municipality. This fact is also probably intensified by relatively remoteness of the village from other municipalities, which introduces low demand. The “use of commercial services” area with an average mark of 4.2 was the second worst-ranked. Due to the recently closed elementary school, the “education opportunities” area ended up as third worst-rated with an average mark of 4.1.

The “working opportunities” area is not improved by the presence of the prison, according to the inhabitants as many employees commute. This area reached an average mark of 4.0. Thanks to the presence of a large employer, there is a relatively good transport service in the village despite its small size, which is supported by good mark of 2.1. The presence of the prison is positively attributed to the feelings of safety, which is assessed by citizens with mark of 2.1. On the contrary, the parking options are rated below 3.3.

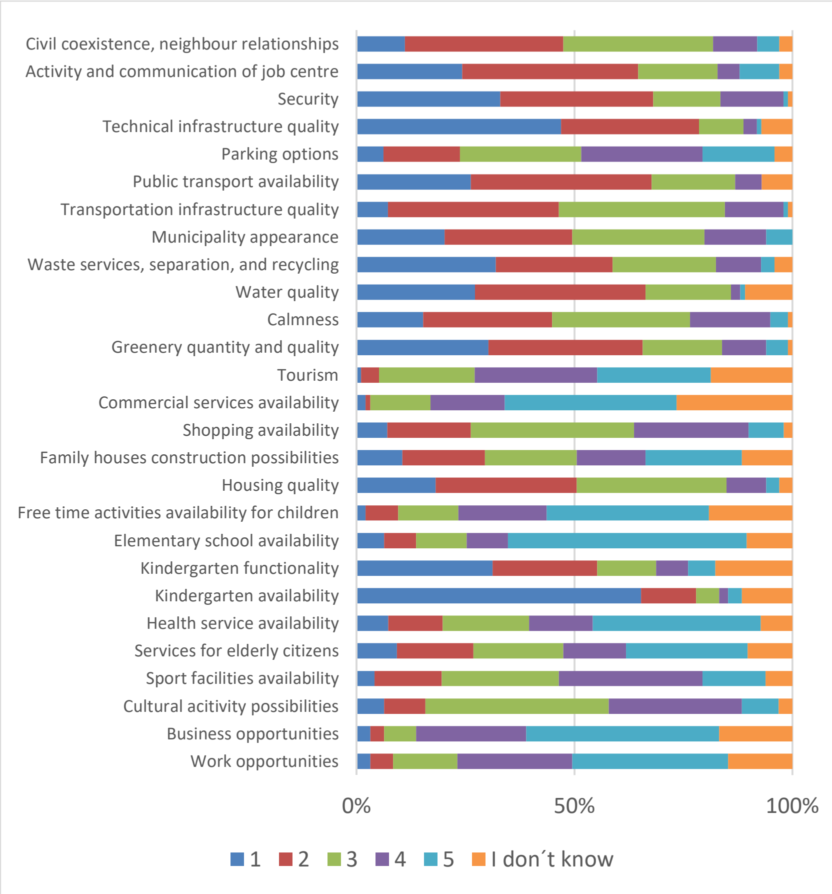


Fig. 2. Environment and service evaluation by Mírov inhabitants.
Source: questionnaire survey with Mírov inhabitants

Residents could comment on what they lack the most in the village. A total of 51 inhabitants responded and provided a number of suggestions for improvement. The most frequently mentioned shortcomings of the municipality are the following: lack of sport events and insufficient facilities for sport-related activities (21 cases), lack of cultural events along with suitable facilities (9 cases), lack of commercial services in the village (4 cases), lack of job opportunities based in village (3 inhabitants), and lack of parking places (3 inhabitants).

The following question was: "Imagine that you can decide how to use public funds of the municipality. What kind of investments would you prefer?" Most people would invest in housing. On the contrary, the restoration of local sights received the smallest support. New parking places are ranked 7th out of a total of 14, improving safety at 11th and revitalizing greenery in the local area of Kolonie, with new parking places on the 8th place.

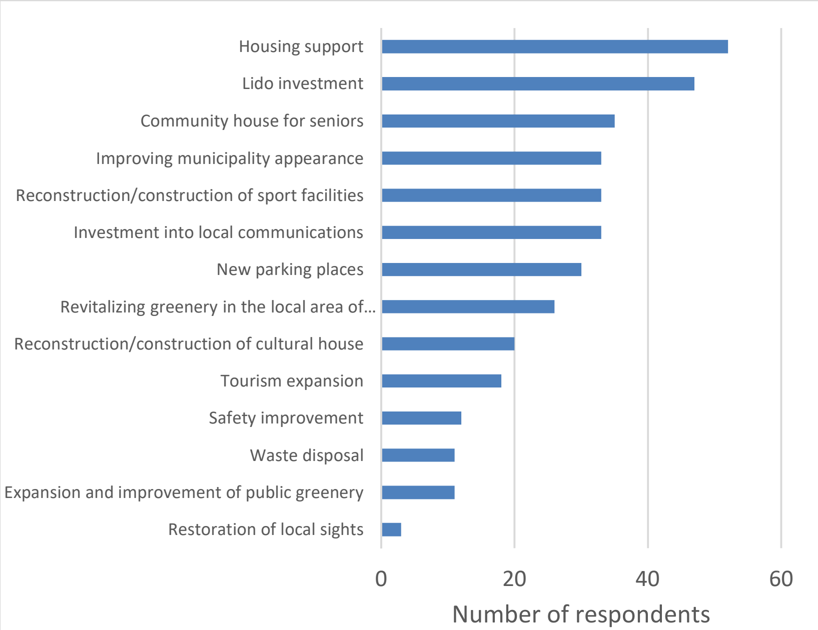


Fig. 3. Answer to question "Imagine that you can decide how to use public funds of the municipality. What kind of investments would you prefer?"
Source: questionnaire survey with Mírov inhabitants

The answers to open question, "Further suggestions and comments", were similar to answers to the question "What specifically do you miss in the village?". In connection with the prison, there were remarks about the prison staff parking in the village. There are also opinions that would welcome greater involvement of the prison in the community life. One respondent proposed to set up a prison museum or to introduce recently popular escape games in unused premises of local school to attract visitors.

3.3 Semi-structured interview with the mayor and a municipal representative

From an interview with the mayor and municipal representative, the municipality was particularly concerned with optimizing the buildings usage in the village. This applies to the abandoned building of the former school, the under-utilized cultural house, and the building No. 24, where former grocery was located. The village plans to build a community house for the seniors and to revitalize the green in a local housing estate with

Kolonie apartment buildings. The presence of the prison places a burden on local citizens as it causes a shortage of parking places, as prison staff do not have sufficient capacity to park on the prison premises and, therefore, they are forced to park in public areas of the village. Staff shift causes dense traffic on the main road and there are issues with speeding. On the other hand, there is a high-quality bus connection and the presence of post office, which mainly makes living by servicing parcels sent and received by prisoners. In other similarly-sized municipalities, post office is generally not functioning. There is no fear of the prisoners' presence among the locals.

3.4 Discussion meeting with residents

The main problems reported by residents during the discussion meeting were the following: lack of sports facilities, poor quality of local road network and poor behaviour of prison staff (parking violations and speeding). In addition, citizens complained about untidiness around the prison. Residents would prefer to improve the state of the local lido and sewers. In addition, there is an issue with accessibility to outdoor sport facilities in the prison area. Locals have the option to attend the sport facilities, but prison staff have a priority, and reservations are often cancelled at the last moment for the purpose of celebrations or sporting events for prison staff.

CONCLUSION

The analysis shows that the prison is of a great economic importance for the municipality, especially in the area of employment, but only partially for the local population in general. Negatives associated with the presence of the prison are speeding of prison staff when commuting and problematic parking as follows from a questionnaire survey, discussion meeting with residents, and an interview with the mayor and municipal representative. The mayor emphasizes the positive influence of the presence of the prison on services in the village, such as existing post office and public transport services. Residents complain about limited access to the sport facilities inside the prison premises.

It has been confirmed that the presence of a large employer affects the living conditions in the village, both positively and negatively. According to the population's opinion, job opportunities are not affected. On the other hand, inhabitants rated the transport services positively. Paradoxically, the presence of the prison reflects a sense of security as this trait was rated above the average. On the contrary, the parking options are rated below average by the population.

This paper was created in a scope of a specific research project of the Department of Regional Economics and Administration, Faculty of Economics and Administration, Masaryk University in 2017. MUNI/A/0976/2016.

REFERENCES

BABINČÁK, P. Porovnanie troch spôsobov hodnotenia subjektívnej kvality života. In Murgaš, F. (ed). KVALITA ŽIVOTA 2013 Sborník příspěvků z mezinárodní konference 4. a 5. 12. 2013 v Liberci. Liberec: TUL, 2013.

BELLANDI, M. Local development and embedded large firms. Entrepreneurship & Regional Development, 2001, 13.3: 189-210.

OSMAN, R., ŠERÝ, O. Český Springfield: velká firma na malém městě. In Robert Osman. Geografický výzkum: participace a angažovanost. Brno: Masarykova univerzita, 2013. s. 120-139, 20 s. ISBN 978-80-210-6415-7.

KUNC, J. Bosch Diesel – Not only an industrial phenomenon in the Vysočina region (Czech Republic). Moravian Geographical Reports, 2006, 29.

BELLANDI, M., Local Development and Embedded Large Firms. Entrepreneurship and Regional Development. Vol. 13, 2001, s. 189–210. ISSN 1464-5114. https://doi.org/10.1080/08985620110051103

JEŽEK, J. Strategické plánování obcí a měst: nové přístupy a cesty k jeho zefektivnění. XVI. mezinárodní kolokvium o regionálních vědách, 2013, 372-376.

ŘEHOŘ, P. Strategický plán rozvoje obcí. Auspicia, 2010, 34.

Participativní metody. Práce s veřejností. URL http://www.participativnimetody.cz/

NOVÁK, V. Bosch Diesel – nejvýznamnější zaměstnavatel v kraji Vysočina. In: KLÍMOVÁ, V. X. mezinárodní kolokvium o regionálních vědách. Brno: Masarykova univerzita, 2007, s. 95–102. ISBN 978-80-210-4325-1.

Shrnutí

Obec Mírov má 385 obyvatel, čímž se řadí v podmínkách České republiky mezi malé obce. Existuje zde věznice se zvýšenou ostrahou s celorepublikovým významem. Zařízení zaměstnává více než 200 zaměstnanců. Přítomnost takto velkého zaměstnavatele přináší obci a jejím obyvatelům řádu výhod, ale i nevýhod. Příspěvek si klade za cíl diskutovat vliv velkého zaměstnavatele na obec a podmínky pro život. V obci bylo provedeno dotazníkové šetření mezi obyvateli, diskuzní setkání s obyvateli s využitím participativních metod práce s veřejností a semistrukturovaný rozhovor se starostou a zastupitelkou obce. Příspěvek obsahuje shrnutí hlavních faktorů, které souvisí s působením velkého zaměstnavatele a ovlivňují obec a její obyvatele. Pro dosažení cíle byla použita kombinace kvantitativních a kvalitativních metod.

SPECIFICS OF THE RETAIL NETWORK SPATIAL STRUCTURE IN THE PIEŠŤANY TOWN

Miroslava Trembošová [1], Sandra Wiecková [2], Ivana Gálisová

[1] Katedra geografie a regionálneho rozvoja, FPV, UKF, Tr. A. Hlinku 1, 949 74 Nitra

mtrembosova@ukf.sk

[2] Katedra geografie a regionálneho rozvoja, FPV, UKF, Tr. A. Hlinku 1, 949 74 Nitra

sandra.wieckova@student.ukf.sk

Abstract: The retail network is a variable subsystem of a cultural landscape closely linked to a settlement structure that sensitively responds to changes in the social and economic situation and is a suitable indicator of the development of human society, the settlement system and the inner structure of the settlements. In the urban environment of post-socialist countries under the influence of globalization the retail network belongs to the most dynamic elements which are very variable in space. A substantial part was processed using statistical-mathematical methods results of which were necessary for the calculation of key demographic, retail – area parameter (m²/1000 inhabitants). Data based and results were processed in Microsoft Excel and map outputs in ArcGIS10.2 software. Our goal is to identify the spatial configuration of these indicators. At the same time, we deal with the processes and specifics of the retail network of the city of Piešťany, which are decisively involved in the modeling of its spatial structure, polycentrism, increase of disparities, commercial suburbanization. The development of the retail network in the city of Piešťany is significantly influenced by the following factors: purchasing power of residents and visitors, globalization impacts of supranational chains´ arrival, availability, synergy effect, development of new forms of selling, and self-government.

Key words: retail network in the city of Piešťany, area parameter, stores (shopping centers, hypermarkets and supermarkets).

INTRODUCTION

Retail is one of the main dynamic forces of the economy which are spatially very variable. It is a summary of all activities related to the direct sale of products or services to final consumers only for personal use, not for business use. It is part of our everyday life in households and at work, but it also serves for activities that give us rest, fun and excitement. Retailers as well as wholesalers or producers whose sales originate primarily from retail business are engaged in retail activities. The aim of our work is to point out the specifics of the retail network spatial structure in the Piešťany Town and by comparing the results of the analysis from 2011 and 2017, to show the development trends in retail amenity and to predict the perspectives for its development in the Piešťany Town.

1 THEORETICAL BACKGROUND

At the end of 20th century and in the first decade of 21st century interest for studying internal relations between spatial models of localization of retail in urban environment and purchasing behaviour increased. Large-area stores of retail chains become the centres of attention and research of geographers. Their impact on spatial organization of retail and traffic systems, area requirements, decentralization processes characteristic by moving shopping centres to satellite and suburb parts of cities and the resulting specific problems. Their classification is not united, different sorting characters create different classifications. Guy (1998) distinguish so called “edge-of-centre”, “out-of-centre” and “out of town” localization of shopping centres. From other professional literature (Szcyrba 2006) there are known three categories of shopping centres (SC) – the first, second and third generation SC. The first generation SC is limited only on selling goods in (by authors Križan and Lauko 2014 and Spilková, 2012a it is store - magnet) like supermarket, hypermarket, or hobby market with the minimum of specialized business units in shopping mall. SC of the second generation offers in addition to central large-area shop also shopping mall with shops, restaurants and other services, just like banks, hair salon, dry cleaner´s, babysitting services, key services and so on. Highest hierarchy level of SC is marked as third generation of SC and it contains signs of the second generation with additional recreation, sport and entertainment facilities (fitness, swimming pools, ice rink, cinemas and others). Based on aspect of localization Daňo (2003) differs 5 types of retails which can be applied also on SC: type 1 in spatial proximity to customer residence, type 2 in spatial proximity to competitive companies, type 3 in spatial proximity to companies with supplementary assortment, type 4 in spatial proximity tourists flow and type 5 position suitable in relation to transport possibilities.

Due to the construction of large-area centres and hypermarkets on suburbs of cities there is a decrease in sales areas which are located in centres of cities. The issue related to revitalization of traditional city retail centres was pointed out by Nagyova (2001) and phenomenon known as problem of “food deserts” is being for example described by Bilková et al. (2015), Bilková and Križan (2015), Choi and Suzuki (2013), Križan and Danielová, (2008), Suchý (2010), Wrigley, Warm a Margetts, (2003) and others.

Ongoing changes in retail, such as development of huge international retail chains, retail concentration, localization changes, technological innovations, new working practices and increasing range of particular transactions, Vias (2004) name as revolution in retail. In the states of V4, these changes are tracked by Aubert and Csapó (2004), Fertaľová (2005), Križan (2009), Mitríková (2008), Pulpitlová (2005), Szczyrba (2006), Trembošová (2010), Viturka et al. (1998), Wilk (2005) and others. Szczyrba (2005, 2006) identified two stages of retail development in the Czech Republic: *“atomization and internationalization of retail associated with its concentration, which has been manifested in the Czech Republic since 1995*”. Similarly, but with a certain time shift, retail was also developed in Slovakia, which was analysed by, Fertaľová and Klamár (2006), Fertaľová and Varga (2008), Križan (2007) and Križan and Danielová (2008), Kunc et al. (2013), Pulpitlová (2005), Trembošová (2009), Trembošová and Dubcová (2013), Spilková (2012, 2016), Szczyrba and Fiedor (2014), Mitríková et al. (2015), Trembošová et al. (2016). The transformation and globalization tendencies of the retail these authors interpret as the most dynamic elements of time-spatial and functional changes in urban and rural environments.

2 RESEARCH METHODOLOGY

The analysis of the spatial aspects of retail is based on an accessible indicators (Bilkova and Križan, 2013), while many common statistical data are gradually becoming not monitored (e.g. annual reports of municipal statistics for retail were completed in 2012). Even economists are highlighting the difficulty of the issue the point of view of data collection (Petrovčíková, 2015).

The data processed in the paper were obtained by the authors through detailed field passports in urban districts (hereinafter UD) of the town of Piešťany. Compared to 2011, the number of UD changed. UD Kocurice was included in the filed survey and since 2014 UD Lodenica was added. Both UDs are without a retail network (tab. 1). In 2011, we visited 511 retail stores in 15 UDs (Gálisová, 2012) and in 2017 it was 523 retail stores in 17 UDs with different area size, assortment offers and character (new or old - used goods) in order to identify their basic characteristics: location, sales area and assortment structure (Wiecková, 2017). As for their classification, we used the criterion of the characteristic and largest offered goods. Subsequently, each unit was included according to the first criterion - assortment into 17 groups of related goods: - stores of food, baverages and tabacoo products, - stores of chemical goods,colors, vanishes and cosmetics, - stores of textiles, clothing and footwear, - pharmacy, medical supplies stores, - toys and sport goods stores, - furniture and household accessories stores, - flower shops and gardening supplies,- stores of electronics, electrotechnics and musicals, - stores of goldsmiths', watchmaking, imitation jewelry and optics, - stationery and office supplies stores and bookshops, - stores of breeding goods, - car shops, - stores of glass, - porcelain, gift shops, - sales of construction goods, - sale of fuels, - sales of industrial goods, ironmongery, - mixed goods stores.

The analysis of the spatial changes of the urban areas we interfered on the basis of surface parameter indicators area parameter PAFS the ratio of the population (in thousands) to the admissible floor space (m^2/1000 inhabitants) (Urbion, 1984). On the basis of the calculated absolute values of the area parameter of individual urban areas, the values of the surface parameter were determined by their assumed hierarchical level (local, urban, regional and supra-regional).

The ongoing changes in the spatial structure of the area parameter can be expressed through the average growth rate which is based on the geometric mean theory. In the sense of Bartscha (1987), if we cannot find the observation values (values every year, month or day) but only their partial sets (in our case, the area parameters were expressed only in 2011 and 2017), we can calculate this data via the average growth rate:

$$W = \left(\frac{\sqrt[n-1]{X_n}}{X_1} \right) * 100$$

n = number of years in the observed period, X_n = area parameter for the last measured year, X_1 = area parameter for the previous measured year.

According to Bartsch, if the W result is greater than 100, it is an average growth rate that is increasing. On the contrary, if the W result is smaller, the average growth rate is decreasing. Moreover, the more W ranges from 100, the average growth rate is either faster (W>100) or slower (W<100).

3 CHARACTERISTICS OF THE PIEŠŤANY TOWN WITH THE FOCUS ON BUSINESS FUNCTIONS

The town of Piešťany is the center of the Piešťany district, which lies in the northern tip of the Trnava region. The Váh River flows through the edge of the town in the Danube Lowlands and at the foothills of the Malé Karpaty (mountain). According to the number of inhabitants 28 266 (as of December 31, 2016), Piešťany Town is the 21st biggest town in Slovakia. Today, the town is the seat of the district, several educational and scientific institutions, and the departments of two universities. Thanks to a spa with a beautiful park on the Spa Island and the town park, it is one of the most famous Slovak towns also abroad. A significant expansion of the spa tourism and associated activities (accommodation, socio-cultural) occurred after the arrival of Winter's family and spa rentals in 1889. Entrepreneur Alexander and his son Ľudovít significantly contributed to the development of the town by building infrastructure (water supply, communications), mill, guest house for workers or later hospital. Piešťany town has become an established center with a well-developed retail network. Larger industrialization occurred in the 60s-70s. (companies TESLA, Chirana) of which Chirana company continued to focus on medical technology until today. At present, Piešťany Town is divided into 17 urban districts of which 5 of them are the core retail network (Stred I., Kúpeľný areál, Horné Piešťany, Juh III., and Za železnicou).

The retail network of the town of Piešťany has been evolving more rapidly since the declaration of the statute of the spa town in 1956. At this time, the first souvenir and spa wafers shops began to emerge. These stores were also part of the first shopping centers (hereinafter SC) in the town, SC Kocka opened in 1976 and SC Prior in 1983. The retail network of the town of Piešťany is also influenced by the zonation which was connected with the housing units construction of Sídliska pred stanicou, Pri Váhu, Adam Trajan during the era of socialism.

In the town of Piešťany in 2017, there were 523 retail stores at the retail area of 124 608 m^2. Almost 21% of the rentable area was used by clothing stores.

The most important urban district in terms of shopping streets and squares - but only for pedestrian shoppers - is UD Stred I., represented by Winterova Street (the pedestrian zone for almost 30 years) and Námestie Slobody (square). In addition to the shopping function, visitors to and residents of Piešťany Town, it is also the center of cultural and social life (Beer Festival, Christmas Market connected with big sales). Main assortment in the Winterova Street is offered by small-scale souvenir shops, spa wafers shops, jewellery shops, catering and clothing stores especially for the spa clientele. From this street there is good walking distance to the Kolonádový most /Colonnade (Glass) Bridge/ where other souvenir shops are located, as it is the area of the highest tourism. Behind the Colonnade Bridge is the most beautiful part of the town UD Kúpeľný ostrov with the famous lakes in the large park and hotel buildings. Ground floor passageways and connecting corridors provide space for retail stores such as drugstore, textiles and clothing stores, imitation jewellery shop and pharmacies. In recent years, small-scale retail operations have been expanding along communications from the center to outside residential areas which are also available to pedestrian visitors or spa guests at Kukučínova and Štefánikova Streets with bakery, butchery, exclusive coffee and chocolate shop, porcelain and imitation jewellery shops. Small-scale shops with accessibility also for motorized customers in UD Stred I. form the following streets: Teplická, Rázusova, E. Suchoňa and Námestie Slobody.

The construction of large-scale retail outlets in Piešťany Town is concentrated in 4 UDs: The first solved area was UD Stred I. where at the crossroads of Teplická and Nitrianska Street from 2010 there is the only shopping center of the “second generation” OC Aupark. Its stores have a varied character (with clothing, footwear, sports outlets, a bookstore) or Billa store. The town market as a traditional form of the “yard” sale is not far from Nitrianska Street. On the north-west outskirts of UD Stred I. there is a “socialist” shopping centre OD Prior with today's Lidl discount store. At present, the next important attraction is also the seasonal farm market. On the other side of the big crossroads is the two-storey shopping centre OD Kocka in the UD Pred stanicou with the CBA grocery store and a small marketplace with both desk and stall sales. At the crossroads of Bratislava and Lipová Streets, several retail stores were built in the period of socialism (in the 70s of the 20th century) and today, it is the core of the retail at the connecting line of town center and railway and bus stations.

UD Horné Piešťany connects on this retail zone with excellent accessibility along the I/61 road in the direction towards the town of Trenčín. Its core is the Billa supermarket since 2000. Together with the shopping centre OD Prior and OD Kocka, it creates a significant shopping triangle of the town surrounded by residential complexes. There is a major specialized shop called Aquacentrum with a wide range of products reaching the regional level. In this UD near the airport, there is a retail focused mainly on the sales of car components and repairs e.g. KIA motors, ARAVER or D-súčiastky.

The third spatial-functional unit with retail services is UD Za železnicou in the outer zone of the town. The large-scale Tesco store and Family Center hypermarket with several non-food stores (Deichmann, Takko, OKAY, JYSK, Kik, DM Drogerie and Dráčik), were built between 2006 and 2008 on the Nikola Teslu Street. They originated "on a green meadow" near II/499 road in the direction towards Vrbové and D1 highway not only because of the good accessibility or proximity to the residential complexes, but also because of the space - today the stores use common parking spaces.

UD Juh III. is the outer spatial-functional zone with the largest housing estate Adam Trajan (5 126 inhabitants as of December 31, 2016) situated on the left side of I/61 road in the direction towards Trnava City. The Kaufland hypermarket and PT Universal store have found their location for retail business in this place. The hypermarket Kaufland includes a large grocery store and promenade with butchery, florist, pharmacy and confectionery and bakery products. It is located about 3 km south-west of the town center with accessibility by public transport links.

Due to the limited spatial possibilities in the town center, large-scale retail outlets in Piešťany Town were moved to the outer parts of the town (UD Juh III., Za železnicou and Horné Piešťany) in a direct connection to the transport network of the town formed by the I/69 and II/499 roads not only from the town-service flows, but also in terms of regional and supraregional links (Figure 1).

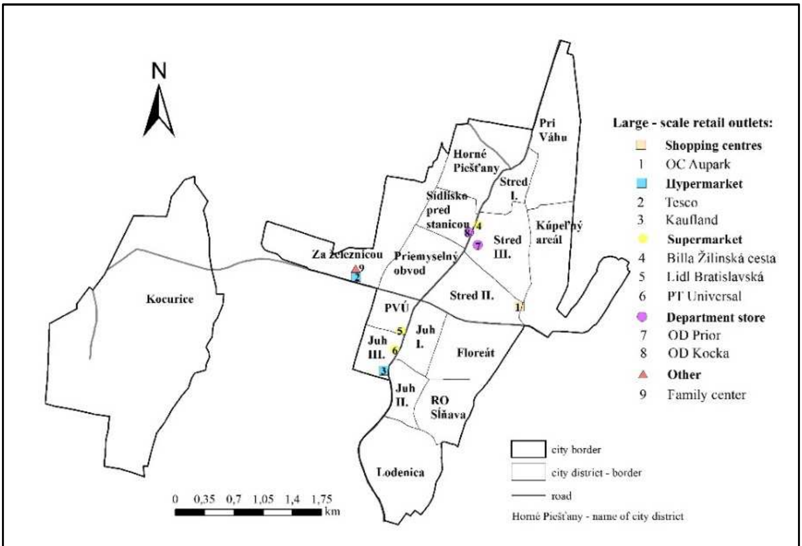


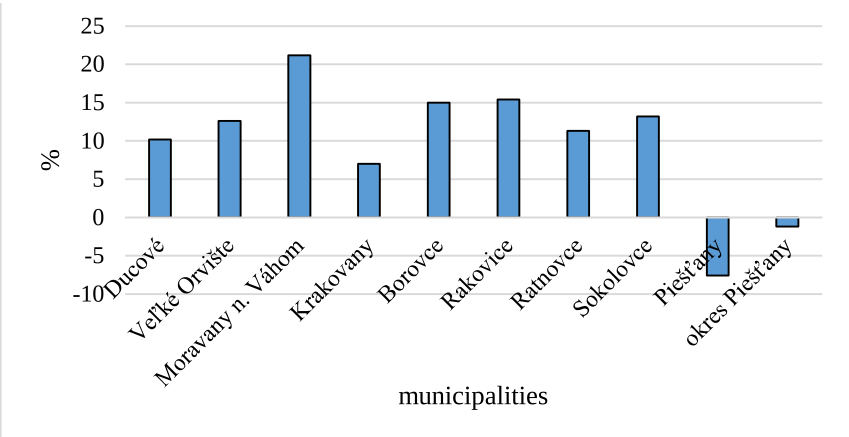
Fig. 1. Shopping centers in urban districts of Piešťany Town in 2017.

Bicycles have long been part of the everyday image of a peaceful recreational town, therefore, Piešťany Town is often called the town of bicycles. Moreover, they are also a very common “mobile” tool for purchasing people.

The Piešťany town belong to the group of “shrinking” towns (Buček, Bleha, 2013), whose population is decreasing. In 2010-2016 years was in population in the town of Piešťany a significant decrease from 29 083 in 2010 to 28 266 in 2016 (by 2.8%). The population decline in cities is a common phenomenon in the post-socialist region (Haase, Rink, Grossmann, 2016). According to Buček and Bleha, (2013) it is influenced by a number of processes accompanying post-socialist transformation and globalization, disintegration, decline in total fertility after 1989, postponed social fertility in post-socialist countries etc.

Jedným z najvýznamnejších faktorov podieľajúcim sa znižovaní počtu obyvateľov mesta je popri nízkom prirodzenom prírastku suburbanizačný proces v okolitých obciach (Graph 1), ktorý vyvolal nedostatok nových bytov a vysoká cena pozemkov v meste. Počet obyvateľov mesta Piešťany v rokoch 2001 a 2011 poklesol o 7,6%, zatiaľ čo v priľahlých obciach vzrástol od 7% v Krakovanoch po 21,2% v Moravanoch nad Váhom. V celom okrese Piešťany bol za toto obdobie zaznamenaný pokles počtu obyvateľov o 1,2%.

One of the most significant factors contributing to the decline of Piešťany town population is the suburbanization process in the surrounding villages (Graph 1), in addition to a low natural increase, which caused a lack of new housing and a high price of land in the city. The population of Piešťany declined by 7.6% in 2001 and 2011, while in neighboring villages it grew from 7% in Krakovany to 21.2% in Moravany nad Váhom. In the whole district of Piešťany, the number of inhabitants decreased by 1.2% over the period.



Graph 1: Variations in the number of inhabitants in selected municipalities in the district of Piešťany (of the Piešťany city background) in 2001 and 2011
Source: Statistical Office, 2017, autors´ survey

4 ANALYSIS OF THE RETAIL NETWORK SPATIAL STRUCTURE IN THE PIEŠŤANY TOWN

By collecting data on sales areas and applying the area parameter (PP) calculation at city district-level in the years under review, we have created a four-stage hierarchy of city districts, based on the average PAFS for EU cities, which is 1,000 m² / 1000 inhabitants (in our hierarchy urban level): i) local: up to 250 m² / 1,000 inhabitants, ii) urban: 1,000-1,500 m² / 1,000 inhabitants, iii) regional: 1,501-3,000 m² / 1,000 inhabitants and supra-regional hierarchical level: 3,001 m² and more / 1,000 inhabitants). This hierarchy was used for the surface parameter of the retail network of Nitra (Trembošová, 2012), Trnava (Trembošová et al. 2016a) and Žilina.

4.1 Dynamics of area parameter

The area parameter is an internationally renowned retail secondary indicator that points to the size of the retail space (excluding storage space). By compiling data and computing the area parameter, we can compare the level and position of the town UDs. In this comparison, the retail in the case of the town of Piešťany should take into account not only the number of permanently living population, but also the number of visitors or spa guests (about 16%).

Tab. 1: Basic parameters of the population and tourists in Piešťany Town in 2011 and 2017

Piešťany Town	2010		2016	
Number	Sum	Aliquot	Sum	Aliquot
Inhabitants	29 083	-	28 266	-
Visitors	92 656	254	106 666	292
Stays (nights)	557 715	1 528	619 262	1 697
Inhabitants and stays (nights)	30 611		29 963	

*** aliquot share / day**

It can be assumed that the vast majority of these "transitional" inhabitants of the town significantly affect the resulting values of the area parameter in two UD Kúpeľný ostrov and UD Stred I. where most of the hotel accommodation capacity is located.

The first step was to evaluate the hierarchical level of UD according to the absolute size of the area parameter (Table 2, Fig. 2). The resulting values ranged from 226 m^2/1 000 inhabitants up to 83 644 m^2/1 000 inhabitants. In both years, there is only one UD in each hierarchical level. A significant change is the transfer of UD Juh II. on the hierarchical level in 2017 associated with the opening of the Piešťanský pivovar /Piešťany Brewery/ in 2015 which not only produces but also sells its beer. Several UDs have moved to regional hierarchical level in 2017. Moreover, we focus on assessing the first or last three UDs. UD PVÚ proceeded from the local level to the regional level thanks to the Lidl supermarket built in 2015 (1 265 m^2/1 000 inhabitants in 2011 and 8 139 m^2/1 000 inhabitants in 2011). UD Kúpeľný ostrov (in 2011 - 4 413 m^2/1 000 inhabitants and 2017 - 10 416 m^2/1 000 inhabitants) also moved from the town level to the regional level. The stores in this UD are still being innovated or increase their capacity. In the future it can be assumed that the area parameter of this UD will continue to grow. The regional level was reached also by UD Stred I. (in 2011 - 4 748 m^2/1 000 inhabitants and in 2017 - 5 175 m^2/1 000 inhabitants) part of which is the shopping centre OD Prior which also contributed to the shift due to continuous development of retail operations.

Tab. 2: Retail amenity in the town of Piešťany according to area parameter (m^2/1 000 inhabitants in 2011 and 2017)

Urban Districts	Retail – area parameter PAFS*		Amenity by sales area (% to the town average)		Growth rate
	2011	2017	2011	2017	11:17
Horné Piešťany	1,250	1,889	33	43	108.59
Stred III.	2,627	595	69	14	74.53
Pri Váhu	958	976	25	22	100.40
Kúpeľný ostrov	4,413	10,416	116	236	118.74
Stred I.	4,748	5,175	125	117	101.74
Stred II.	7,408	2,128	195	48	78.07
Priemyselný obvod	2,245	3,599	59	82	109.86
Za železnicou	38,075	83,644	1,002	1,897	117.08
Sídlisko pred stanicou	1,658	1,742	44	40	100.98
Floreát	174	226	5	5	105.39
Juh I.	259	540	7	12	115.89
Juh II.	212	3,650	6	83	176,65
PVÚ	1,265	8,349	33	189	145.85
Juh III.	612	622	16	14	100.40
RO Slňava	-	-	-	-	-
Lodenica	-	-	-	-	-
Kocurice	-	-	-	-	-
PIEŠŤANY	3,800	4,408	100	100	103.01
PIEŠŤANY*	3,244	3,609			111.25

Source: authors´ survey

***PAFS the ratio of the population (in thousands) to the admissible floor space**

PIEŠŤANY* number of inhabitants of the Piešťany Town together with overnight stays for 1 day

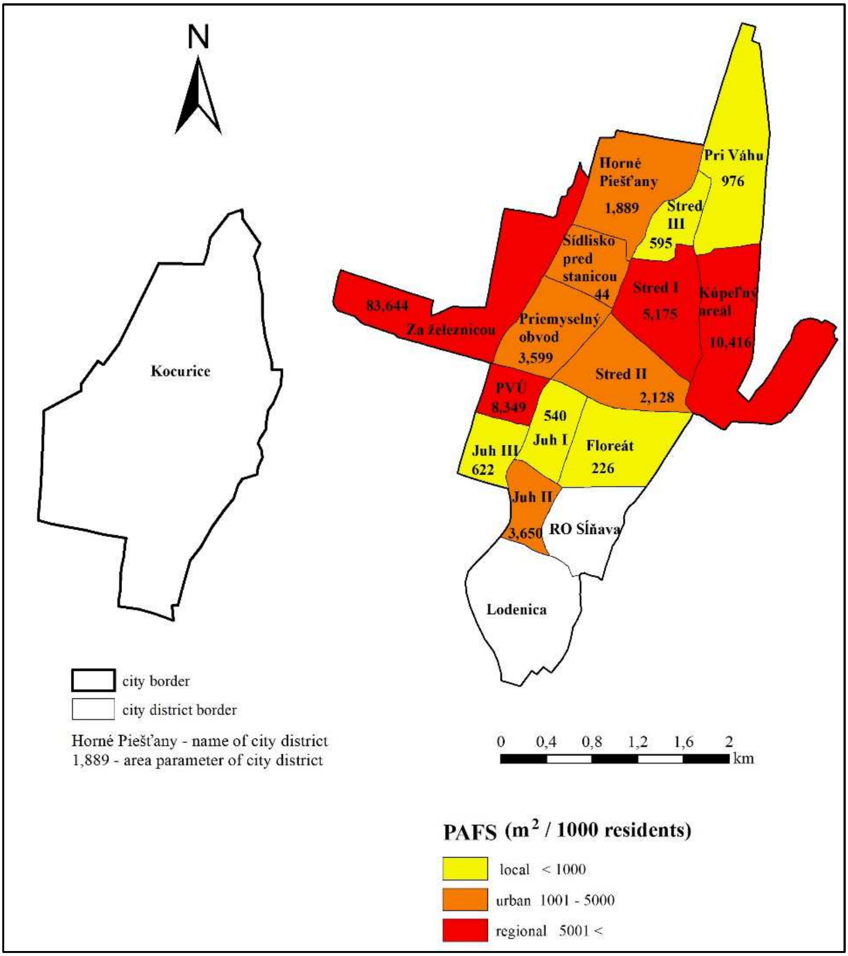


Fig: 2. PAFS (the population (in thousands) to the admissible floor space) according to Urban Districts of Piešťany Town in 2017.

4.2 Average growth rate of PAFS

The second evaluation criterion of the area parameter is the UD amenity with sales area (%). It is determined as a percentage share of the town average (Table 2). The development of amenity by sale area in 2011 and 2017 points to a reduction in the number of levels. In 2011, the UD belonged to all 5 levels ranging from very low to very high. In 2017, there is no high level (61-80%) - the UD amenity only reached four levels. Very low level was reached by UD Floreát (5%), Juh I. (12%), Juh III. and Stred III. (14%), low level by UD Pri Váhu (22%) and UD Sídlisko pred stanicou (40%).

The average amenity was recorded in UD Horné Piešťany (43%) and Stred II. (48%) and the very high level of amenity of area parameter in 2017 was reached by UD Priemyselný obvod (82%), Stred I. (117%), PVÚ (189%), Kúpeľný areál (236%) and Za železnicou (1897%) (Figure 3).

The highest amenity of the retail network according to the area parameter was reached by UD Priemyselný obvod, UD PVÚ and UD Juh II. A very positive change in amenity is seen in UD Juh II. which changed from very low level in 2011 to very high level in 2017. UD PVÚ also changed from the low level in 2011 to very high level. In the urban district Priemyselný obvod we can see a shift from average level to very high level in 2017.

Result of the area parameter analysis is the already mentioned reduction of disparities of retail amenity among individual UDs.

The average growth rate of area parameter, based on the geometric mean theory, is the third way to capture ongoing changes in the spatial structure of area parameter. We can define the period of 2011-2017 as more or less balanced ranging around the value of 100 (Figure 3). The slowest growth rate (the lowest value below 100) was recorded by UD Stred III. (74.53%) and UD Stred II. (78.07%). The growing average growth rate which is characterized by values higher than 100 is typical for the remaining 12 UDs. The highest and fastest average growth rate was recorded by UD Juh II. (176.65%), UD PVÚ (145.84%) and UD Kúpeľný areál (118.74%). The average of the Piešťany Town, according to the average growth rate of the area parameter, has the value of 103.01% which means a slightly increasing dynamics of the area parameter.

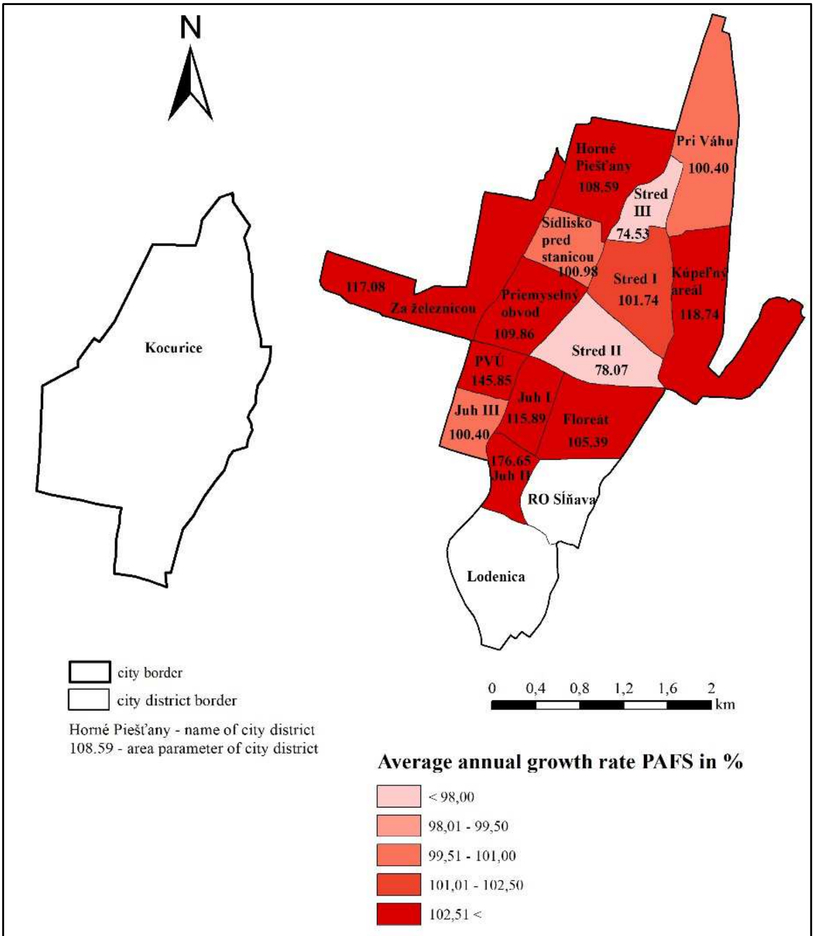


Fig. 3. Average growth rate of PAFS at the level of urban districts of Piešťany Town in 2011-2017.

DISCUSION

In the contributions of the Slovak geography of retail, the authors' attention is only exceptionally focused on the analysis of the spatial changes of the urban areas on the basis of surface parameter indicators area parameter PAFS the ratio of the population (in thousands) to the admissible floor space (m^2/1000 inhabitants). This is especially the analysis new retail space and development of the large-scale retail in a post-socialist city (Pulpitlová, 2005, Dudek-Mankowska and Križan 2010; Trembošová, 2010, 2012, Kunc et al. 2016, Trembošová et al. 2016, Mitríková, 2017). Evaluating the intraurban schemes, retail development in the city centre, in its suburbs or outside the territory of the city (cf. Nagy 2001) should be considered.

Urbanists and geographers traditionally prioritized the retail as a key indicator of city vitality and determining the centre’s position in the city hierarchy (Hillier, 1999). The concept of “live centre” is the main topic of Hillier theory of centrality as a process, in which it is stated that models of movement of pedestrians are affected by the city border network, what is leading to formation of networks of connected centres with retail shops and other services. If shopping depends on the sample of pedestrian movement, which type of space comparable features of city street network predetermines localization of shops (cf. Vaughan et al. 2010). Even from research (cf. Hillier 1999, p.110-113) was revealed, that shops tend to be localized along most spatially integrated streets and in streets with high level of connectivity.

Retailing in postsocialism cities lost, according to Maryas et al. (2014), their traditional and key positions in favour of the new shopping centres, which have grown on the outskirts. These trends (Hillier theory, 1999, Maryaš theory, 2014) have also been identified in surveyed Piešťany town, because the town of Piešťany is a spa and tourist destination, while fulfilling the functions of a district town.

CONCLUSION

In a society formed under the influence of a free market economy, the size of demand is clearly the most important factor. It can be rightly assumed that in the major tourist centers this is the dominant component of demand. This must also be reflected in the nature of the retail network. Given the relatively long history of tourism development in Piešťany, it is not surprising that the retail network in this city has adapted to such a modified demand (Trembošová and Tremboš, 2014).

In the Piešťany town between years 2011 and 2017, there were two processes: the number of inhabitants declined and the number and sales area of retail stores increased. These processes affected the calculation of the selected parameters - area and service parameter and reflected on their change. Compared to 2011, when the regional hierarchical level of the area parameter was reached by 2 UD (Stred II. and Za železnicou), in 2017 it was already 4 UDs (Kúpeľný areál, Stred I., PVÚ a Za železnicou). According to the growth rate, the biggest changes were in UD PVÚ, UD Kúpeľný ostrov and UD Za železnicou. The result of the analysis of area parameter is the reduction of disparities between the retail facilities of individual UDs. The high serviceability was reached by 5 UDs (Stred I., Kúpeľný ostrov, Priemyselný obvod, Juh II., and Za železnicou) According to the growth rate, the most significant changes were in UD PVÚ, UD Priemyselný obvod and Stred II.

Piešťany Town with the status of spa town was also influenced by our procedure also counted aliquots overnight stay visitors (in 2011 - 1 528 and in 2017 - 1 697) to the permanent inhabitants. Since we do not know the exact locations of hotels and guest houses as well as other accommodation facilities with given overnight stays, these numbers were added to the town average. This method changed the town average of both parameters. PAFS reached the value of 3,244 (2011) and 3,699 (2017) (increase by 11.25%), service parameter was 59.9 (2011) and 57.3 (2017) (decrease by 4.35%).

The long-term reduction of the number of inhabitants supports existence of abandoned areas in cities, mostly associated with deindustrialisation processes.

The population decline in the town of Piešťany is definitely not reflected in the retail network which, on the contrary, is developing and growing also due to the growth of the population in its background. Spa, culture, rich history of Piešťany Town attracts visitors to repeated visits which leads owners and potential investors to develop the retail network and innovate already operating and functioning retail stores.

In the next stage of the research it will be interesting to extend our results on the research of the impact of population purchasing power on the development of retail network or comparison with the Topoľčany Town with a similar number of 26 916 inhabitants (to 31.12.2012), where the same research of retail network (total 346 stores in area 45,281 m², a PAFS 1,682 m²/1000 inhabitants) was carried out in 2012.

In the paper, we achieved results that speak of a positive situation in the town of Piešťany at present, but also having a significant effect on the future. It is possible to assume that the retail network of the Piešťany Town will be constantly developing. It should be said that in 2011 the local self-government did not agree with for building the hobby market called OBI because of the chosen place. At present, Piešťany authorities do not register applications for a change in spatial plan for the needs of new investors in retail sector.

Acknowledgment: This article was prepared as part of the project VEGA No.1/0799/14 project: "Geographical Aspects of the Retail Network of Large Cities in New Market Conditions".

REFERENCES

AUBERT, A., CSAPÓ, J. 2004. Transition of retail supply of the small cities of Baranya County. In: *Sammelband Zsilincsar [ed.]: Neue Einzelhandelstrukturen am Rande von Kleinstädten*. Tagung Forschungssechseck Hartberg, Graz, Institut für Geographie und Raumforschung, Karl Franzens Universität. p. 89-98. ISBN 3-901266-02-3.

BARTSCH, H.J. 1987. *Matematické vzorce*. 2. vyd. Praha: SNTL, 1987, p. 746. ISBN 80-200-1448-9.

BILKOVÁ, K., KRIŽAN, F. 2013. Koncentrácia podnikateľských subjektov v maloobchode v slovenských mestách. In: *Geographia Cassoviensis,* Vol. 7., p. 31-44.

BILKOVÁ, K., KRIŽAN, F. 2015. Mapping of grocery stores in Slovak countryside in context of food deserts. In: *Acta Universitatis Agriculturae et Silviculturae Mendelianae Brunensis*, Vol. 63, p. 1633 -1638.

BUČEK, J., BLEHA, B. 2013. Urban Shrinkage as a Challenge to Local Development Planning in Slovakia. In: *Moravian Geographical Reports*, Vol. 21, No.1, p. 2-15. https://doi.org/10.2478/mgr-2013-0001

CHOI, Y., SUZUKI, T. 2013. "Food Deserts, Activity Patterns, & Social Excclusion: The Case of Tokyo, Japan." In: *Applied Geography,* Vol. 43, p. 87-98. https://doi.org/10.1016/j.apgeog.2013.05.009

DAŇO, F. [ed.]: (2003): *Distribučný manažment*. Hronský Beňadik, Netri. 68 pp. ISBN 80-968904-1-7.

DUDEK-MANKOWSKA, S. KRIŽAN, F. 2010. Shopping centers in Warsaw and Bratislava: a comparative analysis. In: *Miscellanea Geographica*, No. 14, pp. 215-225. ISSN 0867-6046.

FERTAĽOVÁ, J., KLAMÁR, R. 2006. Hodnotenie návštevnosti vybraných veľkoplošných predajní. In: *Folia geographica*, Vol. 10, p. 140-155. ISSN 1336-6157.

FERTAĽOVÁ, J., VARGA, P. 2008. The Huff's probability model and its application on selected large-area retail units in Košice. In: *Folia geographica*, Vol. 12, p. 77-81. ISSN 1336-614.

GÁLISOVÁ, I. 2012. *Vybrané geografické aspekty maloobchodnej siete mesta Piešťany*. Diplomová práca. Nitra : FPV UKF; Katedra geografie a regionálneho rozvoja, 2012. 87 pp.

GUY, C. 1998. Classifications of retail Stores and Shopping Centres: Some Methodological Issues. In *GeoJournal*, Vol. 45, No. 4, p. 255-264. ISSN 0343-2521. https://doi.org/10.1023/A:1006960414161

HAASE, A., RINK, D., GROSSMANN, K. 2016. Shrinking Cities in Post-socialist Europe: What can we learn from their Analysis for Theory building today. In: *Geografiska Annaler: Series B, Human Geography*, Vol. 98, No. 4, p. 305–319. https:/10.1111/geob.12106

HILLIER, B. 1999. Centrality as a process: Accounting for attraction inequalities in deformed grids. In: *Urban Design International*, Vol. 4, No. 3, p. 107-127. https://doi.org/10.1057/udi.1999.19

KRIŽAN, F. 2007. Regionálna typológia územia Bratislavy na základe dostupnosti supermarketov a hypermarketov. In: *Geografický časopis*, Vol. 59, No. 4, p. 373-384. ISSN 0016-7193.

KRIŽAN, F. 2009. Globalizácia maloobchodu: definícia základných procesov a ich analýza v slovenskej geografii maloobchodu. In: *Geografický časopis*, Vol. 61, No. 1, p. 49-68. ISSN 0016-7193.

KRIŽAN, F., DANIELOVÁ, K. 2008. „Potravinové púšte" definované na základe merania dostupnosti – prípadová štúdia mesta Bratislava. In: *Urbanizmus a územní rozvoj*, Vol. 9, No. 3, p. 1-6. ISSN 0231-715.

KRIŽAN, F., LAUKO, V. 2014. *Geografia maloobchodu. Úvod do problematiky*. Bratislava: Univerzita Komenského. 196 pp. ISBN 978-80-223-3542-3. ISBN 978-80-223-3542-3.

KUNC, J., FRANTÁL, B., SIWEK, T., HALÁS, M., KLAPKA, P., SZCZYRBA, Z., ZUSKÁČOVÁ, V. 2013. *Časoprostorové modely nákupního chování české populace*. Brno, Masarykova univerzita. 194 pp. ISBN 978-80-210-5875-0.

KUNC, J. KRIŽAN, F. BILKOVÁ, K., BARLÍK, P. MARYÁŠ, J. 2016. Are there differences in the attractiveness of shopping centres? Experiences from the Czech and Slovak Republics. Moravian Geographical Reports, *24*, No. 1, pp. 27-41. ISSN 1210-8812.

MARYÁŠ, J., KUNC, J., TONEV, P., SZCZYRBA, Z. 2014. Shopping and services related travel in the hinterland of Brno: changes from the socialist period to the present. In: *Moravian Geographical Reports*, Vol. 22, No. 3, p. 18–28. ISSN 1210-8812. https://doi.org/10.2478/mgr-2014-0015

MITRÍKOVÁ, J. 2008. *Geografické aspekty transformácie maloobchodu a nákupného správania sa na Slovensku (prípadové štúdie z miest Prešova Košice)*. Prešov, Prešovská univerzita. 213 pp. ISBN 978-80-8068-922-3. *https://doi.org/10.5937/GeoPan1503110M*

MITRÍKOVÁ, J., ŠENKOVÁ, A., ANTOLÍKOVÁ, S. 2015. Application of the Huff model of shopping probability in the selected stores in Prešov (Slovak Republic). In: *Geographica Pannonica*, Vol. 19, No. 3, p. 110 – 121. ISSN 0354-8724.

MITRÍKOVÁ, J. 2017. *Geografia maloobchodu*. *(vybrané kapitoly).* Prešov, Prešovská univerzita. 115 pp. ISBN 978-80-8165-218-9.

NAGY, E. 2001. Winners and Losers in the Transformation of City Centre Retailing in East Central Europe. In: *European Urban and Regional Studies*, Vol. 8, No. 4, p. 340-348. ISSN 0238-2008.

PETROVČÍKOVÁ, K. 2015. Lokalizácia maloobchodných jednotiek v regióne. In: *Ekonomické aspekty územnej samosprávy – medzinárodná vedecká konferencia*: recenzovaný zborník. Košice, Univerzita P. J. Šafárika. 1-6 p. ISBN 978-80-8152-361-8.

PULPITLOVÁ, M. 2005. Maloobchodná sieť mesta Nitry v rokoch 1992, 2002 a 2005. In: *Geografie XVI*: Geografické aspekty středoevropského prostoru, p. 337-342. ISBN 80-210-3759-8.

SPILKOVÁ, J. 2012. *Geografie maloobchodu a spotřeby*. Praha, Karolinum. 245 pp. ISBN 978-80-246-1951-4.

SPILKOVÁ, J. 2016. *Alternativní potravinové sítě: česká cesta.* Praha, Karolinum. 184 pp. ISBN 978-80-246-3307-7.

SUCHÝ, J. 2010. *Problematika potravinových pouští – případová studie Zlín*. Diplomová práce. Praha: Katedra sociální geografie a regionálního rozvoje PřF UK.

SZCZYRBA, Z. 2005. *Maloobchod v ČR po roce 1989. Vývoj a trendy se zaměřením na geografickou organizaci*. Olomouc, Univerzita Palackého. 126 pp. ISBN 80-244-1274-8.

SZCZYRBA, Z. 2006. *Geografie obchodu (se zaměřením na současné trendy v maloobchode)*.Olomouc, Univerzita Palackého. 91 p. ISBN 80-244-1453-8.

SZCZYRBA, Z., FIEDOR, D. 2014. Vývoj velkoplošného maloobchodu Olomouce a výzkum nákupního chování. *17th International Colloquium on Regional Sciences*, Brno, p. 740-748. ISBN 978-80-210-6840-7.

STATISTICAL OFFICE, 2017. http://datacube.statistics.sk/#!/view/sk/VBD_

TREMBOŠ, P. TREMBOŠOVÁ, M. 2014. Cestovný ruch a maloobchodná sieť. In: *Sborník z mezinárodní konference Aktuální problémy cestovního ruchu*

„Cestovní ruch a jeho dopady na společnost“. VŠPJ Jihlava, p. 239-248. ISBN 978-80-87035-87-0

TREMBOŠOVÁ, M. 2009. Intraurbánne spádové oblasti maloobchodnej vybavenosti mesta Nitra v roku 2008. In: *Geografické štúdie*, Vol. 13, No. 2, p. 93-109. ISSN 1337-9445.

TREMBOŠOVÁ, M. 2010. Vybrané aspekty transformácie maloobchodu v meste Nitra v rokoch 1992–2008. In: *Geografický časopis*, Vol. 62, No. 1, p. 49-73. ISSN 0016-7193.

TREMBOŠOVÁ, M., DUBCOVÁ, A. 2013. Vývoj maloobchodu v Nitre v nových trhových podmienkach. In: *Acta Geographica Universitatis Comenianae*, Vol. 57, No. 2, p. 213-230. ISSN 1338-6034.

TREMBOŠOVÁ, M., DUBCOVÁ, A., CIVÁŇ, M. 2016. *Geografické aspekty maloobchodnej siete mesta Trnava a nákupné správanie jej obyvateľstva.* Prírodovedec, UKF Nitra, 175 pp. ISBN 978-80-558-1103-1.

URBION. 1984. *Zásady a pravidlá územného plánovania*. VÚVA Brno/Urbion Bratislava.

VAUGHAN, L., JONES, C. E., GRIFFITHS, S., HAKLAY, M. 2010. The spatial signature of suburban town centers. In: *The Journal of Space Syntax*, Vol. 1, No. 1, pp 77-91.

VIAS, A. C. 2004. Bigger stores, more stores, or no stores: paths of retail restructuring in rural America. In: *Journal of Rural Studies*, Vol. 20, No. 3, p. 303-318. https://doi.org/10.1016/j.jrurstud.2003.10.003

VITURKA, M., MARYÁŠ, J., TOUŠEK, V., VYSTOUPIL, J. 1998. *Investiční atraktivita vybraných měst České republiky*. Brno: Masarykova Univerzita. 119 pp. ISBN 90-210-2007-5.

WILK, W. 2005. Miesjce miast w sieciach handlowych – przykład Polski. In: *Prace a Studia Geograficzne*, Vol. 35, p. 129-153.

WIECKOVÁ, S. 2017. *Vybrané aspekty maloobchodnej vybavenosti mesta Piešťany*. Bakalárska práca. Nitra : FPV UKF; Katedra geografie a regionálneho rozvoja, 2017. 59 pp.

WRIGLEY, N., WARM, D., MARGETTS, B. 2003. Deprivation, Diet, and Food-Retail Access: Findings from the Leeds `Food Deserts' Study. In: *Environment and Planning A*, Vol. 35, p. 151-188.

Zhrnutie

V spoločnosti formovanej pod vplyvom slobodného trhového hospodárstva je jednoznačne najvýznamnejším faktorom veľkosť dopytu. Možno oprávnene predpokladať, že vo významných centrách cestovného ruchu tento tvorí dominantnú zložku dopytu. To sa zákonite musí prejaviť aj na charaktere maloobchodnej siete. Vzhľadom na relatívne dlhú históriu rozvoja cestovného ruchu v Piešťanoch nie je prekvapujúce, že aj maloobchodná sieť sa v tomto meste prispôsobila takto modifikovanému dopytu (Trembošová and Tremboš, 2014).

Skúmané okresné mesto Piešťany patrí do skupiny „shrinking“ miest (Buček, Bleha, 2013), ktorých počet obyvateľov sa znižuje. Pokles počtu obyvateľov v mestách je bežný fenomén v regióne postsocialistických miest

(Haase, Rink, Grossmann, 2016). Podľa Bučeka a Blehu, (2013) je to ovplyvnené radom procesov sprevádzajúcich postsocialistickú transformáciu a globalizáciu, dezintegráciu, pokles celkovej plodnosti po roku 1989, proces odloženej plodnosti v postsocialistických krajinách, suburbanizácia do vidieckych obcí a pod. Dlhodobé znižovanie počtu obyvateľov podmieňuje vznik voľných resp. opustených plôch v mestách, zväčša spojených s procesmi deindustralizácie.

Znižovanie počtu obyvateľov v meste Piešťany sa rozhodne neodzrkadlilo v maloobchodnej sieti, ktorá sa naopak intenzívne rozvíja a vzrastá. Kúpeľníctvo, kultúra, bohatá história mesta Piešťany láka návštevníkov opakovane prichádzať do Piešťan, a to vedie majiteľov a potenciálnych investorov vynakladať úsilie o rozvoj maloobchodnej siete a inováciu už pôsobiacich a fungujúcich maloobchodných predajní.

V meste v rokoch 2011 až 2017 prebiehali súčasne dva procesy, znižoval sa počet obyvateľov a zvyšoval sa počet a predajná plocha maloobchodných prevádzok. Tieto procesy ovplyvnili ukazovatele pre výpočet nami vybraných parametrov - plošný a obslužný parameter a odzrkadlili sa v ich zmene. V porovnaní s rokom 2011, kedy regionálnu hierarchickú úroveň plošného parametra dosiahli 2 UO (Stred II. a Za železnicou, v roku 2017 to už boli 4 UO (Kúpeľný areál, Stred I., PVÚ a Za železnicou). Podľa tempa rastu najväčšie zmeny prebehli v UO PVÚ, Kúpeľný ostrov a Za železnicou. Výsledkom analýzy plošného parametra je znižovanie disparít MO vybavenosti medzi jednotlivými UO. Vysokú obslužnosť podľa rovnomenného parametra dosiahlo 5 UO (Stred I., Kúpeľný ostrov, Priemyselný obvod, Juh II., a Za železnicou). Podľa tempa rastu boli najvýraznejšie zmeny v PVÚ, Priemyselný obvod a Stred II.

Piešťany so statusom kúpeľného mesta ovplyvnili aj naše postupy, keď sme do počtu obyvateľov s trvalým pobytom pripočítali alikvótne prepočty prenocovaných návštevníkov, ktorých v roku 2011 bolo 1528 a v roku 2017 1697. Keďže nepoznáme presné lokalizácie hotelov a penziónov ako i ostatných ubytovacích zariadení s danými prenocovaniami, tieto počty sme boli nútený pripočítať až k priemeru mesta. Týmto postupom sa nám zmenili celomestské priemery oboch parametrov, PAFS dosiahol v roku 2011 hodnotu 3,244 a 3,699 v roku 2017 (nárast o 11,25%), obslužný parameter mesta Piešťany v roku 2011 bol 59.9 a 57.3 v roku 2017 (pokles o 4,35%).

V ďalšej etape výskumu bude zaujímavé rozšíriť naše výsledky o spracovanie vplyvu kúpnej sily obyvateľstva na rozvoj MO siete, príp. o porovnanie s mestom Topoľčany s podobným počtom obyvateľov (26 916 k 31.12.2012, kde prebiehal rovnaký výskum MO siete v r. 2012 spolu 346 predajní na ploche 45 281 m², PAFS bol 1,682 (m²/1000 inhabitants).

V práci sme dospeli k výsledkom, ktoré hovoria o pozitívnej situácií v meste Piešťany v súčasnosti, ale výrazne ovplyvňujú dianie aj do budúcna a je možné predpokladať, že MO sieť mesta Piešťany sa bude neustále perspektívne rozvíjať. V súčasnosti MsÚ Piešťany neregistruje žiadosti o zmenu územného plánu pre potreby nových investorov v maloobchodnom sektore.

SELECTED INDICATORS OF COMPUTER LTERACY OF THE POPULATION IN SLOVAKIA

Katarína Vilinová, Gabriela Repaská, Laura Babjaková

Department of Geography and Regional Development, Faculty of Natural Sciences Constantine the Philosopher University in Nitra, Tr. A. Hlinku 1, 949 74, Nitra

kvilinova@ukf.sk, grepaska@ukf.sk, laura.babjakova@student.ukf.sk

Abstract: Due to the rapid growth of scientific knowledge and development of information and communication technologies, significant changes are taking place in individual countries. New technologies are coming to the fore through which there is an increase in country's economy, employment as well as labor productivity. To some extent, this fact is influenced by the ability of basic computer skills. Computer handling is an essential knowledge important to all areas of human life. Computer work is one of the leading characters of an information society. At the same time, this indicator is also important from the viewpoint of regional development of individual regions. The aim of the paper is to characterize selected indicators of computer literacy (work with text and the Internet) in the districts of Slovakia based on the results of the population census in 2011. The methods of analysis, synthesis as well as graphical and cartographic methods will be the main methods used in the paper.

Key words: computer literacy, work with text, work with the Internet, Slovakia, districts

COMPUTER LITERACY OF THE POPULATION

The current 21st century population is often referred to as an information society. This concept is related to the development of information and telecommunication technologies which affect the economies in individual countries of the world as well as their inhabitants.

As a result of the introduction of new technologies and innovations, the countries have to adapt to this trend and maintain the pace of growth. At the same time, considerable disparities in the development in different regions of the world have emerged. Informatization has led to a transition from an industrial society to an informational society which is very closely related to literacy.

Literacy is currently a very broad-spectrum concept that includes several other types (digital, computer, and information). These began to be separated gradually with the development of civilization. The most basic understanding is that it is the ability of a person to write, read and count.

Digital literacy includes the ability to understand information and use it in various formats from various sources presented through modern information and communication technologies (Velšič, 2005). At present, however, it may seem that this term is only a synonym of computer literacy and it is often being interchanged. These two types of literacy have a close connection, but not the same meaning. Digital literacy is a relatively complex phenomenon which can be effectively expressed through a synthesizing indicator - Digital Literacy Index (DLI). According to Svetlík, Bačíková (2015), the level of digital literacy is specific to several aspects whether in terms of gender, educational structure or other factors. Digital literacy includes also computer literacy and complements it with several competencies and capabilities that enable critical, creative and safe procedures to work with digital technologies in all areas of life. The connection to education from primary school is very important from the viewpoint of development of the given literacy (Hosťovecký, Štubňa, 2012, Kramáreková et al., 2016).

In today's society, great emphasis is placed on **information literacy**. Its importance grows gradually and it is important to every individual from the aspect of both personal and professional life. This literacy is an indispensable part of primary, secondary and tertiary education. However, it gradually becomes part of lifelong learning of the population. The information society is defined by several authors e.g. Korcová (2004), Klinec, (2010), etc.

Computer literacy is generally understood as the ability of a person to handle and use a personal computer. This concept is very difficult to precisely define and separate from information or digital literacy. According to Jirák, Wolak (2007), the computer literacy represents a set of knowledge and skills aimed at handling and using the computer in life (work with a text program, tables, graphs, numerical data, acquiring information and communicating via computer, using the Internet, e-mail account, etc.). One aspect of computer literacy is its spatial differentiation. This phenomenon is analyzed in the young population of Serbia by Stojanovic et al. (2017). They point to the differences in both age and gender structure of this population group.

Indicators for the Evaluation of Computer Literacy of the Population in Slovakia

In Slovakia, computer literacy has been paid close attention in recent years since it lags behind the European average regarding the level of individual computer skills. In particular, it is the older generation which has difficulties in adapting to the use of modern technologies. Increase in the level of computer knowledge and skills is also important from the aspect of communication of population and various state institutions. Due to the informatization of society, most of the services of state institutions are being mediated via the Internet (Velšič, 2015).

The population census in Slovakia in 2011 (SODB 2011) included for the first time the survey on the computer knowledge of the population i.e. skills related to the computer literacy. For the first time, the population was surveyed the level of selected computer skills. The census was a part of the global population and housing census program. It was organized in cooperation with Eurostat and coordinated by the United Nations.

The Statistical Office of the Slovak Republic surveyed the ability of the population to handle individual computer skills which they identified as computer literacy. The content of the survey was not to find the level of handling particular skills, but only the fact if the person handles the given skills through self-assessment. The survey included four areas of computer literacy: work with text, tables, e-mail, and the Internet.

During the SODB 2011, Slovakia had 5 397 036 inhabitants. Based on the census data, 49.9% of the population can work with text while 38.8% of them can handle the work with tables. The work with an e-mail was declared by 46.9% of the population and work with the Internet by 53.8% (Table 1).

Different types of skills belonging to computer literacy and which were analyzed require different knowledge and skills. Work with the Internet is one of the most basic skills in order to handle computer work. This skill is currently handled also by preschool children because it does not require any special education. The second highest share can be seen in the work with text. Nowadays, this skill is a necessity in some jobs as well as in education. It is handled by about half of the population in Slovakia. Regarding the work with table editor such as Microsoft Excel, the lowest percentage of population (38.8%) was recorded. This computer skill is mostly used by people with higher education. This type of activity already requires more knowledge and experience. From a gender perspective, we can say that men prevail in all computer skills (Table 1) which means that male gender has a closer relation to these technical skills.

Tab. 1: Computer skills of the population in Slovakia according to gender in 2011

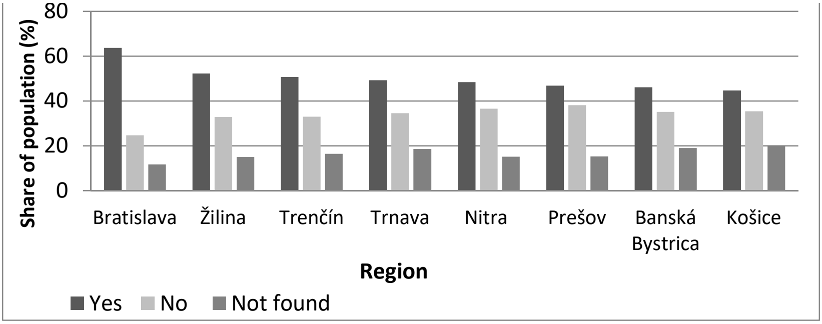
Computer skills	Women		Men		Sum	
	Abs.	%	Abs.	%	Abs.	%
Work with text	1 303 601	24.2	1 387 415	25.7	2 691 016	49.9
Work with tables	1 033 876	19.2	1 062 327	19.7	2 096 203	38.8
Work with e-mail	1 245 998	23.1	1 287 623	23.9	2 533 621	46.9
Work with the Internet	1 445 372	26.8	1 460 002	27.1	2 905 374	53.8

Source: SODB 2011; elaborated by: Babjaková L., 2017

One of the most common activities in the computer work is writing and editing text. **Work with text** usually belongs to the first activities with which the computer beginners start to get familiar. The programs that are needed to create a text are called text editors. There are a number of text editors from different software companies. An example is Microsoft Word which is a part of the most widely used office software called Microsoft Office.

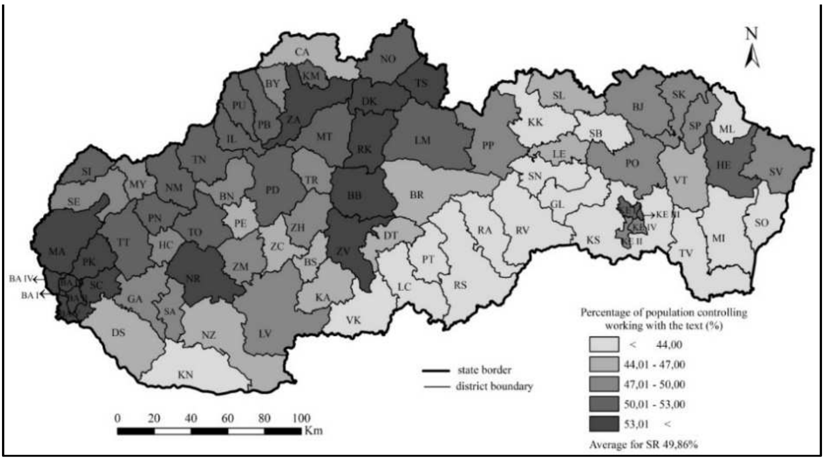
At the regional level, we can see different representation of this skill, which is documented in Graph 1. The highest percentage was recorded in the Bratislava Self-governing Region (63.7%). On the contrary, the Košice

Self-governing Region reached the lowest value with 44.7% of the population who can work with text.



Graph 1: Population with the ability to work with text in the regions of Slovakia in 2011
Source: SODB 2011; elaborated by: Babjaková L., 2017

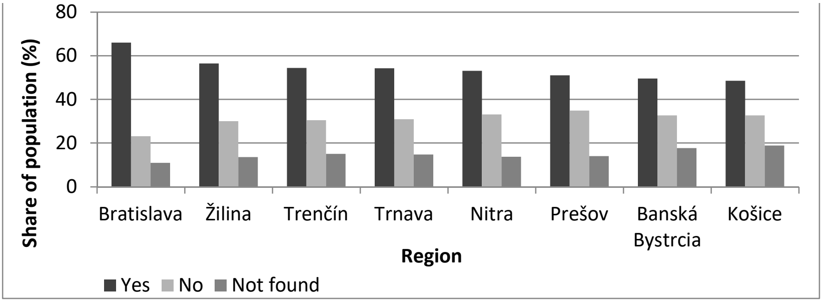
Map 1 documents the studied indicator at the level of districts in Slovakia. Significantly above-average values can be seen especially in the districts located in the Bratislava Self-governing Region. These districts are accompanied by the Nitra District as well as six districts located mainly in the central part of Slovakia. The highest values were reached by the districts of Bratislava V (70.2%) and Bratislava IV (69.2%). Below-average values of handling this skill can be seen in the districts of Southern and Eastern Slovakia with the exception of the districts of Humenné, Košice I, and Košice III.



Map 1: Population with the ability to work with text in the districts of Slovakia in 2011
Source: SODB 2011; elaborated by: Babjaková L., 2017

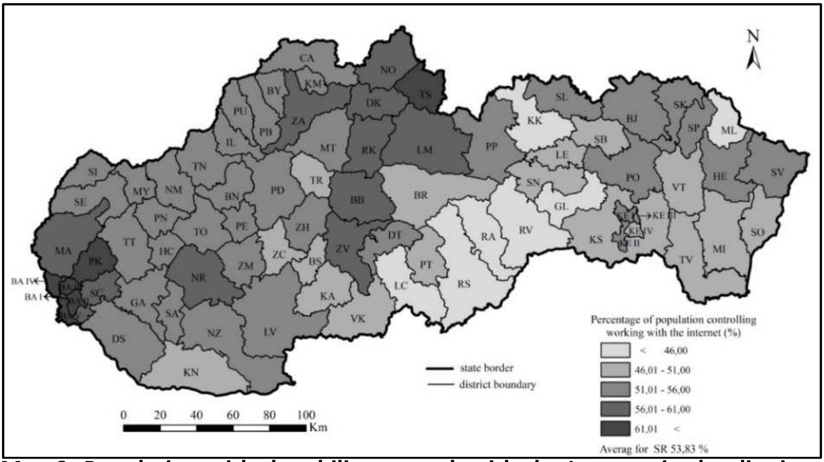
The created disparities between Western and Eastern Slovakia are caused by different educational structure, economic activity of the population and an important role is played in particular by larger representation of the Roma minority in the districts of Southern and Eastern Slovakia. Therefore, the lowest values were reached in the districts of Revúca (37.8%), Rimavská Sobota (38.1%), and Kežmarok (39.3%) which in long-term belong to the least developed districts of Slovakia from the viewpoint of several aspects.

The second studied indicator of computer literacy was the work with the Internet. The Internet is one of the information media that has spread very quickly around the world and it still expands. It is the name for a system for viewing, storing and creating links to documents on the Internet.



Graph 2: Population with the ability to work with the Internet in the regions of Slovakia in 2011
Source: SODB 2011; elaborated by: Babjaková L., 2017

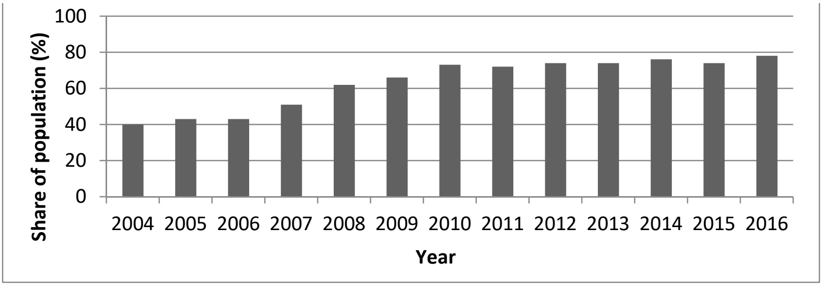
During the census (2011), work with the Internet was the most widely used skill of computer literacy. The highest value at the level of the regions was reached by the Bratislava Self-governing Region (66.1%) and Žilina Self-governing Region (56.4%). Similarly to the previous indicator, the Košice Self-governing Region again maintained its unfavorable position with a share of about 50%. Unlike the previous indicator, the differences in individual regions of Slovakia are less significant (Graph 2).



Map 2: Population with the ability to work with the Internet in the districts of Slovakia in 2011
Source: SODB 2011; elaborated by: Babjaková L., 2017

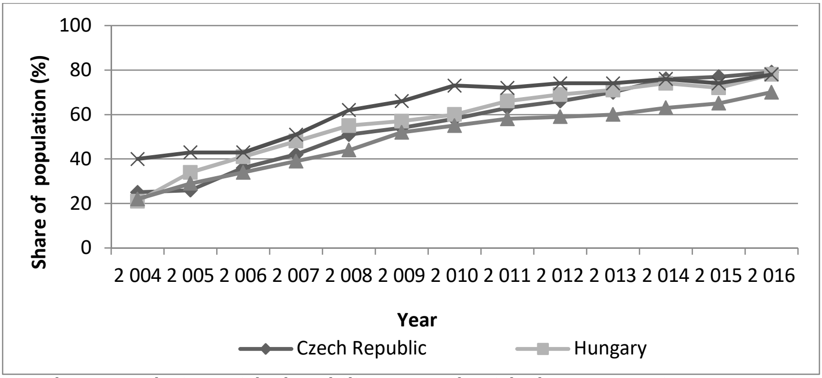
Map 2 documents the ability of inhabitants to work with the Internet in the districts of Slovakia. Similarly to previous indicator, districts of the Bratislava Self-governing Region are dominant. The above-average values were also recorded in these districts: Nitra, Námestovo, Dolný Kubín, Žilina, Ružomberok, Liptovský Mikuláš, Banská Bystrica, and Zvolen. Below-average values were reached by the districts in southern and southeastern part of Slovakia. The lowest share of Internet users was in Revúca (41.4%). This indicator is also affected by the broadband internet connection and its coverage in the regions. The problem is the lack of quality electronic services and the development of access networks. The access networks are built mainly in cities and municipalities with high population density or concentration of business activities. Rural and mountainous areas and economically weak regions remain on the margin of interest. It is these regions where the assistance is directed as a part of the regional development of Slovakia. From the viewpoint of the availability of broadband internet connction, Slovakia clearly belongs to the least developed EU countries despite the dynamic increase in connections.

From the viewpoint of the development of Internet usage, we can see a relatively increasing trend in the studied period of 2004 - 2016 (Graph 3). There were no significant fluctuations during the studied period, but the use of the Internet increased by 3.6% on average from year to year. The greatest progress was in 2007 and 2008. By 2007, the share of Internet users increased by 8% to 51% and in 2008 it was by 11% to 62%. The overall increase in Internet usage during this years is also related to the development of broadband internet coverage in Slovakia which the government set in the programming period of 2007 - 2013 as one of the priorities in the field of informatization of the society. The only decrease in the studied period occurred in 2015 when the share of Internet users dropped by two percent to 74%. By 2016, 78% of the population in Slovakia had the ability to work with the Internet.



Graph 3: Population with the ability to work with the Internet in Slovakia during the years 2004-2016
Source: EUROSTAT; elaborated by: Babjaková L., 2017

Graph 4 documents the development of Internet usage among the population of V4 countries from 2004 to 2016. In the context of the comparison of Slovakia with other V4 countries, we can see a relatively favorable development.



Graph 4: Population with the ability to work with the Internet in V4 countries during the years 2004-2016
Source: EUROSTAT; elaborated by: Babjaková L., 2017

The largest share of the population with the ability to work with the Internet between 2004 and 2014 was in Slovakia. Since 2014, Czechia took a leading position while Slovakia and Hungary recorded approximately the same values. In terms of the change index from the first to the last studied year, the greatest progress was recorded in the Slovak population with the value of 51.3%.

CONCLUSION

Computer literacy of the population is a topic that has been paid much attention in recent years. It is an important aspect for the country and points to its development. It is important to know for the society, professionals and institutions how the population acquires the skills to work with new technologies such as computers.

As for the studied indicators of computer skills of the population in Slovakia in 2011, we can see significant differences in the west-east direction. The western part of Slovakia is economically more developed and more educated as a result of which it recorded the highest shares of the population with computer skills. On the contrary, the eastern part of Slovakia is typical for districts that have long been defined as the least developed regions in terms of several indicators. An example is the lower educational level or economic activity of the population. We can also see considerable differences in the north-south direction where there is a clear lagging of the southern part of Slovakia behind the northern part.

In terms of the development and dynamics of the two main indicators of computer work (work with e-mail, work with the Internet), Slovakia has a positive development in comparison with other V4 countries. By the year 2016, 71% of the population in Slovakia was capable of working with the Internet and 78% with an e-mail. Computer literacy is a necessary prerequisite for life in today's modern society. We can assume that along with the increasing living standard of the population the differences in computer knowledge in Slovakia will decrease and the share of inhabitants capable of computer work will increase. We assume that this trend will be confirmed by the census in 2021.

Acknowledgements: This paper was prepared within the grant project VEGA 1/0934/17: Land-use changes of Slovak cultural landscape over the past 250 years and prediction of its further development.

REFERENCES

HOSŤOVECKY, M., STUBNA, J., 2012. Development of digital literacy in technical subjects at primary schools. **In:** *10th IEEE International Conference on Emerging eLearning Technologies and Applications (ICETA)Location*: Stara Lesna: 2012. pp. 139-141

JIRÁK, J., WOLÁK, R. 2007. *Mediální gramotnost jako dimenze současného člověka.* 1. vyd. Praha: Radioservis, 2007**.** 152 s. ISBN 978-80-86212-58-6.

KLINEC, J. 2010. *Ekonomická podstata prechodu k informačnej spoločnosti.* Bratislava: Ekonomický ústav SAV, 2010. 38 s. [cit. 2017-06-30]. Dostupné na internete:<http://www.ekonom.sav.sk/uploads/journals/WP26.pdf>. ISSN 1337–5598.

KORCOVÁ, Z. 2004. Informačná spoločnosť a SR. **In:** Zborník z vedeckej konferencie *„Aktuálne problémy riešené v agrokomplexe“* Nitra: SPU, 2004, s. 545-551. ISBN 80-8069-488-6.

KRAMARÉKOVÁ, H., NEMČÍKOVÁ, M., RAMPAŠEKOVÁ, Z., SVORAD, A., DUBCOVÁ, A., VOJTEK, M. 2016. Cartographic Competence of a Geography Teacher – Current State and Perspective. In: Bandrova, T., Konečný, M. (eds.) *6th International Conference on Cartography & GIS*: vol. 1, 2016. pp. 200-209. ISSN 1314-0604. https://doi.org/10.18421/GP21.01-04

STOJANOVIC, T., PENJISEVIC, I., LUKIC, T., ZIVKOVIC, J. *Computer literacy of young people in Serbia and regional differences*. In: Geographica Pannonica. vol. 21 (1). pp. 43-53. DOI: 10.18421/GP21.01-04

SVETLIK, J., BACIKOVA, Z., 2015. Digital natives immigrants and literacy, age and gender differences in Slovakia. In: *International Scientific Conference on Marketing Identity – Digital Life Location*: Smolenice: 2015, pp. 331-342

VELŠIČ, M. 2005. *Digitálna gramotnosť na Slovensku.* Bratislava: Inštitút pre verejné otázky. 2005. 31 s. [cit. 2017-07-10]. Dostupné na internete: <http://www.ivo.sk/buxus/docs//vyskum/subor/Digitalna_gramotnost.pdf >.

VELŠIČ, M. 2015. *Digitálna gramotnosť na Slovensku.* Bratislava: Inštitút pre verejné otázky. 2015. 31 s. [cit. 2017-07-10]. Dostupné na internete: <http://www.ivo.sk/buxus/docs//publikacie/subory/Digitalna_gramotnost _2015.pdf>.

Zhrnutie

V dôsledku rýchleho rastu vedeckých poznatkov a vývoja informačno-komunikačných technológií nastávajú v jednotlivých krajinách výrazné zmeny. Do popredia sa dostávajú nové technológie, prostredníctvom ktorých dochádza k ekonomickému rastu krajiny, rastu zamestnanosti a v neposlednom rade rastu produktivity práce. Tento fakt je do určitej miery opvlyvnený schopnosťou základných počítačových zručností. Ovládanie práce s počítačom je nevyhnutnou znalosťou dôležitou pre všetky oblasti života človeka. Práca s počítačom je jeden z popredných znakov informačnej spoločnosti. Zároveň je tento ukazovateľ dôležitý aj z hľadiska regionálneho rozvoja jednotlivých regiónov. Cieľom príspevku je charakteristika vybraných ukazovateľov počítačovej gramotnosti (práca s textom a internetom) v okresoch Slovenska na základe výsledkov Sčítania obyvateľov domov a bytov (SODB) 2011. Počítačová gramotnosť obyvateľstva je téma, ktorej sa v priebehu posledných rokov venuje veľká pozornosť. Je to dôležitý aspekt rozvoja krajiny a poukazuje na jej vyspelosť. Pre spoločnosť, odborníkov ako aj inštitúcie je dôležité zisťovanie stavu populácie v oblasti osvojenia si zručnosti práce s novými technológiami ako sú počítače.

Pri sledovaných indikátoroch počítačových znalostí obyvateľov na území Slovenska k roku 2011 môžeme konštatovať značné rozdiely v smere západ – východ. Západná časť územia Slovenska tvorí ekonomicky rozvinutejšiu, vzdelanejšiu časť územia v dôsledku čoho vykazovala aj najvyššie podiely obyvateľov schopných ovládať jednotlivé počítačové zručnosti. Naopak východná časť Slovenska je typická lokalizáciou okresov, ktoré sú dlhodobo definované ako najzaostalejšie regióny z hľadiska viacerých ukazovateľov. Príkladom je nižšia vzdelanostná úroveň či ekonomická aktivita obyvateľov.

Značné rozdiely sme mohli sledovať na území našej krajiny aj v smere sever – juh, kde je zreteľné zaostávanie južnej časti Slovenska za severnou. Z hľadiska vývoja a dynamiky ovládania dvoch hlavných indikátorov v oblasti práce s počítačom (práca s e-mailom, práca s internetom) má Slovensko priaznivý vývoj aj v porovnaní s krajinami patriacimi do spoločenstva Vyšehradskej štvorky. K roku 2016 ovládalo prácu s e-mailom 71% obyvateľov a prácu s internetom 78% obyvateľov Slovenska. Počítačové znalosti sú nevyhnutným predpokladom života v dnešnej modernej spoločnosti a môžeme predpokladať, že so zvyšujúcou sa životnou úrovňou obyvateľov sa budú v priebehu nasledujúcich rokov zmenšovať aj jednotlivé rozdiely ovládania počítačových znalostí v rámci územia Slovenska a celkovo sa bude zvyšovať podiel obyvateľov schopných ovládať prácu s počítačom. Predpokladáme, že tento trend sa potvrdí pri sčítanie v roku 2021.

POTENTIAL OF THE TOURISM DEVELOPMENT IN MUNICIPALITIES OF THE LOCAL ACTION GROUP HORNÝ LIPTOV

Gréta Vrbičanová[1], Hilda Kramáreková[2]

[1] *Department of Ecology and Environmentalistics, Faculty of Natural Sciences, Constantine the Philosopher University in Nitra, Trieda A. Hlinku 1, 949 74 Nitra, Slovak Republic*

greta.vrbicanova@ukf.sk

[2] *Department of Geography and Regional Development, Faculty of Natural Sciences, Constantine the Philosopher University in Nitra, Trieda A. Hlinku 1, 949 74 Nitra, Slovak Republic*

hkramarekova@ukf.sk

Abstract: Tourism has a significant impact on the economic and social development of the regions. The importance of this sector, not only for the economy but also for the general development of countries, confirms the fact that the United Nations declared the year 2017 as the International Year of Sustainable Tourism for Development. This organization appeals to tourism stakeholders and the public to create a number of positive changes in tourism. Their job is to look for new opportunities, ways of promotion, and tourism services in less desired areas. In this sense, the aim of this article was defined – to analyze the tourism potential for the region of Horný Liptov in the context of activities of relevant organizations and to propose new activities for its further development.

Key words: development, tourism, publicity, Local Action Group Horný Liptov

INTRODUCTION

Tourist industry in Slovakia began to develop in the eighteenth century in the area of Western Carpathian. The development of skiing, mountain climbing and tourism in Tatras and Liptov region started not until 1873 with the establishment of the Hungarian Carpathian Society in Tatranská Lomnica. During the twentieth century, a system of tourist trails was established here ranked among the best in the world considering the length, maintenance, marking, and compatibility with GPS maps (Pichlerová, 2015). The high potential in tourism of Liptov region does not consist only in its natural uniquenesses but also in cultural traditions. In this article, we will deal with potential development of tourism of the Local Action Group Horný Liptov (LAG HL), the method of its propagation and with organizations whose activities in the area influence the development of tourism.

THEORETICAL-METHODOLOGICAL ASPECTS

Tourism is an important factor of the regional economy which becomes evident by the means of income function, employment function, balancing function and value creation function (Jarábková, 2010). Several strategic documents ensureits sustainable development, both on transnational level (e. g. A European Strategy for more Growth and Jobs in Coastal and Maritime Tourism, www.europarl.europa.eu) and on national level The Tourism Development Strategy till 2020, www.telecom.gov.sk). Concerning the legislative, the following laws interfere the most with the tourism area: Act No 91/2010 Coll. on support of tourism and Act No 281/2001 Coll. On Collective Tours, Business Conditions for the Travel Offices and Agencies. Hence the development of sustainable tourism in the area of LAG HL requires usage of natural, cultural and other resources with the emphasis on the preservation of their natural values. The planning of the development must be coordinated with an institution and a strategic document also on the subregional level. For the LAG HL there are two strategy papers in the new program period: Community-Led Local Development (CLLD) of LAG HL 2014-2020 and Common Program of Economic and Social Development of LAG HL till 2022 (the elaborator of both documents is the LAG HL).

The development of microregions in Slovak Republic represents a broad publication issue. From among the inspirational works of national provenience we might mention authors as Charvát (2012), Kramáreková, Dubcová, Kasanická (2009), Oremusová (2009) and others. Many authors also deal with the tourism development problem in conditions of microregions or the LAG in the Slovak Republic, e.g. Novanská a Brnkaľáková (2014), Bátora et al. (2010), Jarábková (2010), Dubcová, Kramáreková, Rýchla (2001), Clarke et al. (2001) and others. In the article, we outlined the question of ecosystem services evaluation which consists in the identification of ecological, social and economic values of the area and its subsequent protection. The authors, who are engaged in this area, are e.g. Bucur, Strobel (2012), Getzner (2010), Považan, Getzner, Švajda (2014) and others. We have used the information also from the authors Vrbičanová, Kramáreková (2016), Vrbičanová (2016), Pichlerová (2015), Mariot (1983) and from the websites www.hornyliptov.sk (LAG HL, 2015), www.klasterliptov.sk (Klaster Liptov, 2017), www.napant.sk (Národný park Nízke Tatry - NAPANT, 2017), www.spravatanap.sk (Tatranský národný park - TANAP, 2017), www.euwt-tatry.eu (European Grouping of Territorial Cooperation TATRY Limited – EGTC TATRY Ltd, 2017).

We used several methods - the method of analysis, field research, questionnaire survey of the 25 mayors of municipalities, comparative method and SWOT analysis. Thanks to them, we identified the suppositions of tourism development in the LAG HL area and the organizations in the area with participation in tourism. The results of the questionnaire survey were evaluated in absolute and relative data and visualized through graphs. Map outputs were processed using ArcView GIS software.

CHARACTERISTICS OF THE LOCAL ACTION GROUP HORNÝ LIPTOV

The LAG HL is situated in the southeastern part of Liptovský Mikuláš district in Žilina region. The area extends on the West of Liptovská kotlina (Liptov Basin), it is lined by the Low Tatras mountain range from the South, and by the West and High Tatras from the South. The most important water course is Váh running through the center of the LAG HL area. The area of this association is bordered by Poland on the North, by Poprad district on the East, and by Brezno district on the South. Considering the transport, the area has a convenient location. A railway traverses almost through its center (railway 105, section Liptovský Mikuláš – Liptovský Hrádok – Važec) and D1 motorway section in the West – East direction. The nearest airport is located in Poprad, a city distant 27 km to the East from the LAG HL area.

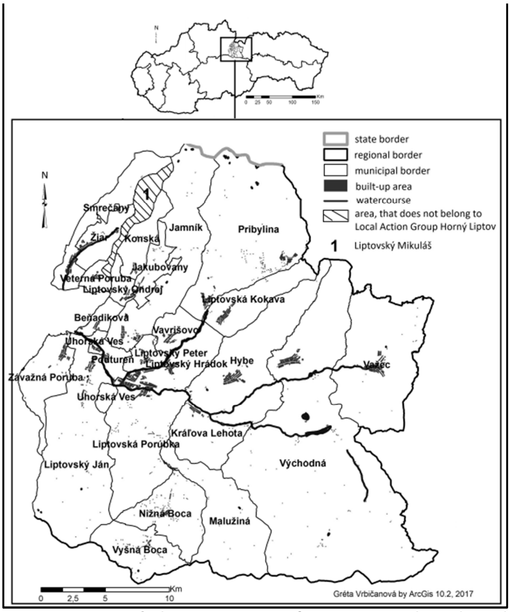


Fig. 1. Area of the LAG Horný Liptov in the Slovak Republic (2017).

The idea to connect the municipalities of Horný Liptov with the intent to systematical partnership on the development originated in 2007. Twenty-one municipalities altogether joined the public-private partnership in 2008 (Vyšná Boca, Nižná Boca, Malužiná, Kráľova Lehota, Liptovská Porúbka, Podtureň, Liptovský Ján, Uhorská Ves, Beňadiková, Liptovský Ondrej, Konská, Jakubovany, Jamník, Pribylina, Liptovská Kokava, Vavrišovo, Liptovský Peter, Hybe, Východná, Važec, Závažná Poruba) and Liptovský Hrádok. Six years later, Veterná Poruba, Smrečany, and Žiar joined the association as well (Fig. 1). Twenty-five municipalities, twelve corporate entities, and eighteen personal entities are its members at the present time. These 25 municipalities represent 800.77 km^2 (59.7% of the area of

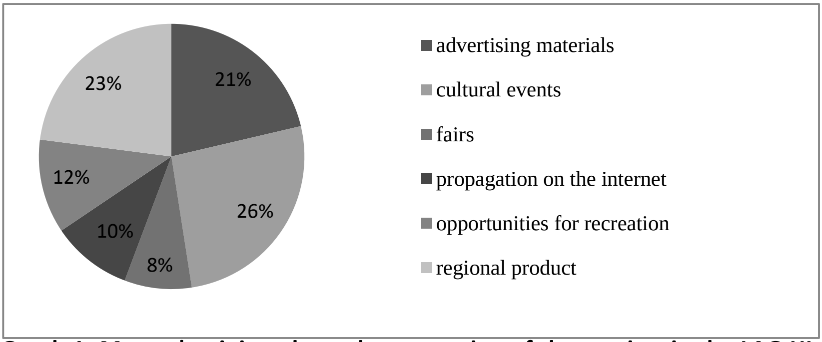
Liptovský Mikuláš district) with 26335 inhabitants (up to 1st July 2017). The webpage of the LAG HL is www.hornyliptov.sk. The members of the association are: members' meeting, board, chair, vice-president, manager and auditing commission. (http://www.hornyliptov.sk/dokumenty.html).

PRECONDITIONS OF TOURISM DEVELOPMENT ON THE AREA OF THE LAG HORNÝ LIPTOV

Within the categorization of the touristic regions in Slovakia, Liptov is ranked among the regions with international importance (Weiss, Kostovský, 2005). The region earned this prestige not only because of natural and cultural preconditions but also thanks to organizations which stand behind their propagation and protection. According to Mariot (1983), the visit rate of the area is the mirror of its quality. The visit rate is comprised of a package of activities, and a standard of services or accessibility. The localization of tourism within the LAG HL binds to the natural conditions predominantly (TANAP/NAPANT) and also of its cultural traditions. For this area is typical higher rate of representation of the traditional way of life in the countryside (Pribylina, Východná, Nižná Boca). The fundamental part of tourism is a package of realization preconditions. By their means, the visitors are offered a stay out of legal residence. A network of catering, accommodation, and sport and relaxing services in the area belongs to the realization preconditions of tourism. They are located in developed destinations considering the tourism (Liptovský Hrádok, Liptovský Ján). The providers of such services in the LAG HL area are dispersed also in TANAP and NAPANT areas. In the area of the LAG HL is tourism development ensured by several program documents and organizations. One of the duties of the LAG HL, which results from the articles of the association (http://www.hornyliptov.sk/upload/File/dokumenty_2014/ stanovy_akt_2014.pdf), is also the control of implementation of the CLLD Strategy of Horný Liptov up to 2020 and the Common Programme of the economic and social development of the municipalities of Horný Liptov up to 2022. Due to the fact that there are 4.7 visitors fall on one inhabitant in the LAG HL (the efficiency of tourist industry in HL area presents a sum of € 8,663,832 and the gain recalculated on one inhabitant is € 313.7), the association gives attention to tourism also in their strategic documents. The association included the demand to enhance the infrastructure of tourism in priority areas of development within the frame of strategic part CLLD. The aim is to build the infrastructure of nature and tourist trails and bicycle tracks in forests as well, whereby the previous programming period 2007-2013 is followed. Almost 260 km of bicycle routes were marked in the LAG HL area within this period (MAS HL, 2015a). The tourism Cluster Liptov (Klaster Liptov) exceeds in the propagation of Liptov region as a whole since 2008 (www.klasterliptov.sk). It is the first Destination Management *Organisation* in Slovakia with the vision to make Liptov a recognizable destination within Europe. From the LAG HL association, the city Liptovský Hrádok and the municipality Smrečany are included in this society of corporate entities (26 members). An active presentation of the offers in the region is advertised on the webpage www.visitliptov.sk, on the social network Facebook as well, or via printed promotional materials. From among many activities of the Cluster Liptov, the collaboration on Hrádocké hradné dni (Hrádok castle days) held within XIV. Hornoliptovský jarmok (Upper Liptov Market Days) in Liptovský Hrádok in the beginning of September 2017 is notable.

The tourism in the LAG HL area is supported by the activities of two national parks NAPANT (http://www.napant.sk/) and TANAP (http://spravatanap.sk/ web/index.php) administrations well, which actively interaction social network Facebook. The planned activities and current events in national parks are advertised there. The area becomes more attractive also thanks to EGTC TATRY Ltd (http://www.euwt-tatry.eu/sk/). Their flagship project "Historical – cultural – natural cycling route around the Tatra Mountains" connects Slovak and Polish Republic. By the end of 2018, the construction of a bicycle route is planned through the municipalities Važec, Východná, Kráľova Lehota, Liptovská Porúbka, Liptovský Ján, Podtureň, and Závažná Poruba from whence it continues to Liptovský Mikuláš. The co-financing of the project and also its propagation on the website (http://www.cestaokolotatier.eu/), social networks Facebook, Instagram, Twitter, and Youtube is provided from the European Union resources from the *European Regional Development Fund* within the cross-border cooperation program INTERREG PL-SK 2014-2020.

With the aim to find out the tendency and the development of tourism of the LAG HL association, we asked the mayors of the municipalities questions about the propagation of the municipality and about the LAG HL association concerning tourism. According to the mayors (Graph 1), the association could have promoted cultural events (26%), regional product (23%), and more advertising materials (21%).



Graph 1: Mayors' opinion about the promotion of the tourism in the LAG HL area

Only 8 out of 25 mayors rated the propagation of municipality as satisfactory, related to quality/quantity of the information advertised on the internet. The majority of the mayors (20 out of 25) consider the offer of services for tourists in the municipality's area as insufficient. The mayors see the potential of the municipality's tourism development mainly in the existence of natural environment (8), in the bicycle routes (6), and in the general propagation of municipality (5).

Through the Rural Development Programme of the Slovak Republic and LAG HL was in 2013 supported a project "Regional electronic information system" (www.hornyliptov.eu). It was realized by the Association of landlords of the Tatras. Its aim was to inform the tourists about the possibilities how to spend the leisure time, and the opportunities of accommodation and catering in Horný Liptov. The last time the webpage was updated was in 2014. Thereby its original idea to start the propagation of the tourism in the LAG HL area declines repeatedly. Currently, the association is not active almost for a year even on its own webpage (www.hornyliptov.sk). It does not do any promotional activity via printed media, such as advertising brochures about municipalities (the last are from 2011), informative bulletins (the last are from 2014), calendars and other advertising items (the last are from 2014), or annual reports (the last is from 2015). In the light of these circumstances, the problem of tourism propagation stays within the member municipalities of the LAG HL.

SWOT ANALYSIS OF THE TOURISM IN THE LAG HORNÝ LIPTOV AREA

Based on the analysis of development documents, interviews with mayors of municipalities as well as questionnaire survey of the mayors of municipalities, we came to the conclusion that all municipalities from the association consider the propagation and utilization of their area for the purposes of tourism as inadequate, except the municipality Liptovský Ján (LAGHL, 2015b). The final view on the tourism situation in the LAG HL area is reflected by SWOT analysis (Tab. 1) processed on the basis of the field research.

Tab. 1: SWOT analysis of the tourism in the LAG HL area

Strengths	**Weaknesses**
• wide offer of natural and cultural uniquenesses • preserved cultural traditions • original rural buildings • presence of protected areas (national parks TANAP, NAPANT...) • tradition in cultural events (Východná, Pribylina, Liptovský Hrádok) • activity of Klaster Liptov • high forest coverage of the area • excellent accessibility (D1, railway...) • elaborated documents for the development of municipalities with a declared interest in developing tourism	• deficient propagation/marketing on the part of the LAG HL • pollution of the area (illegal dumping, insufficient waste sorting ...) • limited service coverage of the area (rental services, guide services, accommodation/catering facilities...) • low number of entrepreneurs within tourism • inappropriate hotel architecture, which often does not fit into the mountain landscape, • inappropriate location of accommodation facilities in valuable and vulnerable areas of protected areas
Opportunities	**Threats**
• field of study "Entrepreneurin rural tourism" at Secondary School of Jozef Dekret Matejovie in Liptovský Hrádok	• absence of eligible funding leading to a reduction of activities related to the tourism

• development of agricultural tourism (Žiar, Beňadiková, Liptovská Kokava) • transition to BIO farms/agriculture • reconstruction of original houses • providing private accomodation • hunting law enforcement (Liptovská Porúbka, Liptovská Kokava) • independent municipality initiative to build tourism infrastructure	• growing number of marginalized population leading to a higher rate of criminality and vandalism • illegal felling and timber pests leading to forest loss • collision between nature protection and investors leading to problems with planned recreational built – up areas and sustainable landscaping

Source: own processing, 2017

PROPOSALS FOR ACTIVITIES OF TOURISM DEVELOPMENT

The LAG HL area offers a large number of ways how to spend leisure time for local and foreign tourists throughout the whole year. Both natural and cultural wealth Horný Liptov region abounds in is not promoted enough on the part of the association.

Considering the marketing, *existence on social media* would be one of the key opportunities for the association how to address the younger generation of population. As a suggestion of the actual propagation of individual municipalities from the association, we created an *advertising material* thematically oriented on tourists. It contains summary of the history, location, nature, bicycle tourism, membership of the municipality in the LAG HL, significant personalities, economic activities, tourism, and attractions in its area (Fig. 2).

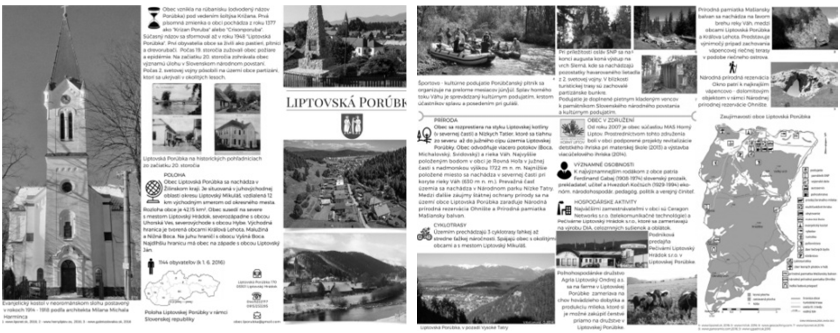


Figure 2. Promotional brochure of the Liptovská Porúbka municipality.
Source: own processing, 2017

The area of the association could be more attractive for tourists via *interactive map* on the LAG HL webpage. It would contain cultural or natural uniquenesses of the area that are not mostly promoted (Fig. 3). A planned construction of spa and *recreational resort* in Liptovská Kokava could also draw new tourists to the area. The LAG HL could promote accommodation in original rural houses which would improve the local economy and keep the tourists in the area for a longer time. At the same time, agricultural tourism would begin to be advertised as a new kind of tourism. *Hiking* (e.g. the hill Ďumbier) or *contests* (e.g. photographic) organized through the LAG HL would be interesting not only for tourists but also for locals. The meaning of these activities would be ecotourism as a more environmentally friendly form of tourism in protected areas with the aim to know the nature and advertise its preservation.

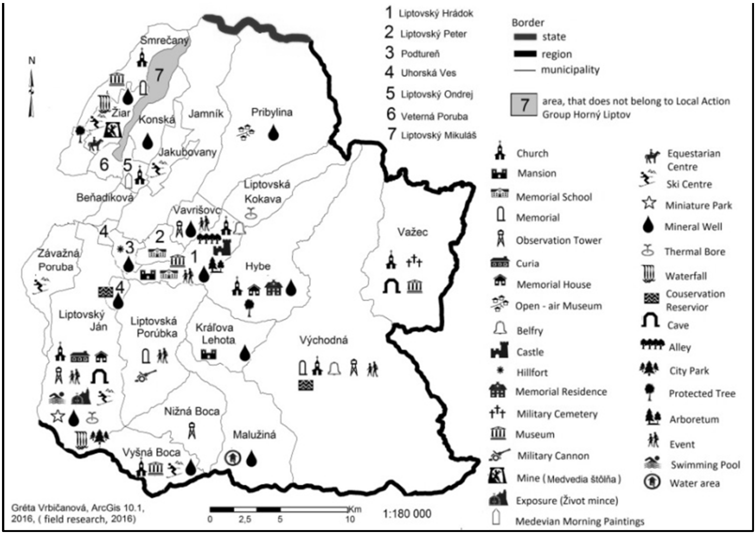


Fig. 3. Uniquenesses of the LAG Horný Liptov.

Throughout the summer season, a *summer camp for children or families* would enrich the people on vacation and locals as well. The LAG HL would co-organize it together with local teachers or TANAP/NAPANT administrations, and entrepreneurs. Participants would be staying at original rural houses in the municipalities within the association which would positively influence the local economy. The program would consist in the discovering of the natural beauty in the region, local gastronomy, traditions, and customs. Very useful activity would be online or printed *tourist guidebook* of the area (based on the example by Bátora et al. 2010).

With the vision to actively interconnect and use the natural elements of protected areas with social and economic aspects, tourism requirements stand before the question about the assessment of ecosystem services. According to the Civil Association Pronatur (2014), current nature preservers' arguments, such as the occurrence of protected species and habitats, are weak to prevent from rapid progress of developers' projects in protected areas. Conservationists would gain stronger arguments by the representation of nature's value in numbers and tourism could be sustainable in the protected areas.

CONCLUSION

In 2017 passed nine years since the establishment of the association in Horný Liptov. Despite the long period of activity, the LAG HL fails in expressive tourism propagation in the area. Besides the propagation, deficiency could be seen also in realization suppositions and offered activities which are poorly based in the LAG HL area. The association does not create appropriate conditions for ecotourism or agricultural tourism development in the area. These are considered as a promise of future for the rural area, economy improvement, regional development, and environment protection. The advantage of the LAG HL is the impact of organizations which support the tourism development indirectly within their activities even within the association's area. They present chosen parts of this locality by their own webpages and social networks as well (Cluster Liptov, EGTC TATRY Ltd., TANAP and NAPANT national parks administrations). With the vision to start a new concept of tourism, we created several activities that consist in agricultural tourism and ecotourism.

REFERENCES

BÁTORA, J., DUBCOVÁ, A., HUNKA, J., KRAMÁREKOVÁ, H., NEMČÍKOVÁ, M., VOJTEK, M,. 2010. *Turistický sprievodca mikroregiónom Požitavie – Širočina.* 2. doplnené vydanie. Malé Vozokany: Mikroregión „Požitavie – Širočina – záujmové združenie obcí pre CR“. 304 s. ISBN 978-80-970475-0-4.

BUCUR, C., STROBEL, D. 2012. *Valuation od Ecosystem Services in Carpathian Protected Areas – Guidelines for rapid assessment.* Brasov: Green Steps.

CLARKE, J., DENMAN, R., HICKMAN, G., SLOVAK, J. 2001. *Rural tourism in Roznava Okres: a Slovak case study.* In Tourism management, Volume 22. Issue 2. p. 119-218. ISSN: 0261-5177

DUBCOVÁ, A., KRAMÁREKOVÁ, H., RÝCHLA, H. 2001. *Potenciál mikroregiónu Požitavie – Širočina pre cestovný ruch.* In Geografie XII: Geografické aspekty středoevropského prostoru. Předpoklady vstupu ČR a SR do Evropské unie. Brno: Masarykova univerzita. s. 31-37. ISBN 80-210-2664-2.

EZÚS TATRY s.r.o. 2017. *Cesta okolo Tatier*. Dostupné online: <http://www.euwt-tatry.eu/sk/cesta-okolo-tatier.html>. [cit. 2017-09-06].

GETZNER, M. 2010. *Ecosystem services, financing and the regional economy: a case study from Tatra National Park (Poland).* Biodiversity. Vol. 11. p. 55-61 https://doi.org/10.1080/14888386.2010.9712648

CHARVÁT, T. 2012. *Analýza využitia prostriedkov z Programu obnovy dediny na rozvoj mikroregiónov.* In Geografické informácie. ISSN 1337-9453, 2012, roč. 16, č. 1, s. 116-123.

JARÁBKOVÁ, J. 2010. *Vidiek – nevyužitý potenciál z hľadiska cestovného ruchu.* Nitra: SPU. 111 s. ISBN 978-80-552-0364-5.

KLASTER LIPTOV. 2017. *Klaster Liptov.* Dostupné online: <http://www.klasterliptov.sk/sk/klaster_liptov.php.>. [cit. 2017-09-06].

KRAMÁREKOVÁ, H., DUBCOVÁ, A., KASANICKÁ, K. 2009. *Trvalo udržateľný rozvoj mikroregiónu Požitavie - Širočina - začiatok cesty ...* . Nitra: UKF v Nitre, 2009. 185 s. ISBN 978-80-8094-610-4.

MARIOT, P. 1983. *Geografia cestovného ruchu.* 1 vyd. Bratislava: VEDA, 1983. 252 s. ISBN 71-053-83

MIESTNA AKČNÁ SKUPINA HORNÝ LIPTOV. 2015a. *Stratégia CLLD*2014 - 2020. Dostupné online: <https://www.enviroportal.sk/eia/dokument/237031>. [cit. 2017-09-07].

MIESTNA AKČNÁ SKUPINA HORNÝ LIPTOV. 2015b. *Spoločný Program hospodárskeho rozvoja a sociálneho rozvoja do roku 2022*. Dostupné online: <http://www.hornyliptov.sk/upload/File/2016_dokumenty/SPRO_HL_19_4_2016.pdf>. [cit. 2017-09-06]

NAPANT. 2017. *Aktivity a spolupráca*. Dostupné online: <http://www.napant.sk/akcie/akcie.htm. >. [cit. 2017-09-06]

NOVANSKÁ, V., BRNKAĽÁKOVÁ, S. 2014. *Cestovný ruch ako nástroj trvaloudržateľného rozvoja mikroregiónu Biela Orava s ohľadom na mienku vybraných aktérov územného rozvoja.* Acta Universitas Matthiae Belii, 16. Banská Bystrica. s. 29

OREMUSOVÁ, D. 2009. *Geografické aspekty regionálneho rozvoja mikroregiónu Termál*. Nitra: UKF v Nitre. 146 s. ISBN 978-80-8094-559-6.

OZ PRONATUR. 2014. *Hodnotenie ekosystémových služieb NP Muránska planina.* Dostupné online:<http://www.ozpronatur.sk/wp-content/uploads/2014 /02/ ESS_ Mur%C3%A1nska_planina.pdf>. [cit. 2017-09-06]

PICHLEROVÁ, M. 2015. *Vedecký turizmus ako jedna z foriem cestovného ruchu Slovenska.* Dostupné online: <https://www.tuzvo.sk/files/FEE/katedry_fee/kptk/pichlerova_.pdf.>. [cit. 2017-09-06].

POVAŽAN, R., GETZNER, M., ŠVAJDA, J. 2014. *Value of Ecosystem Services in Mountain National Parks. Case Study of Veľká Fatra National Park (Slovakia).* Polish Journal of Environmental Studies. Vol. 23. No. 5. 1699-1710. ISSN 1230-1485

TANAP. 2017. *Projekty*. Dostupné online: <http://spravatanap.sk/web/index.php/2012-08-24-09-46-38/projekty-sk.>. [cit. 2017-09-06]

VRBIČANOVÁ, G., KRAMÁREKOVÁ, H. 2016. *Aktuálne trendy regionálneho rozvoja Miestnej akčnej skupiny Horný Liptov*. Geografické informácie, 20 (2). Nitra. p. 768–781.

VRBIČANOVÁ, G. 2017. *Regionálny rozvoj Miestnej akčnej skupiny Horný Liptov*. Nitra. UKF v Nitre. FPV, Diplomová práca, 2017, p. 95

WEISS, P., KOSTOVSKÝ, D. 2005. *Regionalizácia cestovného ruchu v Slovenskej republike.* Bratislava: Ministerstvo hospodárstva SR, odbor cestovného ruchu, 2005.

Zhrnutie

V rámci kategorizácie regiónov cestovného ruchu (CR) na Slovensku sa Liptov zaraďuje medzi regióny s medzinárodným významom. Jeho súčasťou je aj územie Miestnej akčnej skupiny Horný Liptov (MAS HL) s 25 obcami, ktorého potenciál rozvoja je v súčasnosti stále nedostatočne využívaný.

Prostredníctvom viacerých metód (metóda analýzy, terénny výskum, dotazníkový prieskum 25 starostov obcí, komparatívna metóda, SWOT analýza) sme identifikovali predpoklady rozvoja CR územia MAS HL a organizácie s participáciou na CR. Najväčší nedostatok v oblasti rozvoja CR vidíme v jeho propagácii. Priblíženie sa k potenciálnym turistom prostredníctvom sociálnych sietí využíva na území MAS HL správa TANAP-u, NAPANT-u, ale aj Klaster Liptov či EZÚS Tatry. Vzhľadom na to, že združenie momentálne nevyvíja žiadnu propagačnú činnosť, zostáva tento problém prevažne na členských obciach MAS HL. Pozornosť venujú vlastným internetovým stránkam či sociálnym sieťam.

Sme toho názoru, že cieľom udržateľného turizmu na území MAS HL by mal byť turistický produkt, ktorý je v rovnováhe s ochranou prírody a zároveň poskytuje turistom zážitok z prírodných a kultúrnych hodnôt krajiny. S víziou naštartovať nový koncept CR sme navrhli osem aktivít, ktoré by mohli pomôcť lepšie propagovať CR a naštartovať agroturistiku či ekoturizmus.

Useful Geography: Transfer from Research to Practice

Proceedings of 25th Central European Conference

Edited by: Hana Svobodová

Published by Masarykova univerzita, Žerotínovo nám. 617/9, 601 77 Brno, CZ
1st electronic edition, 2018

ISBN 978-80-210-8908-2

muni
PRESS