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of 23rd Central European Conference

Central Europe Area in View of Current Geography

8th–9th October 2015, Brno, Czech Republic

Masaryk University, Brno 2016

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INTRODUCTION

Dear members of geographic community and friends of geography,

regular meetings of Czech and Slovak geographers run for 23 years and are traditionally held under regional focus on the Central European space. In 1993, in the period immediately after the split of the Czech and Slovak Federal Republic, the idea appeared to organize regular meetings, at which not only geographers of both countries will exchange their knowledge, but also will maintain the excellent traditional relations ahead.

Joint conferences were organized by the Department of Geography at the Faculty of Education, Masaryk University, Brno, Czech Republic and the Department of Geography, Faculty of Natural Sciences, Constantine the Philosopher University in Nitra, Slovakia. From this year the organizing departments regularly rotate after one year (in odd years in the Czech Republic and even year in the Slovak Republic). Already 23rd year was marked with responses to current trends in society transmitted into geography. That's why the organizers chose a simple name of the conference: Central European space in view of the current geography. Regular meetings of geographers in Brno and Nitra already represent an unique opportunity to know each other and provide participants with a broad overview of the activities on both sides of the “young” political border.

The conference is regularly attended by experts from both geographic departments, as well as experts from Academies of Sciences of the Czech and Slovak Republic. Because the conference is held on academic space (Faculty of Education), common regular participants are also geography teachers from elementary and secondary schools. A very positive trend is given by the increasing number of participants from both Republics, which reached 72 participants from four different countries (Czech Republic, Slovakia, Poland and Nepal) in 2015.

The final output of the conference is represented traditionally by the post-conference proceedings. It is the same case with the last conference. Therefore, you can hold the book in your hands now, or you can read it in the electronic version. The content of proceedings and contents of the individual papers cover a quite wide range of themes. Because of geography deals with many of sub-disciplines, that complement each other and propose an interesting view of the current Central European space. More than fifty different papers are presented in this proceedings starting from physical geographic themes (digital geographic data, landscape as a laboratory), through applied geography and digital geographic data processing to the geographic education. One chapter about the activities of young geographers is also included. Together is in this procedeedings 56 papers from six section. Included are two papers from poster section and one papers about prof. Demek.

On behalf of the Conference Organizing Committee I express my pleasure to thank all the authors for their active participation and providing me as the editor with interesting papers published in the proceedings. I wish readers to gain a lot of useful information for their further scientific research or teaching.

Libor Lněnička

Head of Conference Organizing Committee and Editor of the Proceedings

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All papers have been peer-reviewed. Originals of review reports are available from the conference chair.

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

CONTENT

SEVERAL REMARKS CONCERNING THE THEORETICAL AND METASCIENTIFIC CONTRIBUTION OF PROF. RNDR. JAROMÍR DEMEK, DR.SC. TO GEOGRAPHY AND LANDSCAPE ECOLOGY CONSIDERING THEIR NOMOTHETIC-IDIOGRAPHIC NATURE

Florin Žigrai[1]

[1] Foreign external professor and co-worker of the Chair of Geography and Applied Geo-Information Science at the University of Prešov, Slovak Republic, e-mail: florin.zigrai@a1.net

ABSTRACT

These selected remarks to the theoretical and meta-scientific contribution of Prof. Demek, DrSc. to geography and landscape ecology taking into account the nomothetic-idiographic nature suggest that today's honouree helped the development and progress of this theme reaching high international level through his long-year and concentrated effort. In the mean time he was also able to transform the empirical and analytical research carried out in genetically and functionally diverse territories of different physiognomic character in the Czech Republic and abroad into its nomothetic-synthesised form. This circumstance reveals the author's extraordinary capacity to interpret geography in its natural and social contexts. It enabled him to compare varied territories and to arrive at the corresponding syntheses.

Prof. Demek simultaneously stressed the necessity of a close linkage between empirical, methodical, theoretical and meta-scientific geographical and landscape ecological research and pointed out the importance of study involved with the idiographic/nomothetic nature of these two sciences. It is, as a matter of fact, the guarantee of the combined merological/holistic approach to landscape as their common research object. In his interpretation landscape is an integrated whole representing the most important part of human environment in its time-spatial complexity, contextuality and integrity. This approach is the indispensable prerequisite of an efficient solution for the existing ecological, environmental and socio-economic problems in landscape and for the determination of its natural, cultural, and historical potential necessary for its declaration as part of natural and cultural heritage of humanity.

Key Words: *idiographic nomothetic theoretical meta-scientific contribution*

1. INTRODUCTION

First of all I should like to thank to the Organisation Committee of the 23rd Central European Geographical Conference at Brno convoked at the occasion of the jubilee of Prof. RNDr. Jaromír Demek for the opportunity to publish several remarks to his theoretical and meta-scientific contribution to geography and landscape ecology taking into account their nomothetic/idiographic nature.

The broad scientific, research and didactic spectre of Prof. Demek in the field of geography and landscape ecology is obvious from the great number of published studies and laudatory articles (Martínek, 1998 and Mackovčin, Křížek, 2010) as they show the rare capacity to integrate the different nomothetic/idiographic character of these sciences. The nomothetic/idiographic character of geography and landscape ecology represents one of their key meta-scientific characteristics. Idiographic, nomothetic or mixed idiographic/nomothetic/meta-scientific nature of geography and landscape ecology represents their inherent feature, which is, so to say, its genetic code. It influences not only their overall character but also the relationship between the basic and applied research. Cognition of idiographic/nomothetic nature of geography and landscape ecology helps insight into their authenticity, impact on everyday life and future development along with their social and scientific position.

2. SEVERAL REMARKS TO IDIOGRAPHIC-NOMOTHETIC AND THEORETICAL META-SCIENTIFIC CONTRIBUTION OF PROF. DEMEK IN GEOGRAPHY AND LANDSCAPE ECOLOGY

One of important properties of outstanding scientists and lecturers, and particularly Prof. Demek, is that they command the idiographic and nomothetic approach on the level of empirical, methodical, theoretical meta-scientific research of geography and landscape ecology. Prof. Demek demonstrated the idiographically conducted research with his typical effort to obtain time-spatially unique and unrepeatable knowledge by means of objective/subjective research and merological, descriptive particular approach in numerous regional empirical studies. Idiographic contribution of these studies is, for instance, the delimitation of physical geographical or geomorphologic territorial units of Czechia on topic, choric and regional levels (Demek, 1988) and compilation of the *Zemepisný lexikon ČR* /Geographical Lexicon of the Czech Republic (Demek, Mackovčin, et al. 2006).

On the other side, the honouree exposed his nomothetically targeted research in order to obtain knowledge and results by objective and exact research and holistic, experimental abstract approach in several theoretical and meta-scientific works. The nomothetic contribution is in the elaboration of the systemic theory of landscape studies (Demek, 1974b), explanation of the theory of cultural landscape (Demek, 1979), elaboration of theoretical and meta-scientific foundations of geography (Demek, 1974a, 1984, 1987), interpretation of landscape as a geosystem (Demek, 1978), meta-scientific outline of the study, history of geography (Demek, Pech, Riedlová, 1980), enlightenment and functions of landscape (Demek, 1981), comparison of objects and approaches applied by geo-ecology and landscape ecology, as well as the attempt to forecast of future of landscape ecology (Demek, 1999 a, b, 2000). All these studies that reflect the rich and year-long experience and knowledge of basic, empirical, geographical and landscape-ecological research greatly contribute to their synthesis and generalisation and thus to formulation of generally valid regularities. This is the way Prof. Demek contributed to the shift of geography and landscape ecology from their idiographic position to the nomothetic position. However, it does not mean that the idiographic/nomothetic nature of these sciences, as the condition of their sustainable development has been disrupted. Precisely the results achieved in basic, applied, theoretical and meta-scientific research became the guarantee of their idiographic/nomothetic nature. Publications, which appeared in a short interval, prove the rare balance between the author’s idiographic and nomothetic research approach in spite of the amazingly rapid transition between them. It seems that the jubilee sees the empirical/idiographic knowledge obtained in field research in the nomothetic time-spatial complexity, contextuality, and integrity, which is the strongest side of idiographic-nomothetic sciences such as geography and landscape ecology.

Studies involved with theoretical and meta-scientific questions of geography (Demek, 1974a,b, 1978, 1979, 1984,1987) show that the author’s theoretical and meta-scientific contribution is particularly in:

- plotting the scheme of geographical sciences,
- delimitation of the object and approach of geographical research,
- compilation of the developed model of landscape sphere,
- analysis of the development of differentiation and integration of geography,
- defining the theoretical geography and its research object and approach,
- elaborating methodological foundations of geography as well as
- delimitation of basic research procedures in geography.

Studies of Prof. Demek devoted to theoretical and meta-scientific questions of geo-ecology and landscape ecology placed on the intersection of geography and ecology (Demek,1999a, 1999b, 2000) reveal that his theoretical/meta-scientific contribution is in:

- highlighting the differences between geo-ecology, landscape ecology and bio-geography by their principal research objects and approaches,
- interpretation of geo-ecology in the sense of teaching landscape as a synthesised transdisciplinary science focused on cultural landscape,
- creation of the system of geographical sciences and classification of geo-ecology into the groups of sciences involved with general geographical compounds,
- inner division of geo-ecology into individual partial disciplines with the corresponding research objects and approaches of conservation and renovation geo-ecology, and

- formulation of the paradigm for the obligatory transformation of the present conservation landscape ecology into renovation landscape ecology while observing the principles of sustainable development of landscape.

The benefit of Prof. Demek's numerous empirical, methodological and theoretical studies dealing with geography and landscape ecology is also the possibility of their nomothetic/idiographic interpretation:

- the nomothetic character of geography and landscape ecology distinguished by its theoretical and synthesised aspect whose carriers are the theoretical and meta-scientific geography and landscape ecology while the idiographic nature of geography and landscape ecology distinguished by its empirical and analytical aspect whose carrier is the empirical and methodical geography and landscape ecology,
- dynamic stability and sustainable development of geography and landscape ecology is in procuring an approximate balance between their nomothetic and idiographic character accompanied by conservation of an approximate balance between empirical/methodical, theoretical, meta-scientific, applied and didactic geography and landscape ecology as well as the balance between the development of physical and human geography on the one side and the "geographical" and "ecological" landscape ecology on the other.
- the ratio between idiographic/nomothetic nature of geography and landscape ecology is not static. It changes depending on the object of geographical and landscape-ecological research and approach on
- the level of analyses of the basic or empirical geography and landscape ecology situated on the intersection of geographical and landscape-ecological sciences with other sciences the nomothetic/idiographic nature of analytical physical geography and "ecological" landscape ecology is more highlighted while greater idiographic/nomothetic nature is typical for the analytical human geography and the "geographical" landscape ecology,
- the idiographic nature is distinct on the level of regional geographical syntheses in the frame of comprehensive regional geography and landscape ecology, and
- the nomothetic nature starts to assert itself through meta-geography, meta-landscape ecology, history of geographical and landscape ecological thinking, geographical and landscape-ecological aspects of meta-sciences and geographical and landscape ecological philosophy on the level of theoretical geography and landscape ecology by generalisation of the idiographic nature of comprehensive (regional) geography and landscape ecology. Meanwhile, the transformation of meta-scientific nature of geography and landscape ecology proceeds from the concrete to the universal, from the universal to the unique and from the unique to universal.

The outlined theoretical, meta-scientific, idiographic/nomothetic contribution of Prof. Demek to geography and landscape ecology is also important in terms of forecasting and measures applicable over the future development of these two sciences:

- strengthening of the position of geography and landscape ecology on the edge of nomothetic and idiographic sciences on the meta-scientific level in research of the mechanism of mutual "nomothetisation" and "idiographisation" of sciences and in coordination, cooperation and participation of geography and landscape ecology between the nomothetic and idiographic sciences;
- generalisation of research results in geography and landscape ecology may contribute to formulation of time-spatial laws ruling geographical and landscape-ecological features, phenomena and processes. This will simultaneously enrich the theoretical part of these sciences and the results will be applicable in meta-geography and meta-landscape ecology as meta-scientific superstructure of theoretical geography and theoretical landscape ecology in the process of advanced generalisation and mediation of a dialogue between nomothetic and idiographic sciences by overcoming their meta-theoretical, methodological and meta-linguistic barriers;
- efficient inclusion of structural sciences by means of mathematics and cyber sciences strengthening the nomothetic aspect of geography and landscape ecology;
- approximation and mutual completion of theoretical bases of geography and landscape ecology to other nomothetic and idiographic sciences, and
- formulation of certain regularities of geographical and landscape ecological research by idiographic approach, for example, time-spatial comparison of obtained results and knowledge

from several genetically and functionally similar or related territories. The aim of comparison is to seek qualitative and quantitative estimation of affine features in these territories necessary for the identification of common territorial regularities or even general laws.

3. CONSLUSION

Selected remarks to the theoretical-meta-scientific contribution of Prof. Demek, DrSc to geography and landscape ecology taking into account their nomothetic/idiographic nature should first of all point out his credit obtained by long-year and intensive scientific and pedagogic activities focused on the development and advance of this theme. He contributed to the development and shift of this theme to the high international scientific level. Prof. Demek transformed the very intensive empirical and analytical research in genetically, functionally differing territories in Czechia into nomothetic and synthesised form. This circumstance reveals his unusually developed understanding of geography with both its natural and social implications which he applied to the comparison of different territories and produced the corresponding syntheses.

The jubilee also emphasised the necessity to interconnect the empirical, methodological, theoretical and meta-scientific geographical and landscape ecological research and drew attention to the importance of idiographic/nomothetic nature of geography and landscape ecology and its study. As a matter of fact, it guarantees the mixed merological and holistic approach to landscape as the common research object. In his interpretation landscape is an integrated whole representing the most important part of human environment in its time-spatial complexity, contextuality and integrity. This approach is an indispensable prerequisite of an efficient solution for the existing ecological, environmental and socio-economic problems in landscape and for the determination of its natural, cultural, and historical potential necessary for its declaration as part of natural and cultural heritage of nation. In conclusion, I should like to wish Prof. RNDr. Jaromír Demek, DrSc., my outstanding teacher and long-year friend, good health and a lot of strength in benefit of the whole geographical and landscape-ecological community.

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ACCURACY ASSESSMENT OF MEASUREMENTS OF SELECTED GPS/GNSS DEVICES

Matej Vojtek[1], Kristína Furmanová[1] and Jana Vojteková[1]

[1] 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,
e-mail: mvojtek@ukf.sk

ABSTRACT

The Global Positioning System (GPS) or Global Navigation Satellite System (GNSS) are geoinformation technologies that enable to collect information on position anywhere and anytime. The aim of the paper is to analyze, compare, and assess measurements made by four GPS devices (Trimble Juno 3B, Garmin Oregon 550t, Garmin GPSmap 78s, Garmin eTrex) and one GNSS device (Trimble Pathfinder Pro 6H with Trimble Juno 3B as the control unit), which we used as a reference device when assessing their accuracy. The measurements were carried out on 14th April 2015 on the example of hiking trail in the Tribeč mountains: Liečebný ústav Zobor (Zobor Medical Centre) – vrch Zobor (Zobor peak) – Svoradov prameň (spring). The task of GPS measurements in the field was to measure the hiking trail and position and elevation of hiking guideposts on the trail and comparing them with the indicated elevation. There were sections with various conditions for receiving signal from satellites on the trail (open space, woody vegetation covers) which affected the number of satellites, from which the individual devices were able to receive signal, and thus the actual measurements. The total length of the reference trail is 4.75 km, the lowest point on the trail has 290.2 m, the highest point (Zobor peak) has 586.9 m, and elevation difference represents 296.7 m. We localized seven guideposts along the measured trail: 1. Liečebný ústav Zobor, 2. Svoradov prameň, 3. Tri duby, 4. Lyžiarska lúka, 5. Zobor, 6. Sedlo pod Zoborom, and 7. Pyramída. However, measured elevations were in most cases lower than those indicated on the guideposts while vertical accuracy during the measuring ranged from 0.8 m to 6.2 m. Average of deviations of individual trails from the reference trail ranged from 2.7 m (Trimble Juno 3B) to 6.7 m (Garmin eTrex). On the other hand, the values of maximum deviation ranged from 9.2 m (Garmin Oregon 550t) to 46.6 m (Garmin eTrex). In the case of the reference device itself, the horizontal error ranged from 0.4 to 8.8 m while the average of errors was 3.2 m. The vertical error ranged from 0.5 to 20.1 m with the average value of 5.1 m. The results indicate that the selection of GPS device depends on the task which is needed to be done. Typical (tourist) GPS devices are primarily sufficient for navigation and orientational measurements in the field. High accuracy and efficiency of data collection is provided mainly by GNSS devices. Moreover, their measurements can be further corrected (reference stations) in real time or after the measures are done by so-called postprocessing.

Key Words: *GPS, GNSS, trail, guidepost, deviation*

1. INTRODUCTION

Development of information technologies is constantly in progress offering new possibilities of their practical use. One of the requirements of the current society is fast and accurate localization and spatial-time description of an object. Therefore, to meet this requirement, geoinformation technologies (geographic information systems, remote sensing, global positioning systems, etc.) are used. Their interconnection enables to define the object based on geographical coordinates and describe its properties (Vojtek, Oláhová, Boltižiar, 2011).

The Global Positioning System (GPS) or Global Navigation Satellite System (GNSS) are geoinformation technologies used to determine the accurate location and they provide very accurate time reference almost anywhere on Earth (Hofmann-Wellenhof, Lichtenegger, Collins, 2001). There are several (global or regional) satellite systems (e.g. NAVSTAR GPS, GLONASS, Galileo, Beidou/Compass, IRNSS), but the principle of their operation is the same and it is based on three segments: space, control, and user (Bhatta, 2011).

Mobile geoinformation technologies allow the user to work with spatial dimension and collect data anywhere and anytime (Lemmens, 2011). According to Rapant (2006), they integrate the following: small portable computers (e.g. PDA, tablets), software for geoinformation systems, geodata, wireless communication technologies, GPS devices, Internet, and geoweb.

Use of mobile geoinformation technologies – e.g. high-precision GPS/GNSS receivers allows to obtain professional and high-quality field data which can then be analyzed and evaluated in computer environment (McCoy, 2005, Kennedy, 2009, Ghilani, Wolf, 2012).

The aim of the paper is, therefore, to analyze, compare and assess measurements of selected GPS/GNSS devices on the example of the hiking trail in Tribeč mountains: Liečebný ústav Zobor (Zobor Medical Centre) – vrch Zobor (Zobor peak) – Svoradov prameň (spring). The task of GPS measurements in the field was to measure the hiking trail and position and elevation of hiking guideposts on the trail and comparing them with the stated elevation.

2. METHODS

For measuring the hiking trail, which was carried out on 14th April 2015, we chose four GPS devices: Trimble Juno 3B, Garmin Oregon 550t, Garmin GPSmap 78s, and Garmin eTrex with the horizontal accuracy ± 2-5 m under the suitable conditions and one GNSS receiver Trimble Pathfinder Pro 6H with Trimble Juno 3B as a control unit which was used as the reference device for the accuracy assessment (Figure 1).

In order to measure the position and elevation of guideposts, we used the previously mentioned GNSS device Trimble Pathfinder Pro 6H which allows to obtain measurements with horizontal accuracy of < 1 m (SBAS) under suitable conditions. In the case of network corrections (real time or postprocessing) from the reference stations, it can be corrected to ± 10 cm. The maximum productivity of this device is ensured by the Trimble Floodlight technology, which enables to reduce the satellite signal failure because of shading vegetation during the measuring, and Trimble H-Star technology ensuring high accuracy of measuring data (www.trimble.com).

Figure 1: A – GPS devices and B – reference GNSS device used for measuring

The measurement method consisted of the following steps:

1. The SBAS mode was used in the selected devices and in the case of losing SBAS corrections, the devices switched to the autonomous mode,

2. For measuring GPS positions of the trail, one second time interval was set in each GPS device,

3. Trimble devices (Juno 3B) had the mobile GIS TerraSync version 5.61 installed,

4. The measured data from Garmin GPS devices were necessary to transform from WGS84 into the S-JTSK coordinate system, for which we used the MxGPS extension for ArcGIS 10.1 software,

5. Data from the Trimble devices were transferred to computer using the GPS Pathfinder Office software. They did not have to be converted since they were directly received in the S-JTSK coordinate system.

6. The obtained vector layers in shapefile format were analyzed and visualized through ArcGIS 10.1 software from Esri.

7. To calculate and compare the deviations of trails measured by GPS devices with the reference trail measured by Trimble Pathfinder Pro 6H, we used the “Near” tool (ArcToolbox) in ArcGIS 10.1. This tool determined the distance from trail (GPS position) measured by selected GPS devices to the nearest GPS position in the reference trail.

3. RESULTS

The total length of the reference trail is 4.75 km, the lowest point on the trail has 290.2 m, the highest point (Zobor peak) has 586.9 m, and elevation difference is 296.7 m (Figure 2). There were seven guideposts along the measured trail (Figure 3): 1. Liečebný ústav Zobor, 2. Svoradov prameň, 3. Tri duby, 4. Lyžiarska lúka, 5. Zobor, 6. Sedlo pod Zoborom, and 7. Pyramída, which elevations were compared with the measured elevation (Figure 4). Table 1 shows that the measured elevations were in most cases lower than those indicated on the boards. However, the vertical accuracy during the measuring (with 68% confidence level) must also be taken into consideration. It was affected by the current measuring conditions which means that higher vertical errors were caused by vegetation covers although SBAS mode was used to receive corrections.

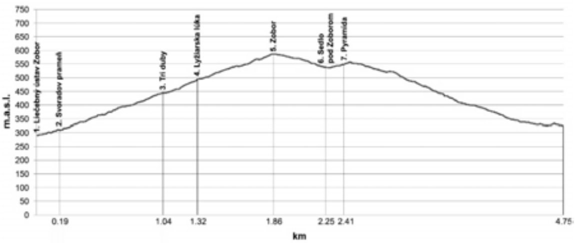

Figure 2: Profile of the reference trail

Figure 3: Selected guideposts (Tri duby, Zobor) on the hiking trail

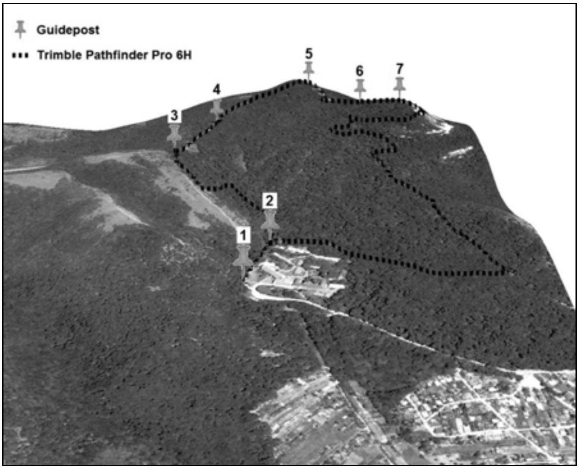

Figure 4: Reference trail and guideposts visualized on digital elevation model (3D view)

Table 1: Comparison of stated and measured elevations on guideposts

No.	Guidepost	Elevation (m.a.s.l.*)		Difference (m)	68% Confidence Level (m)
		Stated	Measured		
1.	Liečebný ústav Zobor	292	290.2	-1.8	0.8
2.	Svoradov prameň	310	312.7	+2.7	0.8
3.	Tri duby	444	443.6	-0.4	5.2
4.	Lyžiarska lúka	495	493.6	-1.4	3.4
5.	Zobor	588	586.9	-1.1	0.7
6.	Sedlo pod Zoborom	535	538.0	+3.0	6.2
7.	Pyramída	556	552.2	-3.8	2.2

** m.a.s.l. – meters above sea level*

As for measuring the reference trail itself, using the Trimble Pathfinder Pro 6H device, there were different horizontal and vertical deviations during the measuring. The dataset contained 4,487 GPS positions with horizontal and vertical deviations (68% confidence level). Their frequency distribution can be seen on Figure 5.

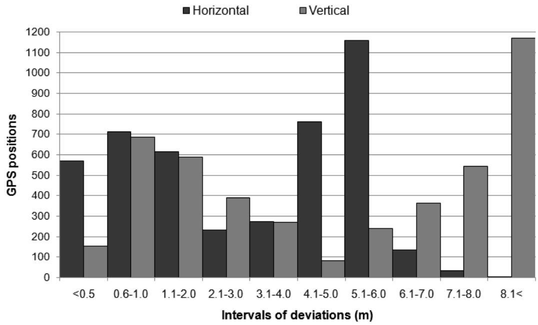

Figure 5: Frequency distribution of deviations (GNSS receiver)

Regarding horizontal error, this has a range of 8.4 m (from 0.4 m to 8.8 m) while the average is 3.2 m and standard deviation has a value of 2.1 m (Table 2). Vertical error, compared to the horizontal error, has even greater range (20.1 m) which is connected on one hand with the creation of covers by woody vegetation and on the other hand with the fact that the survey of elevation needs to have signal from more satellites as it is with the position (Hofierka, Kaňuk, Gallay, 2014). Average value of deviations (errors) in this case is 5.1 m and standard deviation is 3.6 m.

Table 2: Accuracy (68% confidence level) during measuring of trail using GNSS receiver Trimble Pathfinder Pro 6H

Deviation	Horizontal (m)	Vertical (m)
Minimal	0.4	0.5
Maximal	8.8	20.6
Average	3.2	5.1
Standard	2.1	3.6

The trails of other GPS devices were compared with respect to the reference trail (Trimble Pathfinder Pro 6H) using the nearest distance principle (see Methods). The results of measurements show that the most deviated trail from the reference trail is the one measured by Garmin eTrex device, which is also documented by Table 3 and Figure 6A. The average of deviations is 6.7 m, standard deviation is 6.3 m, and maximum deviation reaches 46.6 m. Garmin GPSmap 78s device showed the second largest deviation from the reference trail: average of deviations (5.4 m), standard deviation (4.7 m), and maximum deviation is 25.3 m (Table 3, Figure 6B).

The third highest average of deviations (3.0 m) was recorded by Garmin Oregon 550t device and the lowest by Trimble Juno 3B (2.7 m). However, when we compare the maximum deviation of these two devices, Trimble Juno 3B shows by 10.1 m higher error. Similarly, the standard deviation is higher by 0.8 m (Table 3, Figure 6C, D).

Table 3: Deviations from the reference trail (GNSS receiver Trimble Pathfinder Pro 6H)

Order	GPS device	Maximal deviation (m)	Average of deviations (m)	Standard deviation (m)
1.	Trimble Juno 3B	19.3	2.7	2.6
2.	Garmin Oregon 550t	9.2	3.0	1.8
3.	Garmin GPSmap 78s	25.3	5.4	4.7
4.	Garmin eTrex	46.6	6.7	6.3

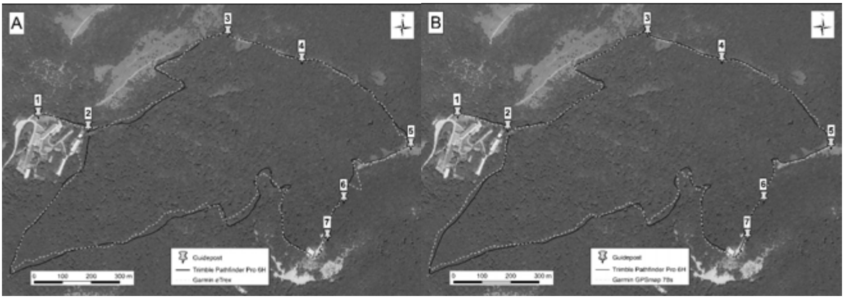

Figure 6A, B: Comparison of trails measured by selected GPS/GNSS devices

A – Trimble Pathfinder Pro 6H, Garmin eTrex; B – Trimble Pathfinder Pro 6H, Garmin GPSmap 78s

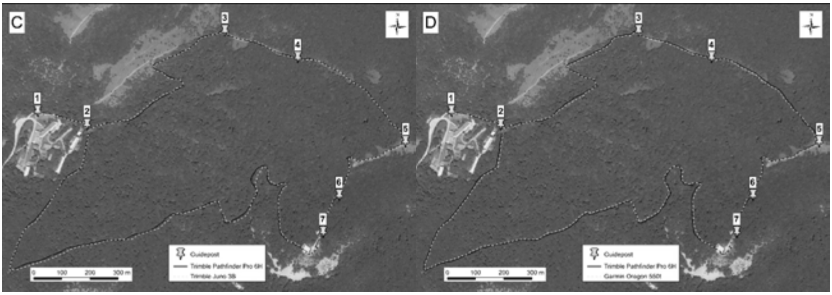

Figure 6C, D: Comparison of trails measured by selected GPS/GNSS devices

C – Trimble Pathfinder Pro 6H, Trimble Juno 3B; D – Trimble Pathfinder Pro 6H, Garmin Oregon 550t

4. CONCLUSION

The current period is characterized by constantly developing information technologies intervening almost all areas of life. Geoinformation technologies are a typical example of such technologies which, by their interdisciplinarity, affect almost all sectors and their development arises from multiple scientific disciplines and practical areas of life (Boltižiar, Vojtek, 2009).

One of the requirements of today's society is fast and accurate localization and spatial-time description of an object. To meet this requirement, mobile geoinformation technologies are used integrating several components, which include GPS/GNSS receiver, and allowing to define the object based on geographical coordinates and describe its properties.

In the paper, we dealt with the assessment of measurements made by four GPS devices: Trimble Juno 3B, Garmin Oregon 550t, Garmin GPSmap 78s, and Garmin eTrex and one GNSS device Trimble Pathfinder Pro 6H, which we took as a reference device with regard to other GPS devices. The measures were conducted along the hiking trail in the Tribeč mountains: Liečebný ústav Zobor (Zobor Medical Centre) – vrch Zobor (Zobor peak) – Svoradov prameň (spring). There were various conditions on the trail for receiving signal from satellites (open, woody vegetation covers) which affected the number of satellites, from which the individual devices were able to receive signal, and thus the actual measurements.

After processing the measurements from each GPS device, we calculated deviations of each trail from the reference trail. Average of deviations ranged from 2.7 m (Trimble Juno 3B) to 6.7 m (Garmin eTrex). On the other hand, the value of the maximum deviation ranged from 9.2 m (Garmin Oregon 550t) to 46.6 m (Garmin eTrex). In the case of reference device itself, the horizontal error ranged from

0.4 to 8.8 m while the average was 3.2 m. The vertical error ranged from 0.5 up to 20.6 m with the average value of 5.1 m.

There are GPS/GNSS devices of different types and brands available on the market which properties are however different. The results of the paper show that the choice of such device depends on the task which is needed to be done. Typical (tourist) GPS devices are primarily sufficient for navigation and orientational measurements in the field. High accuracy and efficiency of data collection is provided mainly by GNSS devices. Moreover, their measurements can be further corrected (reference stations) in real time or after the measures are done by so-called postprocessing.

ACKNOWLEDGEMENT

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IDENTIFICATION OF CHANGES IN THE MICROREGION TERMAL ON AERIAL PHOTOS

Michaela Žoncová[1], Alena Dubcová[1] and Hilda Kramáreková[1]

[1] 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,
e-mails: michaela.zoncova@ukf.sk, adubcova@ukf.sk, hkramarekova@ukf.sk

ABSTRACT

Function and image of landscape have changed under the influence of different social, political and socio-historical changes. These processes are also reflected on a rural country where there was a decline and restructuring of the dominating industry – agriculture. The industry has shaped the countryside and the impacts of changes were also noticeable in the country. A good way to study the changes in the rural landscape is to identify signs of transitive economy on aerial photos. The aim of this paper is to point out the possible signs of a transition economy in rural areas on aerial photos.

Key Words: *rural landscape, changes in landscape, aerial photos*

1. INTRODUCTION

Rural area is often seen as opposite of city, urban area. Johnston (1986) sees the countryside as an area with extensive land use with low population density. It is defined on the basis of land use. In rural landscape, but also in the landscape as a whole, constantly ongoing changes were in progress that can have a negative or positive impact on the landscape.

Hradecký and Buzek (2001) suggest that human activity consciously and unconsciously affects the biotic and abiotic components and processes of the landscape, but mostly with negative impacts. After 1989 there was a transition from a centrally planned economy to a market economy. This transition has caused a sequence of transformation processes that are reflected also on change of the image and land use.

2. MATERIAL AND METHODS

The Microregion Termal consists of the thirteen municipalities – Bardoňovo, Čechy, Dedinka, Dolný Ohaj, Hul, Maňa, Podhájska, Pozba, Radava, Trávnica, Veľké Lovce and Vlkas (Figure 1). The Municipality of Podhájska is the center of the microregion and it is dominated by tourism, thanks to the thermal swimming pool (Oremusová, 2009).

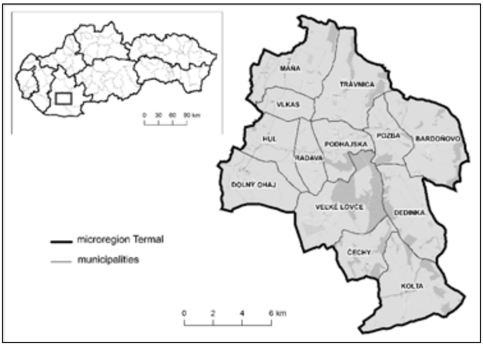

Figure 1: The area of interest
Source: Žoncová by ArcGIS 10.1

All municipalities in the microregion have the character of rural municipalities and therefore it is possible to analyse the changes in them that rural landscape in Slovakia passed. To observe changes in functional land use in the microregion Termal were used statistical data (years 1996 and 2014) from the Statistical Office of the Slovak Republic (SOSR). The appropriateness of the use of aerial imagery to identify changes in landscape shows Boltižiar (2008) and for the greatest priority states accurate projection of the Earth's surface and providing amount of quantitative, but mainly qualitative information about individual objects in landscape, whose dynamics can be observed in different time period. Aerial photographs for monitoring landscape changes are also used by Feranec (2012), who considers satellite technologies as an inseparable part of exploring a dynamically changing world. Land use can be interpreted in different ways on orthophotos. In European countries is widespread interpretation by the methodology Corine Land Cover (Feranec & Oťahel, 2001). By monitoring changes in the rural landscape affected by natural or human factors deal with e.g. Vojteková (2013), Šolcová (2012) and Malenová (2007). For the analysis of changes were used black-and-white (panchromatic) aerial photos from 1987 and colourful orthophotos from 2003. The images were provided from Topography Institute of Colonel Jan Lipsky in Banska Bystrica (TICJL). To identify the current status, we used images from GoogleEarth, where the latest available images are from 2013. By the georeferencing aerial imagery in software ArcGIS 10.1 we could using the method "on screen" observe changes taking place in the landscape and identify individual impacts of socio-economic changes in the rural microregion Termal. The use of aerial photography in a variety of specialized software is time-consuming and exacting in analysis, but also ordinary visual interpretation without equipment is suitable for the identification of significant changes in the landscape (Boltižiar, 2008).

3. CHANGES OF RURAL LANDSCAPE ON AERIAL PHOTOS

Changes in the rural landscape after 1989 mainly consist of the change in functional land use. Primary production function is now replaced by residential, recreational or industrial function. Change of function is hardly noticeable in aerial photography, because of it, there is necessary field research and detailed detection function of each object in the past and present. Figure 2 shows the noticeable changes in land use in the microregion Termal in the period 1996-2014. The area lies in the agricultural land, which is part of the largest granary of Slovakia.

Changes occur in the area of agricultural areas, especially in the manner of its use. For example, there is a decrease of the area of permanent grassland at the expense of increase in other, undefined areas, what is possibly impact of reduced or extinct animal production in agriculture. We can thus conclude that permanent grassland wilderness, become unused land. In Vlkas, there is visible opposite phenomenon – transformation of unused land into arable land. Such or other impact of social-economic changes since 1989 in the microregion can be clearly observed on the aerial photographs regards specifically: the disintegration of agricultural cooperatives, termination of small farming on private crofts, suburbanization, building-up of residential houses, afforestation and succession, revitalization of municipalities and tourism development.

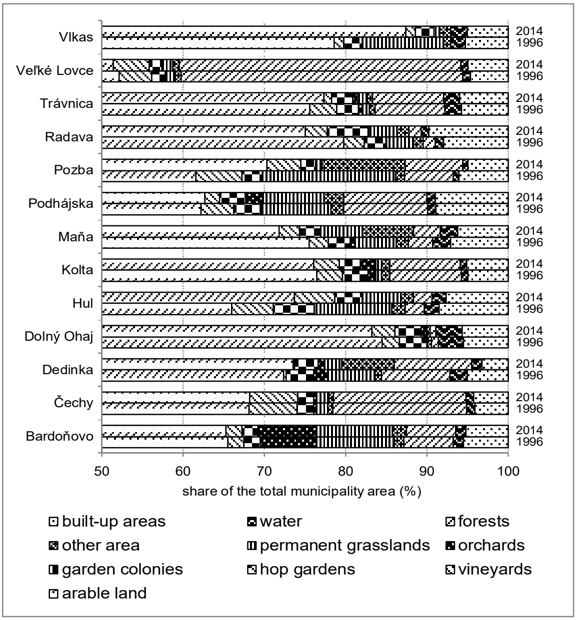

Figure 2: Changes of land use in the microregion Termal in 1996 and 2014
Source: Statistical Office of the Slovak Republic, 2015

3.1 The disintegration of agricultural cooperatives

After 1989, the economy has transformed from a centrally planned economy to a market economy, the main elements of the reform were privatization, restructuring of companies and market liberalization. These processes in the rural landscape caused the disintegration respectively the disappearance of many agricultural cooperatives (Némethová, 2009), state farms and companies and their subsequent insufficient using (Figure 3).

Figure 3: The disintegration of agricultural cooperative in Čechy
Source: TICJL, GoogleEarth

Figure 3 shows the gradual disintegration of an agricultural cooperative in the municipality of Čechy, where nowadays remained untapped area (brownfield). Currently agricultural land is cultivated in the municipality by three agribusiness: Agricultural Cooperative Kolta, AGROSPOL Semerovo, AGROCONTRACT Mikuláš, a.s., which manage in areas of the former cooperatives, although they use not all of a cooperative area.

3.2 Changes in small forms of farming

In the period up to 1989, along with large-area farming, there was also system of small felling areas called crofts that were allocated to members of agricultural cooperatives for their own farming. There were areas of rectangular shape elongated in substantially one direction. They are usually concentrated in the closeness of human settlements in the form of narrow strips, used for growing cereals, sunflowers, corn and other crops (Žarnovičan & Májeková, 2013). The basis of the transformation of agriculture was restitution – the refund of land to original owners. The expected effect of the increase in private farming was not filled. People lost interest in farming, the bond of man to land weakened. Most of agricultural land is leased to farms of various forms (cooperatives, Ltd., PLC, etc.). Today, system of small felling areas is managed by private farmers (Figure 4).

Figure 4: Uniting of crofts in Radava
Source: TICJL, GoogleEarth

In Figure 4 we can see an example of the municipality of Radava, whose landscape has been characterized by many small orchards, gardens and crofts. This form of farming, however, is gradually declining, there is a land uniting and former original mosaic of landscape is slowly disappearing. Narrow strip of agricultural land are uniting and create a larger area.

3.3 Suburbanisation

After the rural municipalities lost a large number of its population during the period of socialist industrialization, there was period of return of people to life in the countryside in the last years. While in 1991 lived in rural areas 43.32% of the Slovak population, in 2013 it increased to 45.92%.

Repeated revival of the rural area especially with the new population is linked on one side with a housing shortage, the high cost and higher cost of living, with unresolved problems of environment and transport in the cities and on the other, there can be observed quicker processes of the suburbanisation because of cheaper estates, unoccupied homes and flats and so on. (Czaková, 2009 Repaská, 2012). In the countryside are again built new houses (Figure 5), reconstructed the old houses, the countryside is enriched by urban elements by construction of multi-storey apartment buildings.

Figure 5: Building of new houses in Dolný Ohaj
Source: TICJL, GoogleEarth

Figure 5 shows the building of new houses on the outskirts of Dolný Ohaj, where a new street was created. This would result in the process of suburbanisation at the expense of a decrease of agricultural land.

3.4 Building of multi-storey blocks of flats

For rural municipalities, which are located in economically developing regions, is typical from the mid-90s higher building activity. It is heading to the reconstruction and modernization of existing houses and flats and is manifesting also in the "boom" of new residential buildings. In the countryside small "housing estates" are creating that are typical for the urban environment (Figure 6). Not only that, the height of buildings changes, but also changes their visual aspect. Municipalities want to attract more people to the countryside.

Figure 6: Building of multi-storey blocks of flats in Hul
Source: TICJL, *GoogleEarth*

In the microregion Termal is obvious a multi-storey residential buildings in several municipalities. In the village of Hul were completed two blocks of flats with 15 flats in 2010, and in 2012 another two blocks of flats with 14 flats. This resulted in a new residential area in the village with revitalized environment and infrastructure (Figure 6), not only for local but also for those, who moved in the village.

3.5 Reforestation and succession

As a result of collectivization, mechanization and the creation of large-area fields, field's balks and groves were destroyed. This encroachment on the landscape had degrading impact on the rural landscape heterogeneity. Currently, the emphasis is on reintegration of heterogeneity by afforestation. This principle is also supported by various legislative and program documents. Agri-environmental program of Slovak Republic supports reforestation, creation of green areas and grassing of agricultural land, which is unsuitable for agricultural use. Strategy for Soil Protection and Use recommends letting soil unsuitable for agricultural use in agricultural land, but use them as agricultural green (permanent crops). National Soil Policy of Slovakia emphasizes that a conflict of economic interests in land use with environmental interests should take precedence ecological interests (Klinda & Bebej & Toma, 2002). The landscape is afforested efficiently and purposefully. According to Midriak and Zaušková (2011) an agricultural land in the country began to desolate due to a change of ownership and the stagnation of agriculture, particularly livestock production. This resulted in the onset of secondary successional processes, overgrowing shrub and forests leading to the formation of forest (Figure 7).

Figure 7: Successional processes in Pozba
Source: TICJL, GoogleEarth

In the microregion Termal, in the municipality of Pozba, is visible abandoning of agricultural land and subsequent overgrowing by scrub and woodland vegetation (Figure 7).

3.6 Revitalization of municipal centres

Due to rapid industrialization and the migration of population from rural to urban areas to work began rural area lagging behind. Only central municipalities have developed. After 2000, however, there was revitalization of rural area; rural life has become popular again. Rural production function, however, is gradually pushed away by a residential and recreational function. Dilapidated buildings in rural areas are refreshed, revitalized, primarily central parts of municipalities through funds from the EU (Figure 8).

Figure 8: Revitalization of central part in Maňa
Source: TICJL, GoogleEarth

As an example we can use a state in the municipality of Maňa, which the centre has undergone by a complete makeover. The building of new and reconstruction of existing pavements, new bus stops, reconstruction of local roads, construction of public lighting and revitalization of public greenery with creating an artificial stream were co-financed from the Regional Operational Programme (Figure 8).

3.7 Development of tourism

After the decline of agriculture in the 80s and 90s, the countryside was looking for new impulses for development. To the fore gets the phenomenon of rural diversification, specifically transformation of the agricultural (production) rural space to multifunctional system that tries to use maximum of their potential and move capital to different activities, which in the past were represented mainly in the urban areas – tourism, industrial activity etc. Mainly in the microregion Termal tourism plays a major role – is based on a thermal spa in Podhájska, which is a driving force in the microregion (Figure 9).

Figure 9: Development of tourism infrastructure in Podhájska
Source: TICJL, *GoogleEarth*

Figure 9 points on the development of the swimming pool in Podhájska. The first borehole was made in 1973, when local people put yourself first pool by brigade way. Development of the resort area came after 1991, when it came under the administration of the municipality of Podhájska. In 2003, there performed the complete reconstruction of the borehole and the winter pool and whirlpool was built. In 2012, there was opened a new wellness center Aquamarin – funded by the municipality of

Podhájska in the amount of 8 million €. On aerial photos is visible a new building zone south of the resort. Here arose new accommodations (eg. Apartment Monty ***, Sunny apartment, Pension 3galeria).

4. CONCLUSION

Rural landscape succumbed and constantly is succumbing to changes, which are consequence of socio-economic development. Identification and observing of these changes is important to detect negative and positive impacts of these changes on the landscape and for proposing particular precautions and for possible prediction of further development. To indicate the changes taking place in the landscape are a good tool aerial images, using which we can observe chronology of changes. On aerial photos are well recognizable changes that the rural landscape has undergone since 1989 – the disintegration of agricultural cooperatives, followed by abandonment of the land and its succession or subsidized afforestation. It is also noticeable decline of small forms of farming on private crofts, which does not appear as a long narrow strip of agricultural land on aerial photos than in the past. Small-scale arable land is mostly used by privately employed farmers, they change shape and use, and their abandonment leads to their uniting or extinction. Visible is also the conversion of production countryside to a multifunctional rural countryside, where tourism development gets to the fore (construction of tourism infrastructure at the expense of agricultural land). In view of the changes taking place within the boundaries of municipality residential area, it leads to the construction of houses or block of flats, creating new street on the outskirts or is concentrated in the rural area directly on unused plots. It changes the quality of life in municipalities, e.g. by revitalization of municipal centres. The use of aerial photographs to identify changes in the rural landscape is an appropriate tool, but is also necessary field research by which it is possible to specify identification of objects or changes.

ACKNOWLEDGEMENT

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X3DOM: OPEN WEB PLATFORM FOR PRESENTING 3D GEOGRAPHICAL DATA AND E-LEARNING

Lukáš Herman[1] and Jan Russnák[1]

[1] Department of Geography, Faculty of Science, Masaryk University, Kotlářská 2, 611 37 Brno, Czech Republic, e-mails: herman.lu@mail.muni.cz, russnak@mail.muni.cz

ABSTRACT

3D visualization is important for a number of applications used daily in various domains related to geographical space such as disaster management, urban planning, documentation of cultural heritage, as well as teaching geography. This paper is devoted to the issue of 3D modelling at different spatial extents and levels of detail. Theoretical section summarizes a review of data formats, software and web technologies used for the 3D visualization of geographical data. X3DOM library has been chosen for the implementation of several 3D visualizations. Different input data and software were used for each of these use cases. The individual processing methods were compared with each other. Possibilities of implementation of interactive functions in X3DOM library and their utilization in educational materials for the teaching geography were also described in detail. Advantages, limits and future development of the proposed concepts are discussed in the conclusions.

Key Words: *3D visualization, e-learning, geographical data, web cartography, X3DOM*

1. INTRODUCTION

The 3D visualization of geographical data is nowadays used in many fields and with regard to different issues. 3D visualizations and maps can be applied to the analysis of the current state, the reconstruction of the past, the prediction of future developments, and the choice of multiple options for future development within planning. 3D visualizations may be used by children, students, adult laymen or experts and they also have the ability to assist in dealing with problems on different scales – from the global and regional levels to the local level involving towns and cities (Voženílek, 2005; Lin et al., 2015).

Řezník (2013) states that geographical information has been crucial for research in a wide variety of sciences not only within geography and there are also many possible applications for 3D models and visualization. The use of 3D visualisation has been proposed in following areas: virtual tourism (Ding, 2011), 3D cadastre (Shojaei et al., 2013), disaster management (Kemec et al., 2010; Řezník et al., 2012), urban planning (Ki, 2011), research of urban heat island (San José et al., 2012), analysis for solar energetics (Hofierka & Zlocha, 2012), geomorphology (Růžičková et al., 2013) or documentation and reconstruction of historical sites and cultural heritage (Jedlička et al., 2010; Svatoňová & Rybanský, 2014).

3D visualization is also used in the teaching of geography, especially in e-learning, because 3D relates mainly to digital media. Hirmas et al. (2014) focuses on the 3D visualization in teaching physical geography, particularly at the presentation of physio-geographical phenomena using the device GeoWall. Niedomysl et al. (2013) has tested efficiency of 3D visualization of demographical data. To assess the suitability of 3D visualizations can be also used modern methods such as eye-tracking (Popelka & Dědková, 2014) Expectations and ideas of students associated with the use of geographical digital geographical data and 3D virtual environments describe Bandrova & Konečný (2014).

This paper focuses on 3D visualization of geographical data. Because X3DOM library was chosen for implementation of use cases, the properties of this library were described in detail. X3DOM library is given in context with other software, formats and web technologies for visualization of 3D geographical data. Available ways how to prepare data for visualization within this library are also described. We try to suggest and implement functionality that is needed in e-learning.

2. TECHNOLOGIES FOR 3D VISUALIZATION

Technologies that are used in 3D visualization include formats and software primarily used in computer graphics domain, as well as GIS (Geographic Information System) applications and formats.

2.1 Data formats

Probably the oldest most widespread format for interactive 3D computer graphics is VRML (Virtual Reality Modelling Language). VRML is a text file format in which 3D geometry can be specified along with surface colour, texture, transparency, and other properties. Together with the extension GeoVRML can be VRML model localized in various geodetic coordinate systems. X3D (Extensible 3D) is another open standard file format based on XML (Extensible Markup Language) for the description of spatial scenes. Essentially, it is recognized as the successor to VRML. COLLADA is also designed to store 3D objects and animations as it has similar capabilities to VRML and X3D and also the structure of XML (Reddy, 2008; Behr et al., 2009; Kolbe, 2009).

GML (Geography Markup Language) is an XML grammar defined by the Open Geospatial Consortium (OGC) to express geographical features. GML was originally only 2D; however, since version 3.0, it has also been possible to manage 3D data. CityGML is an application schema for GML 3.1.1 for the storage and exchange of virtual 3D city models. KML (Keyhole Markup Language) is primarily intended for the publication and distribution of geographical data. The format is primarily used for the mapping applications Google Maps and Google Earth. KML 2.2 was adopted in 2008 as an OGC standard. KML file can contain a links to COLLADA 3D models. Compressed form of KML, the KMZ format, offer in comparison to KML also textured COLLADA 3D models (Kolbe, 2009; Russnák, 2012).

2.2 Software

Software primarily designed for computer graphics, computer-aided drawing (CAD), photogrammetry or GIS can be used when processing 3D spatial data. 3D GIS software represent, for example, ESRI ArcGIS with the extension 3D Analyst (includes modules ArcScene and ArcGlobe), ESRI City Engine (software which is based on procedural modelling principles), Intergraph GeoMedia Terrain, MapInfo with Vertical Mapper extension, Surfer from Golden Software, Safe Software FME, IDRISI, freely available tool LandSerf or open source software GRASS and gvSIG with 3D extension. Software for photogrammetry and remote sensing, which enable the creation and processing of three-dimensional data, include ERDAS Imagine by Leica Geosystems, PCI Geomatica (module OrthoEngine) and ENVI (Voženílek, 2005; San José et al., 2012).

Between CAD programs working with 3D data belongs for example Autodesk LandXplorer, Bentley Microstation or Trimble SketchUp. Regarding software for 3D computer graphics the commercial Autodesk 3D Studio MAX, Cinema 4D and Rhinoceros 3D are often used. But there are also freeware applications MeshLab and View3DScene or open source tools Blender and Wings 3D. Individual aforementioned applications are in the process of creating 3D models often combined. The key factor is then the support of formats that are used to transfer between applications. It is appropriate to use standards in these connections (all formats specified in section 2.2 are standards). Also the price is important aspects for selecting 3D software in addition to the functionality. In this case, we focus primarily on non-commercially distributed applications (freeware and open source), and probably the most widely used commercial GIS software (ESRI ArcGIS).

2.3 Web libraries

A wide spectrum of technologies, which run in web environment, is available for rendering the above-described data formats. In addition to standalone applications such as previously mentioned Google Earth, there are a number of techniques for displaying 3D data using a simple web browser. Many of them use plugins. 3D models can be displayed in an internet browser using Flash plugin, version 11.0 or higher, or Microsoft Silverlight technology, version 3.0 or higher (Behr et al., 2009). Plugins are used also for the implementation of virtual globes, for example NASA World Wind, which is in the Java language.

Today, however, preference is given to technologies which work without plugins. These solutions are usually built on HTML5 (HyperText Markup Language) and JavaScript library WebGL (Web Graphics Library). One of many examples of libraries based on WebGL is X3DOM, which uses the data structure of the X3D format. The advantage of this library is broad support in Web browsers. Other libraries similar to X3DOM are, for example, SpiderGL, which also uses data in a COLLADA file structure (Di Bennedetto et al., 2011); XML3D; Three.js or SceneJS. Further overviews of the various web libraries used in 3D data visualization are provided by Behr et al. (2009), Behr et al. (2011) or Lienert et al. (2012). There are also WebGL-based alternatives of virtual globes, Nétek et al. (2013) describes in detail one of them, which is called OpenWebGlobe.

3. PRINCIPLES OF X3DOM LIBRARY

X3DOM open source framework is based on direct integration of X3D elements into the HTML code. The main goal is to achieve X3D scene available for JavaScript DOM (Document Object Model), which allows modifying the 3D scene by only adding, removing or changing DOM elements. The current implementation of the X3DOM uses so called fallback model, which renders 3D scenes through an InstantReality plugin, a Flash11 plugin or a WebGL. For running no specific plugin is needed and WebGL-enabled web browsers are available for most platforms. WebGL is supported in Internet Explorer 11 and higher, Google Chrome 9 and higher, Mozzila Firefox 4 and higher Opera 11 and higher, Safari Safari 6.0 and higher on OS X. WebGL is enabled not only on desktop computers, but also on mobile devices, for example, on Chrome for Android, Firefox mobile for Android and Safari on iOS (8 and higher). X3DOM is free both for non-commercial and commercial purposes (Behr et al., 2009; X3DOM, 2015).

Common JavaScript events, like *onclick*, on 3D objects are supported in X3DOM. There is also available a runtime API, which provides a proxy object to programmatically read and modify runtime parameters. The API functions serves for interactive navigation, resetting views or changing navigation modes. X3D data can be stored in HTML file or as part of external files. Their connection is realized via the element *Inline*. Particular X3D elements can be clearly distinguished through their attribute *DEF* (Behr et al., 2011; X3DOM, 2015).

The advantage of X3DOM is also good access to documentation. A number of examples, tutorials, links to best practices and other practical information are located on the web page www.x3dom.org. Scientific articles summarize also general information, for example, Behr et al. (2009) or Behr et al. (2011). Technical aspects of the use of X3DOM library for the 3D cartographic visualization of environmental information describe Herman & Řezník (2013) and utilization of X3DOM for detailed city mapping outlines Herman et al. (2015). Koch & Paulsen (2014) used X3DOM to presentation of 3D geological data and OceanView (2015) demonstrates water level changes in the Baltic Sea. There are also a number of applications, where X3DOM is used for e-learning. Kress (2015) have created an educational interactive presentation of the planets of the solar system. X3DOM can be used also for teaching human anatomy (Birr, 2015) or for implementation of virtual museum (3D-Coform, 2015).

4. PROCESING OF INPUT DATA

Important aspect is complexity of data processing and transformation, when creating own 3D visualization. Because X3DOM uses the structure of X3D, software that supports storing data into this format can be used for processing and it is not necessary to process data manually or develop new applications. Four different workflows of data processing were tested in this paper. Commercial software (ESRI ArcGIS – ArcScene module) and especially freely available (3DEM, BVHRefiner Dataset Converter, Notepad++, QGIS, SketchUp, View3dScene, X3D Encoding Converter) were used in these workflows. A common part of all four workflows is modification of HTML code, so that the final file contains a reference to the X3DOM library and link to external X3D file or X3D elements directly inserted (as it is outlined below).

```
<html xmlns="http://www.w3.org/1999/xhtml">
  <head>
    <link rel='stylesheet' type='text/css' href='x3dom.css'/>
    <script type='text/javascript' src='x3dom-full.js'/>
  </head>
  <body>
    <X3D xmlns="http://www.web3d.org/specifications/x3d-namespace">
      <Scene>
        <Shape>
          <Appearance>
            <Material diffuseColor="0 0 1"/>
          </Appearance>
```

```
          <Box/>
        </Shape>
        <Inline url="red_box.x3d"/>
      </Scene>
    </X3D>
  </body>
</html>
```

4.1 3DEM

Data that are chargeable as well as freely available can be utilized for creating of 3D visualizations. Data, which are free of charge, were processed in first workflow. SRTM (Shuttle Radar Topography Mission) data can be used as input to create 3D visualization of simple terrain model. It is possible to load SRTM data (stored as HGT files) to freeware 3DEM. This software provides the setting of colour scheme, clipping to smaller part, display as 3D view and finally saving this 3D view as VRML file. As it is shown in figure 1, there are two ways to further process of VRML files. The first way, on-line tool called X3D Encoding Converter, directly creates an HTML page with the 3D scene. But it is necessary to modify HTML code (overwrite links to the library X3DOM onto actual version of locally stored JavaScript file). Second way is conversion of VRML file to X3D, for example by View3dScene, and linking them through Inline element. Resulting visualization is displayed in left part of figure 2.

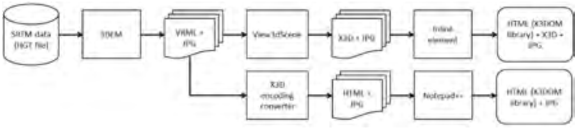

Figure 1: Export from 3DEM software to X3DOM

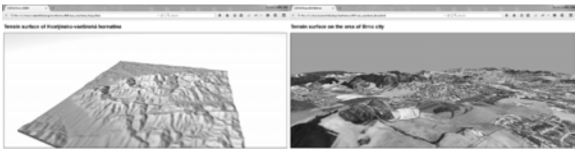

Figure 2: Terrain visualization in X3DOM (left: export from 3DEM software, right: processing in BVHRefiner Dataset Converter)

4.2 BVHRefiner Dataset Converter

The above described solution is limited by the size of present terrain model. For visualization of larger or detailed terrain models can be used in X3DOM element BVHRefiner, which provides dynamic loading and adaptive refinement of raster tiles (both elevation data and textures). Open source application BVHRefiner Dataset Converter has been developed for creation of raster tiles. Subsequent steps before tilling are interpolation of terrain surface and generation of texture (see fig. 3). Open source software QGIS has been tested for this pre-processing. Terrain surface has been generated from contour lines from ZABAGED (The geographic base data of the Czech Republic), which is more detailed than SRTM. Output from terrain analysis (e.g. slope or orientation) can be used as texture for surface, but in this case we use images from WMS (Web Map Service) that has been downloaded and clipped according to extent of terrain layer. Terrain surface has been exported to TIFF (*Tagged Image File Format*) file and orthophoto texture to JPG (Joint Photographic Experts Group) file. BVHRefiner Dataset Converter divides these raster files into tiles, stores them into hierarchical structure of folders and generates XML code for linking these tiles to X3DOM. Result is shown in right part of figure 2.

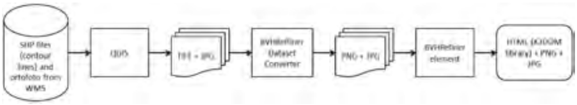

Figure 3: 3D modelling in ArcScene and export to X3DOM

4.3 ArcScene

Other objects such as buildings are processed in 3D modeling except terrain models. It is suitable to use ESRI ArcScene, which is designed for 3D visualization of spatial data. 3D spatial data (mass points and building footprints) have been loaded into ArcScene as Shapefiles. This data was acquired by geodetic measurement, process of data acquisition describe in detail Stachoň et al. (2014). TIN surface have been generated from mass points, this TIN (Triangulated Irregular Network) surface has been then converted to raster and clipped to rectangular shape (see fig. 4). Terrain models with other (it means irregular) shapes cannot be exported from ArcScene. Orthophoto used for texture has been georeferenced and transformed to UTM (Universal Transverse Mercator) coordinate system as well as surface data and footprints. It is necessary to use coordinate system that has the same units for all three axes for correct display of 3D data. Colours, base height and extrusion have been set to the buildings. While there were even textures for building modeling, they were not used, as these data could not be exported to output VRML file. However terrain model was textured and subsequently exported without any problems, as well as objects without textures (see left part of fig. 5).

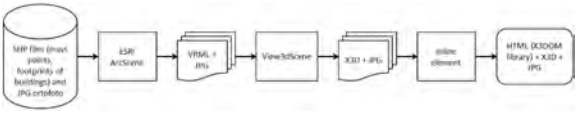

Figure 4: 3D modelling in ArcScene and transformation to X3DOM

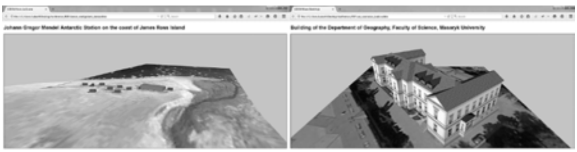

Figure 5: 3D models with textures (left: created in ArcScene, right: exported from SketchUp)

4.4 SketchUp

Because the export of textured objects from ArcScene failed, we tested also the ways to create the X3DOM with fully textured 3D models. Software Trimble SketchUp proved to be functional. 3D model, which was originally created by Russnák (2012), was used to verify this possibility. This model of building has been downloaded from the web storage 3D Warehouse. User can create easily also own 3D models in SketchUp. Modified or created 3D models can be exported to COLLADA and COLLADA files can be transformed to X3D in View3dScene software (see fig. 6).

Figure 6: Transformation of 3D models from 3D Warehouse to X3DOM

4.5 Comparison and suggestions

Selection of the appropriate software for data preparation for 3D visualization depends among other things on the extent and details of the modelled area. Smaller terrain model can be transformed in program 3DEM. Larger terrain with own textures should be processed using BVHRefiner Dataset

Converter. ArcScene can export a textured terrain models and other volumetric objects (e.g. simple buildings). It was found that the buildings with textures were not written to the output VRML file. For polyline and point layers errors occur in symbology. These features are not displayed correctly. If it is essential to create X3DOM visualization with all correctly textured objects, it is most appropriate solution to use export from SketchUp (in right part of fig. 5). The program can also handle relatively detailed 3D data. SketchUp is also the only software that has been able to export terrain model with irregular shape.

View3dScene was the best of the tested programs to create files in the format X3D from both VRML and COLLADA files. Any of the methods described above does not create X3D files with attribute information. If such files need to be created, it is necessary to use XSLT (eXtensible Stylesheet Language Transformations) transformations, which describe Herman & Řezník (2013).

5. INTERACTIVITY FOR 3D VISUALIZATION AND E-LEARNING

Interactive functions can be divided into two basic categories: *navigation* and *interaction with content* of 3D scene. Library X3DOM provides some generic navigation methods. Interactive objects will be handled by HTML-like events. Navigation can be user-defined or controlled by specific predefined modes. X3DOM supports following interactive navigation modes: fly, walk and examine. *Fly* mode is based on free moving to all directions in the 3D scene without gravitation. *Walk* mode is very similar to being in the scene and walking on the ground surface. Rather than moving through a 3D scene, *examine* mode is like holding an object in hand and twisting and turning it to look at it. Examine have also modification, which is called turntable. Turntable provides same interactions as examine mode, but the minimal and maximal vertical rotation angle can is specified and overturning of the horizontal plane is restricted. Non-Interactive movement encompasses the functionality of: resetting a view, showing all or upright the view.

Interaction with content can be implemented for example with usage of jQuery UI (User Interface) library. jQuery UI in general is a set of user interface interactions, effects, widgets, and themes built on top of the jQuery JavaScript Library. In this case jQuery UI serves for implementation of control panels allowing user to switch between layers, sliders enabling to set the transparency of the layers and popup windows. Popup windows contain the additional textual or graphic information and they are available after clicking on feature in 3D scene. However, it is rather problematic to connect additional information to objects in a 3D scene. It is necessary to do so manually.

Use case that demonstrates interactive functionality represents the petroleum trap. Data were processed according to workflow described in section 4.4. 3D models downloaded from the repository 3D Warehouse served as input data. The most suitable type of movement seems to be turntable. In the figure 7 you can see the use of pop-up windows, in explanation (on the left) and testing (on the right).

Figure 7: Interactive 3D visualizations of petrol traps (left: explanation, right: evaluation)

3D models can be use not only during explanation of geographical phenomena, but also in evaluation (testing) of knowledge. You can implement the functionality to select the correct answer in JavaScript. So it can be entered the following task: select the 3D scene described object. Another possible way how to enrich the 3D scene can be its connection with the 2D map. Such a connection would help, for example, improve understanding of the contours in visualizing terrain models.

6. CONCLUSION AND FUTURE DEVELOPMENT

To sum up, the following major advantages of 3D visualization based on X3DOM were identified:

- it enables user-friendly 3D visualization based on Web technologies;
- id displays different types of spatial data processed both in commercial programs and free or open source;

- it does not require any new software or plugin to be installed;
- it is based on open JavaScript library and may therefore be further modified or easily extended;
- it allows creation of fully interactive presentations of spatial data, which are potentially useful in many areas (for instance in those which are mentioned in the introduction);
- it enables web based e-learning for explanation or evaluation of geographical knowledge.

Future work will follow two main directions – one is more theoretical (usability research of various 3D visualizations), second one is purely technical. Regarding usability research, speed and efficiency, speed and learnability should be examined, when solving given tasks. These aspects of various types of 3D models and maps may be studied – for instance, through eye-tracking techniques. We can also analyze the users interaction (the speed and fluency of movement in a virtual environment or preferred modes of movement).Some preliminary findings in the field of usability of interactive 3D visualization describes Špriňarová et al. (2015), but further research in this area will certainly be necessary. , Detail research of 3D visualization and their usability will be conducted in the future. This research will utilize similarly methods and solve similar issues as they are used today for research of 2D maps. The currently solved questions and the research methods used in cartographic oriented usability studies describe, for example, Staněk et al. (2010) or Kubíček et al. (2014).

In addition to studying usability, it is advisable to continue to pursue practical issues. In particular, the optimization of data processing procedures and their simplification to avoid the need to utilization of larger amounts of software. It would be appropriate to spread the support for exporting to X3D format. Standardized data have also considerable potential in this task, especially those published under the European INSPIRE Directive (2007/2/EC). The problem is currently also connecting additional (attribute) information to the elements in X3D format. It's necessary to do it manually, so it would be appropriate to develop tools that facilitate this task or do it completely automatically. For example it would help to create plugin into any open GIS software like QGIS, which would allow (semiautomatic) export to X3D, or to an HTML file with embedded X3DOM. It would be also desirable to develop tools for creating X3D files with attached attributes.

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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

Jaromír Kolejka[1], Martin Boltižiar[2], Hana Svatoňová[1], Matej Vojtek[2] and Jana Oláhová[2]

[1] Department of Geography, Faculty of Education, Masaryk University, Poříčí 7, 603 00 Brno, Czech Republic, e-mails: kolejka@ped.muni.cz; svatonova@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, Slovak Republic, e-mails: mboltiziar@ukf.sk; mvojtek@ukf.sk

ABSTRACT

One of the likely power centers of Great Moravia was located in the Moravian-Slovak border near Mikulčice and Kopčany municipalities in the floodplain of the Morava River in 8th and 10th century. Available mapping documentation of this area comes only from the 16th century. Reliable maps, however, are available from the early 19th century. Some elements of the historical cultural landscape could have survived the deep turbulences and in the paper we propose the possibilities to identify some of them. Their finding is based not only on old maps, but also on some indications in the current thematic maps describing the components of the nature.

***Key words**: Great Moravia, old maps, aerial photographs, historical and natural indications, interpretation of maps, GIS, remote sensing*

1. INTRODUCTION

Existing results of the identification of the Moravia past talk about the likely core of the Great Moravian Empire which was located in the Dolné Pomoravie Region between Staré Město near Uherské Hradiště (locality called Valy) and Pohansko Region where numerous artifacts were found attesting to the existence of power, spiritual, and economic centers of the empire. Also central part of this area around the municipality of Mikulčice is from the 50s of the 20th century in the center of attention of archaeologists and historians. Their findings suggest a similar significant settlement where the Great Moravian power was concentrated at a certain time. This is probably the Great Moravian castle (fort) mentioned in early medieval documents as “grad Morava” or “urbs antiqua Rastizi” which could be at a certain time the metropolis of Great Moravia or at least the main power center (probably before later moving of metropolis into the area of Staré Město near Uherské Hradiště after amplification of floods due to extreme rainfall in relation to the increased activity of the Icelandic volcanoes). On the Slovak side of the Morava River, an ancient Church of St. Margaret of Antioch, which substantial part of the wall is considered by experts as heritage of the Great Moravia, preserved in the neighborhood of the municipality of Kopčany. By this, it becomes the only standing building from the period of the empire despite the fact that it has undergone some partial conversions and modifications in later times. In the period of the Great Moravian Empire, probably an agglomeration of Slavonic settlements existed there which was apparently unprecedented in the entire western Slavonic cultural circle. Historical complex of the Slavonic agglomeration – the current Czech national cultural landmark of Slavonic Fortified Settlement at Mikulčice, Slovak national cultural landmark – Church of St. Margaret of Antioch and conservation zone of Kopčany thus represent a unique area which applies for a UNESCO World Heritage Site. In September 2012, the Minister of Culture of the Czech Republic signed the nomination documentation and thus closed the most important part of the preparation of the proposal of “Mikulčice-Kopčany Archaeological Park” for entry on the UNESCO World Cultural and Natural Heritage. Nomination papers were delivered to the headquarters of UNESCO in Paris at the end of September 2012.

2. LANDSCAPE ARCHAEOLOGY AND ITS RELATION TO THE GEOGRAPHICAL RESEARCH

Landscape archeology is a field of study that is intensively developed since the late 80s of the last century. It uses, by a variety of ways, own data of archaeological research and also historical, geological, geographical, biological, economic, social and other data in order to create a comprehensive picture of the state of territory in the past especially in the period for which the research is specifically focused on (Fontes, 2010). Synthetic landscape materials have been used only recently (Gojda, 2000) and yet they have not undergone adequate use of their content and significance. Their application is primarily used especially in the field where not only the archaeological sites with purposive human creations are of interest (sites and artifacts), but in particular the concept of ancient landscape associated with a particular period in the past. Here, the landscape research partly gets to the boundary of paleogeography in its geographical sense (Paleogeography – geography of landscapes in the past of the planet Earth while the standard narrow conception of paleogeography means – distribution of land and water in the geological past of the Earth). Reconstruction of the landscape for historically not very distant periods may touch with a high detail, even relatively large areas such as the battlefields of World War I (Saey et al., 2013, Gheyle et al., 2013). On one hand, it seems that to the past, the territorial range of research reduces and leads to the generalization of results. The fact remains that 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.

3. GEOGRAPHICAL RESEARCH OF THE GREAT MORAVIA CENTRE

Archaeological evidence for essential significance of the core of Great Moravia are crucial. With the effort of obtaining the status in the network of UNESCO WHS, however, it will be the declaration of the specific level of protection and care not only over archaeological sites, but also over open landscape of the Morava River floodplain which also underwent extensive changes for about the last 1100 years. This area has not been given sufficient research attention from the point of view of natural science. 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). Despite the quaternary geological research (e.g. Havlíček, 1999) and analyses of the likely routes of old roads (Květ, 1999, Dresler, 2012), there has not been any attempts to obtain specific supporting evidence about landscape (“non-construction”) Great Moravian heritage which lies in “fingerprint” of the former cultural landscape, its natural and anthropogenic elements, in cultural landscapes of later periods to the present. Especially this second issue is essential for the definition and management of the preparing cross-border protected area of UNESCO. In Moravian and Slovak side of the considered protected territory, there are ongoing adjustments to serve attractive appearance and functioning of the archaeological park. According to the findings of the preliminary field survey (Fig. 1), these changes and measures are not always led by landscape factography and rather they tend to a preference of aesthetic reasons (planting alleys, paths and trails management, bridging the Morava River). Geographic landscape research can bring a considerable number of key evidence of the missing natural and economic structure of landscape of the study area at the time of Great Moravia. Currently available geodata and technologies allow their processing by the means of thorough spatial analysis of geographic data.

4. DATA SUPPORT OF NON-TRADITIONAL RESEARCH

The study area of the preparing archaeological park was repeatedly subjected to taking of aerial photographs and its results are partly available free of charge on the Internet (Fig. 2). By using these aerial photographs is possible to identify a great part of already vanished network of flow and dead branches of the Morava River. Their dating is indeed beyond the proposed research, but only their identification in the field (according to small terrain undulations, differentiation of soil cover, differences in land use, occasional rainfall, seasonal flooding, bioindications, etc.) allows us to create an image of the territory dynamics. In the same way, we can use the older black-and-white aerial photographs from the 50s of the 20th century which are also available on the Internet (Fig. 3). Detailed soil and forestry documents from a given area are available as well as more broad materials of quaternary geology.

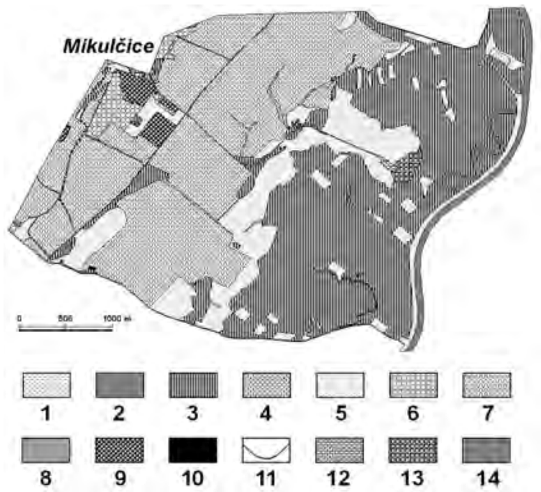

Figure 1: Mikulčická niva (floodplain) – Land use in 2014 (1 – wetlands, 2 – water bodies, 3 – forests, 4 – shrubs, 5 – meadows, 6 – gardens, 7 – arable land, 8 – residential buildings, 9 – industrial buildings, 10 – extraction of raw materials, 11 – roads, 12 – archeological museum, 13 – site of the Great Moravian monument, 14 – car parking)

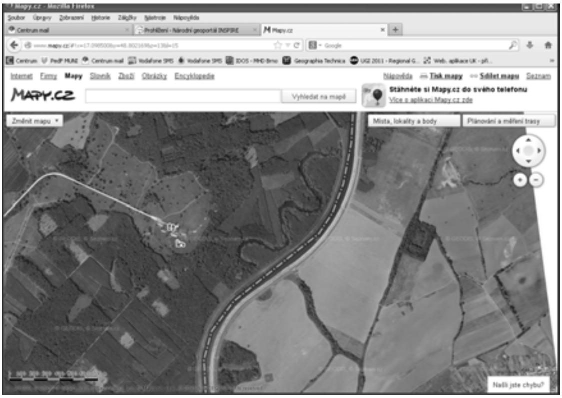

Figure 2: Mikulčice-Kopčany. Recent color orthophotomap from the GEODIS BRNO company on the website: www.seznam.cz.
Source: www.seznam.cz

Old maps of military surveys document the state of land use (so-called economic structure of the landscape) from the second half of the 18th century and new maps even up to today. Moreover, they allow to determine the spatial-temporal changes of land use in this period, to determine their most conservative elements and in their case to suggest a possible connection with the period of Great Moravia. Unlike the archaeological research, which focuses on the findings of material artifacts or evidence of human presence in the form of buildings and physical objects, landscape research is aimed to cover the area/territory by the knowledge and their (time) spatial analysis. In this case, it is the integrated analysis of identified changes in the natural landscape structure (with regard to incidence, shape, and course of former river beds – undated) and economic landscape structure (identified in each documented historical periods – dated). Geographical research of ancient cultural landscape is not related to the activities of non-invasive archeology focusing on human works. Geographical research highlights the knowledge of the current or past environment represented by the natural and cultural landscape. From the constellation of former landscape it is, however, possible to deduce the location of the former human creations. Furthermore, old maps of military survey (Fig. 4) are available both on the website of CENIA and the University of J. E. Purkyně in Ústí nad Labem (www.geolab.cz).

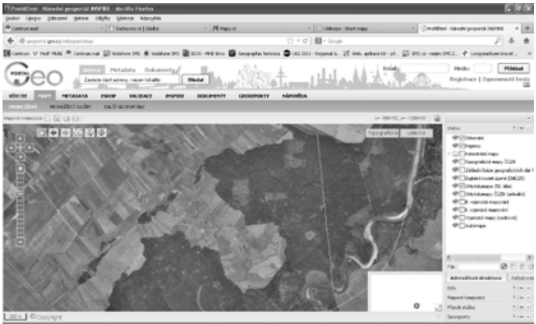

Figure 3: Mikulčice-Kopčany. Black-and-white orthophotos from the 50s of the 20th century available at CENIA geoportal

Source: www.cenia.cz

5. RESEARCH HYPOTHESES

Geographical research of the landscape in the area of one of the possible core of Great Moravia is based on several hypotheses.

1. A future archaeological park should be a living area, therefore, it cannot be “forced” inanimate historical functions. However, it is necessary to respect all of the Great Moravian heritages in its preserved forms (buildings, sites, individual parts of the natural and economic landscape structure). Road and drainage network in the past were quite different from the current or modern network and they were in mutual concord. Parts of both networks could preserved up to the pre-industrial (and especially pre-socialist) period. According to proven sections, we can estimate to a certain extent the progress of lost parts.

2. In the period of Great Moravia, the agglomeration filled, besides the settlement and related functions, also production functions (and of course a defense function). Moreover, they could leave tracks in the natural and economic structure which are potentially identifiable based on the integrated analysis of natural and economic landscape structure from the dating past to the present. This mainly concerns the distribution of forests, agricultural and water areas. Although they are not conservative elements of landscape structure, yet certain long-sustaining sites may also indicate previous long period of stability. Eventually, we can take into consideration the findings of detailed maps of the manor in the neighborhood of sites on both sides of the Morava River (in Holíč there was e.g. the summer residence of the Habsburgs) that can shift the knowledge about the territory further into the past.

Fig. 4: Maps of the II. Military Survey on the CENIA geoportal
Source: www.cenia.cz

3. Interesting sources of information about the past state of the landscape are available geological and soil indications as well as vegetation indicators (for indication of other than residential and funeral locations). Moreover, there are available quite good map data. By their joint evaluation with information from previous fields of research (according to hypotheses), we can also come to further refining of the image and former state of the territory and what its legacy could be today. Methodological background will be secured by the technology of geographic information systems and remote sensing based on the use of knowledge of partial geographic disciplines studying the water objects, soil, relief and its genesis, localization factors of human creations in the landscape.

There is no doubt that the results of the outlined research could significantly enrich the knowledge about the study area, but this time from a landscape point of view which is based on the integration, analysis, and synthesis of spatial knowledge. From the application point of view, they could significantly affect the future management of the territory and in particular to prevent ill-considered actions. There is thus the possibility of logical synthetic linking of knowledge of natural science with archeology and history which is, in the case of the sites under the auspices of UNESCO, a rare exception.

6. PRELIMINARY INDICATIONS OF GREAT MORAVIAN HERITAGE IN THE CURRENT LANDSCAPE

Territory of floodplains is an extremely dynamic type of natural landscape unit. Annually recurring cycle of flooding, sedimentation, displacement of meanders, recovery of vegetation cover (especially the herb layer due to its considerable resistance to flood damage), erosion and accumulation are able in a relatively short period of time to blur the products of human activity. Many cases are known in the world where fluvial morphogenetic processes completely "natured" the territory before and even centuries of intense human activities (Olympia, Ephesus, Mennofer, Metaponto, Harappa, etc.). Although there was not probably such far change of the original urbanized area in Mikulčice-Kopčany (archaeological sites are not completely covered with material that would create an entirely new relief), therefore, it is necessary to count with the fact that there is a high attention for the evaluation of the identified objects of landscape structures belonging to the Great Moravian period. In addition, we must also count with the fact that the study area underwent an enemy invasion followed by the destruction of objects. Whether this occurred before or after the dramatic and unusually severe floods at the turn of the 9th and 10th centuries AD, in connection with massive explosions of Icelandic volcano and exceptional long-term production of condensation nuclei for the enormous rainfall over central Europe, it will be hardly proved.

Nevertheless, the research aims to:

1. Obtaining the image of the Great Moravian heritage in current natural landscape structure and thus what natural objects and shapes preserved from the time of the empire and were therefore part of the former environment without being directly shaped by human activity.

2. Identification of stable sites in the current economic landscape structure (in land use) which could indicate far older (non-construction) polygon objects which come from former distribution of agricultural, forest, and water areas.

3. Special-purpose evaluation of natural science cartographic materials (about soils, vegetation, geology, relief, etc.) for the needs of identification of Great Moravian heritage in current landscape.

4. Creation of cartographic documentation to objects of increased interest due to potential correlation with the period of Great Moravian Empire and creation of a comprehensive methodological procedure which will be based on landscape analysis of the area and synthesis of the available archive data for the needs of identification of human heritage in current landscape.

From the oldest available map documentation of the Mikulčice-Kopčany area from the third quarter of the 16th century (Fabricius map of Moravia) and subsequent first quarter of the 17th century (Comenius map of Moravia), it is clear that forests prevailed in the area (Fig. 5).

Figure 5: Mikulčice-Kopčany at Fabricius map (left) and Comenius map (right)

At the time of acquisition of both maps, the current archaeological site of the Great Moravian fortified settlement was located in the southern part of the large river island whose eastern rim forms the main stream of the Morava River while the western edge was represented by the joint branch of the Morava River and part of the Kyjovka River (or Kyjovka River ran into this branch shortly after leaving the large water area marked on both maps). On the contrary, Kopčany are located in non-forested area south of the Morava River curve. At least since the 16th century, the territory was dominated by forests and the island was shared by the Czech crown and Hungarian Kingdom. If we consider the church of Kopčany as architectonic heritage of Great Moravia (if only very partially), then it avoided the destruction that would otherwise hit all the buildings on the opposite bank of the Morava River. It can be assumed that the attack on the former power center of Great Moravia was rather directed from the west through far smaller natural barrier which was a branch of the Morava River or Kyjovka River than was the own Morava River. This could have at that time such size that the attackers could not cross it or it was out of line of sight from conquering fort. In the Czech part of the studied area of Mikulčice-Kopčany (Fig. 6), there are preserved parts of numerous meanders in the open landscape between the archaeological site and the edge of the valley of Morava River along the canalized flow of Kyjovka River, which are badly visible in terrain, but easily identifiable on aerial photographs.

The forest could have been an obstacle of direct line of sight. Probably shortly after the conquest of the fort, next severe flood occurred (previous floods perhaps just shacked the fort and morality of defenders) so disrupted buildings were not suitable for repair or repair was banned by higher force or it did not find an organized force. It is also possible that these factors were combined. Therefore, it is reasonably possible that between the fort and church near today's Kopčany was the strip of forest and deep riverbed of the Morava River, probably in the long section, which lacked a convenient ford or bridge (which could have been torn down for defensive purposes). This strip of forest probably later expanded as heavily flooded area got to the former settlement periphery (in addition, its power role disappeared, even though the fort itself did not have to be flooded, the surrounding area was flooded probably in the remaining space between Morava and Kyjovka rivers up to the foot of the western marginal bank of the joint floodplain of both rivers). This seems not to have been strongly afforestated by succession. On the contrary, it served economic purposes (arable land, meadows).

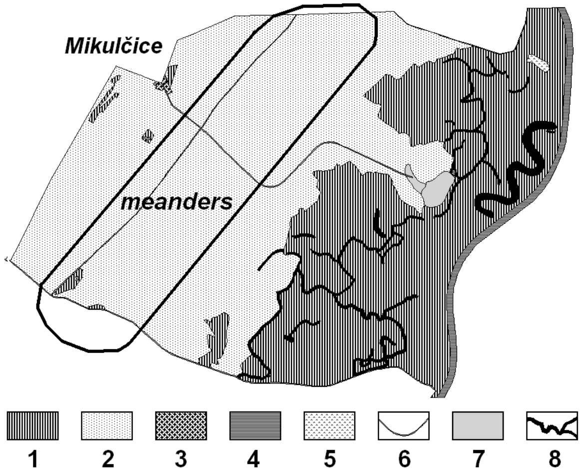

Figure 6: Mikulčická niva (floodplain) of the Morava River – selected long-term elements of the current landscape (1 – forest with more or less preserved outlines in the period of last 200 years, 2 – open landscape of fields and meadows, 3 – built-up area on the edge of Mikulčice, 4 – current water area of the canalized Morava River, 5 – wetland, 6 – line elements of the current road and canalized Kyjovka River, 7 – fortified settlement with fortification, 8 – preserved network of depressions of former river branches in forest areas – according to the interpretation of topographic maps)

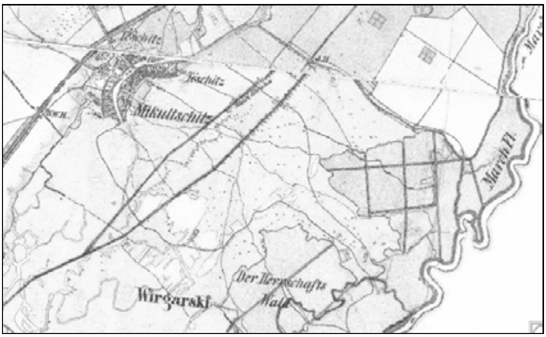

Figure 7: Cutout from the 4th section of the map of II. Military Survey shows no longer existing several routes in the area between the Mikulčice village and the fort (meadows between forests in the SE part of the cutout). The current access road to the site leads in approximate route of the longest road with S-shaped deflection from west to east.
Source: www.cenia.cz

A number of roads and trails were directed though the flooded area west of the fort which generally have tendency to preserve for a very long time although the intensity of their use varies widely. Many roads can be still seen on the map of the II. Military Survey which more or less directly or with large detours lead to the fort (Fig. 7).

The map shows also curves of the already disconnected meandering Kyjovka River (branch of the Morava River?) and another less obvious active and abandoned riverbeds in the fields, meadows, and forests. They could be part of the defense system of the fort in the time of prosperity and also decline after flooding.

7. CONCLUSION

The obtained preliminary indications of the former landscape from the Great Moravian period, of course, require a supplement, mutual comparison, certain verification, insertion into the GIS for further analyses. It is clear, however, that with a certain vision of success we can work even if the findings are not entirely proven. Loading of thematic layers together with available data will still enable to create a picture (though incomplete) of the former landscape structure. However, this has been the task of research in the project from the Visegrad Fund towards the locations in the area of Mikulčice and Kopčany.

One of the power centers of Great Moravia (8th and 10th century) was located in the Czech-Slovak border near Mikulčice and Kopčany, in the valley of the Morava River. Historical complex of Slavonic agglomeration (Czech national historical landmark of Slavonic Fortified Settlement, Slovak national historical landmark – Church of St. Margaret of Antioch, and conservation zone of Kopčany) represents a unique area which have applied for registration to the UNESCO World Heritage Site. The earliest available mapping documentation dates from the 16th century and reliable maps date from the early 19th century. The research of past landscape is represented by more or less successful reconstruction of natural or cultural landscape. It is possible to deduce the location of former human creations by the constellation of the former landscape. The oldest available map documentation of the area of Mikulčice-Kopčany dates from the third quarter of the 16th Century (Fabricius map of Moravia) and the first quarter of the 17th Century (Comenius map of Moravia), where it is clear that this area was dominated by forests. It is possible that there was a long strip of forest and a deep riverbed of Morava without a ford or bridge between the fort and the church. This strip of forest later expanded because the heavily flooded area spread to the periphery of the former settlement. Number of paths and trails used to lead towards the fort from the west via floodplain. They tend to remain the same for a very long time although the intensity of their use varies greatly. Even maps of II. Military Survey still show many paths leading towards the place of the fort and settlement. We obtained preliminary evidence of former landscapes of Great Moravian period, but of course it will require a supplement, mutual comparison, certain verification, insertion into the GIS for further analysis. Loading of thematic layers of available data will still enable to create a picture (though incomplete) of the landscape structure of Great Moravia center.

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REMOTE SENSING IN THE TEACHING OF SCIENCE AND GEOGRAPHY: THE EXPERIENCE AND LATEST RESEARCH RESULTS OF INTERPRETATION OF IMAGES

Hana Svatoňová[1] and Šárka Hošková-Mayerová[2]

[1] Masaryk University, Faculty of Education, Department of Geography, Poříčí 7, 603 00 Brno, Czech Republic, e-mail: svatonova@ped.muni.cz

[2] University of Defence, Faculty of Military Technology, Department of Mathematics and Physics, Kounicova 65, Brno 662 10, Czech Republic, e-mail: sarka.mayerova@unob.cz

ABSTRACT

Remote sensing is one of the latest geoinformatic technologies providing the actual image of the landscape. Satellite and aerial images are available to the public mainly through the Internet (for example via Google Earth, websites of NASA and ESA and other sources). The use of images in the teaching of geography, biology, chemistry and physics brings new and interesting features for this activity. The results of the research of interpretation of aerial photographs and satellite images show that (1) pupils are able to interpret aerial and satellite imagery successfully, (2) younger pupils prefer to read aerial and satellite images before reading maps, (3) there is no significant difference in the success of reading images between girls and boys, (4) students interpret information from the false colour images successfully, (5) students work with images in their own time and find this activity attractive, (6) images are used relatively rarely in the teaching.

Key Words: *Remote sensing; Earth observation; interpretation of satellite images; didactics of science and geography.*

1. INTRODUCTION

Remote sensing technologies open to the public. The inauguration of civilian satellite earth observation in 1972 brought about the birth of an entirely new view of the world. For the first time ever it became possible to view the planet Earth synoptically as a whole, to study the many-facetted dynamic events on its surface, to carry out a continuous review of the effect of human development and activities and relate them to the global ecosystems. Satellites orbiting the Earth can acquire an enormous amount of data over a range that would be impossible for any ground-based method alone. Satellite systems are now being used for navigation, rescuing people, weather forecasting, monitoring changes in the landscape, gathering information about deposits of raw materials, for geography, ecology, archaeology, military etc. The images are often provided free of charge through different map servers and special web sites focused on Remote sensing and Earth observation (European Space Agency (ESA) and National Aeronautics and Space Administration (NASA). Education is an important target of remote sensing, special programmes are being prepared for educators and for students. The world of satellite and aerial images has opened for education.

2. SATELLITE AND AERIAL IMAGES FOR SCIENCE AND GEOGRAPHY

Remote sensing as one of the most advanced technologies can be used in teaching of several subjects, and is suitable for integration of objects or environmental projects.

2.1 Satellite images and maps

Satellite images show the Earth as it really is, with all morphologic details. They present the same detailed information content independently of the scale used. The combined use of different satellite systems allows the recognition of surface details up to 0.3 m (f. e. the latest satellite World-View 3, high spatial and spectral resolution – 31 cm, on track from August, 2014) .The advantage of aerial and satellite images is an informational richness and timeliness. Images serve for the evaluation of the landscape physiognomy and its changes and also for cartography (creating and updating maps).

Images are not maps, see fig. 1. Map is an abstract model of reality. Topographical and thematic maps describe the contours of the landscape, and they show the spatial distribution of thematic features by means of colour, lines or symbols. The many and varied themes can be described in standard forms. The maps are brought up to date at longer or shorter interval. The information content is scale-dependent too.

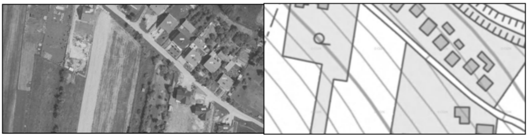

Figure 1: (a) aerial image; (b) map
Source http://geoportal.gov.cz.

Maps were developed for thousands of years, they are traditional materials in many school subjects too. But images could be a new educational tool.

2.2 Satellite images for science and geographical education

Satellite images can be used in teaching of geography, but Remote sensing offers some interesting suggestions for teaching chemistry, biology and physics too. The satellite image can document the status and the development of monitored data (ozone, pollution, chemicals, temperature of water and air, chemical composition and physical properties of materials, etc.). Interpretation of images supports reasoning and giving things into perspective. The advantage is that the curriculum "doesn't float" freely in the space, but also has its specific spatial location. The result of explanations of chemical processes of ozone is then referred to not only as "the equation" but primarily as a spatial representation of the ozone-layer. We have chosen a few examples as an inspiration for using images in teaching of science or geography.

- In *chemistry* we can explain the processes of production of nitrogen oxides. We can show results of measurement instruments (sensors on satellite) for recording density of the gas in the atmosphere at a satellite map and introduce areas of the world with increased production of NOx. Similarly we can present the development of the ozone layer, distribution of methane and formaldehyde in parts of the world or changes of UV index during the year.
- In *biology* we can use satellite images for presenting of the development of glaciation of the Earth, changes of the vegetation indices during the year, we can also show the area of occurrence of different species of animals and plants or the movement of animal or health status for forest management.
- In *physics: physical* educational topics can be the physical fundamental of Remote sensing (the electromagnetic spectrum, the physical properties of objects, satellite tracks, escape velocity).
- In *geography* pupils can describe places, learn to recognize and identify objects, recognize spatial relations, explain location of special phenomena shown on satellite maps (ozone, NO_2, formaldehyde, methane, etc.), compare multi-temporal satellite images, describe the development of the landscape and its transformation or animate the movement of clouds or drying of lakes.

3. VISUAL INTERPRETATION OF AERIAL AND SATELLITE IMAGES

Interpretation of aerial photographs and satellite images is a specific process of learning geographic reality based on the detection, identification and spatial localization of individual objects and terrain features. The interpretation of satellite images is one of the most important methods of obtaining information about the landscape and its changes over time. To interpret the image means to decipher its contents multifaceted in terms of purpose. The fundamental role of the interpretation of aerial and satellite images is systematic "reading" based on:

- correct recognition and classification of objects,

- determining their properties, quantitative and qualitative characteristics,
- accurate spatial (position) localization of detected objects,
- examination and assessment of the interaction and causation between the displayed objects and phenomena,
- analysis of these links and the detection of patterns that characterize the critical components and properties displayed area.

Spatial resolution affects the interpretation process and all its individual tasks. The closer is the spatial resolution to a size of the object the lesser is the chance to recognize or even to detect the object in an image. Although spatial resolution is a very important parameter, the interpretability of an image can be severly affected by other influences such as terrain illumination, sensor angle of look, object shadows or current state of the atmosphere (Kovarik, 2012; Talhofer, 2015). Research of visual interpretation of satellite and aerial images indicates that non experts and children are able to read images and recognize spatial relations. Kim et al. (2012) investigated whether young children possess the potential to understand aerial photographs and maps as representations of reality and also how scale affects children's performance, and whether children show interest in and enjoy working with spatial representations. Three remote sensing images of different scales were employed to examine children's ability to interpret spatial representation. The results indicate that young children have the ability to use spatial representation. Most participants were able to understand aerial photographs. Children from three years old begin to understand the aerial photographs as a representation of real spaces (Blaut, 1997), and their understanding continues to develop into adolescence (Liben & Downs, 1992; Downs & Liben, 1997). Liben & Downs (1989) and Liben & Yekel (1996) described preschooler's and children's understanding of maps and map symbols. Svatonova & Rybansky (2014a) present research of success of student visual interpretation, students were able to read false colour images as well as true colour images. Ortophotos were tested as a model for presenting reality for non-experts, participants were more successful in describing reality after reading ortophoto then after reading a map (Svatonova & Rybansky, 2014b). Adults' visual interpretation was also analyzed by R. Lloyd et al. (2002) and F.M.B. van Coillie et al. (2014). R. Lloyd et al. (2002) investigated how people process information from aerial photographs to categorize locations. Three cognitive experiments were conducted with human subjects viewing a series of aerial photographs and categorizing the land-use for target locations. Van Coillie et al. (2014) analyzed the accuracy of image digitization performed by adults with various degrees of experience regarding processing images and various degrees of motivation.

4. RESEARCH

The research of visual interpretation was focused on the ability of adolescent children to read images, the current status of the capabilities of reading, and the use of images in leisure time and in the classroom. Research respondents solved selected spatial (and identical) tasks in pairs of documents (image and map, true colour image and false colour image). 378 students (198 boys and 180 girls) in age 11, 15 and 19 years were tested during 2013. 11 and 15 aged participants were pupils of elementary school, 19 aged were university students in their first class.

4.1 Task research and participant

Aim of research was to evaluate:

- success of reading satellite and aerial images,
- difference in the success of reading satellite and aerial images between girls and boys,
- reading satellite and aerial images in free time,
- attractiveness of satellite and aerial images for students,
- subjective preference, difference between maps and images,
- usage of satellite and aerial images in current teaching.

4.2 Results

The following conclusions can be made based on the evaluation of tasks focused on the evaluation of success of reading aerial images and maps and bring the following results:

- 64%—80% of objects were successfully identified in the aerial images, 53%–70% of objects were successfully identified in the maps,
- respondent's age affects the success of reading images, the older the age of the students, the lower the difference between image and map processing efficiency. The highest difference was detected in the group of 11 years old students. In the 19 years old students' group, the efficiency of map reading was slightly higher (+4%),
- there is no significant difference in the success of reading images between girls and boys, see fig. 2. Both genders solved tasks with similar efficiency (difference within 5%). However, a detailed analysis of the map reading efficiency showed significant differences between genders – in the group of 11 years old students', girls achieved better results (difference 10%), but boys were more successful in the 15 and 19 years old students' groups (+12%; +16%),

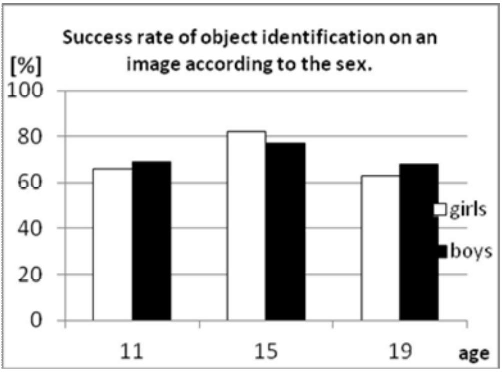

Figure 2: Success rate (%) of object identification on an image according to the sex

- 19 years old students prefer maps (67%), 11 years old students showed similar preference for both options (46% and 49%), over 20% of 15 years old participants preferred both materials similarly, i.e. one fifth of 15 years old participants did not prefer either of these options. Girls (11 and 15 years old) prefer images. For more details see fig.3.

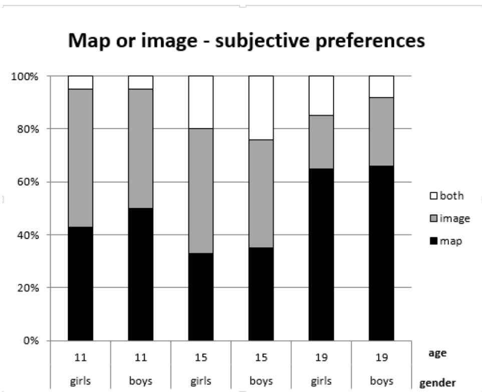

Figure 3: Success rate (%) of object identification on an image according to the sex

- the average score achieved in interpretation of images with different colours is not the same,
- differences in score were small, differences corresponding to the age groups of participants were maximally 5%. Slightly better scores were achieved with false colour images,
- the youngest respondents (11 years old) consider images to be very interesting (66 %) or moderately interesting (26 %). The number of positive answers falls with increasing age. The 19 year-old students were more reserved in assessing the interestingness of images, nevertheless 95 % of them stated "yes, very interesting" or "moderately interesting",
- although objectively the students achieved better scores with false-colour images, eventually the results were very similar to their results with true-colour images,
- images are used relatively rarely in the teaching.

5. DISCUSSION

The purpose of the research performed in 2013 with 378 participants, specifically 11, 15 and 19 years old students, was to compare differences in the efficiency of visual interpretation of maps, aerial images and satellite images in various colour presentations. It was found that 11 years old students achieve better scores with images than with maps, and that the scores are very similar for girls and boys. Nevertheless, boys achieved better scores with maps than girls. Differences in map skills related to gender were confirmed also by Chang, K & J.J R. Antes (1987). Personal preference for maps or images varied with age. Younger students preferred images, 19 years old students preferred maps. These results could be connected with gradual development of abstractive thinking and developing spatial thinking in adolescence. Children's ability to interpret aerial images was clearly confirmed also in study realized by Liben L. S. & C. A. Yekel (1996), Muir, M. & J. Blaut (1969). Thus, it would be suitable to integrate both document types (aerial images and maps) in educational activities.

6. CONCLUSION

Millions of people who want to address the major issues that concern the present and future of our world use spatial information gathered from space. Satellite data are used in basic research but it is a great opportunity to use them in educational process. Student are able to interpret satellite and aerial images. We can conclude that

- pupils are able to interpret aerial and satellite imagery successfully,
- younger pupils prefer to read aerial and satellite images before reading maps,
- there is no significant difference in the success of reading images between girls and boys,
- students interpret information from the false colour images successfully,
- students work with images in their own time and find this activity attractive,
- satellite images are used relatively rarely in the teaching.

Generally we can observe that children and adolescents without previous training are able to interpret aerial and satellite images very well. These result can encourage teachers to use images as another educational tool.

ACKNOWLEDGEMENT

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GEODIVERSITY VALUES AS A BASIS FOR GEOSITE AND GEOMORPHOSITE ASSESSMENT: A CASE STUDY FROM ŽĎÁRSKÉ VRCHY HIGHLAND

Aleš Bajer[1], Karel Kirchner[2] and Lucie Kubalíková[2]

[1] Institute of Geology and Pedology, Faculty of Forestry and Wood Technology, Mendel University, Zemědělská 3, Brno, Czech Republic, e-mail: bajer@mendelu.cz

[2] Institute of Geonics, Czech Academy of Sciences, Branch Brno, Drobného 28, Brno, Czech Republic, e-mails: kirchner@geonika.cz, LucieKubalikova@seznam.cz

ABSTRACT

Geodiversity is understood as a set of geological, geomorphological, pedological and hydrological components, including systems consisting of these components and geological, geomorphological and pedological processes. It bears various values which are analysed within the ecosystem services context (scientific, cultural, economic, functional values etc.). These values together with geotourism and geoeducation principles and definitions are used as a basis for a methodical approach to geosite and geomorphosite assessment for geotourism and geoeducational purposes.

Methodological approach is applied at selected sites (particularly rock formations) in the top part of the Žďárské vrchy Highland. The acquired results can serve as a basis for geoconservation of Protected Landscape Area (PLA) Žďárské vrchy, development of geotourism as well as an offer for extension of geoeducational activities.

Key words: *Geodiversity, geoeducation, geotourism, geosite and geomorphosite assessment, Žďárské vrchy Highland.*

1. INTRODUCTION

Geodiversity plays a key role both in environment and human activities. The complex relationships between geology, natural processes, landforms, landscape, soils and climate are fundamental to the distribution of habitats and species. It also provides many essential natural resources that society and economic growth depend on (Gray, 2013).

In the past as well as at the present, geological and geomorphological features and processes have always attracted people's attention. These features and processes have been exploited and used already in prehistoric time, e. g. Palaeolithic extraction and treatment of the hornblende in the region of Krumlov forest in Southern Moravia), the use of the suitable landforms as shelters (e. g. Býčí skála cave in Moravian Karst) or as the important communication paths (e. g. Moravian Gateway – the Amber road led through). Later, the castles and fortresses were built on the significant elevations for defence reasons (e. g. Loket castle in the Western Bohemia) or the natural processes as the watercourses were used for the transportation of the materials or as a source of energy.

Besides this exploitation of geological and geomorphological features and processes, people also tried to explain their origin. Usually, the explanations were linked to the supernatural forces and some of the explications were rather fantastic while others contained surprisingly accurate description of the features and processes. These explanations formed the basis for the myths related to the various sites (Mayor, 2004). For this area of interest, the term "geomythology" is used (Vitaliano, 1968).

Geodiversity do not serve only as a resource in a strict sense (materials, fuels), but it also acts as a resource for geotourism and recreational activities (hiking, climbing). It provides a testimony about the past nature processes and enable to observe the present processes; therefore, understanding geodiversity can serve as a basis for geoeducational activities and better acceptation of the conservation of abiotic nature.

2. BASIC TERMS AND DEFINITIONS

2.1 Geodiversity and geoconservation

Geodiversity concept first appeared in the early 1990's in Australia and it was defined as "the diversity of Earth features and systems" (Sharples, 1993). Later, the definition was extended (e. g. Sharples, 1995, Dixon, 1996, Australian Heritage Commission 1997 and 2002) and it included "the range or diversity of geological (bedrock), geomorphological (landform) and soil features, assemblages, systems and processes" (Australian Heritage Commission, 2002). Gray (2004) introduced a broader definition which was based on the analysis and discussion of different approaches: geodiversity is the natural range (diversity) of geological (rocks, minerals, fossils), geomorphological (land form, processes) and soil features, including their assemblages, relationships, properties, interpretations and systems; this approach was slightly redefined 9 years later (Gray, 2013) – the hydrological features were added. Ibáñez (1995) introduced the term "pedodiversity" to describe the diversity of soils and Panizza (2009) presented the term "geomorphodiversity" which refers to the diversity of landforms and processes. Both "diversities" are considered as a subset of geodiversity (Gray, 2014, oral communication).

The importance of geodiversity is represented by multiple values that are important for human activities (Gray, 2004, Gray, 2013). These values can be divided into several groups (intrinsic values, regulating and supporting values, cultural values, economic and functional values, educational values) and they will be discussed in the next chapter.

Thanks to its values and its importance for human society, geodiversity should be conserved and preserved. Maintaining an inventory of geodiversity and its assessment can serve geoconservation, geoeducation and geotourism purposes.

Geoconservation can be described as an activity of humans which is oriented to the conservation of geoheritage and which aims to preserve the natural diversity of significant geological (bedrock), geomorphological (landform) and soil features and processes, and to maintain natural rates and magnitudes of change in those features and processes (Sharples, 2002). Burek and Prosser eds. (2008) distinguish between the terms "conservation" and "preservation": while preservation can be taken as keeping something in the same state, stopping it from changing; the conservation is an activity or an intent of conserving and enhancing geological and geomorphological features, processes, sites and specimens which also involves working with the natural change to retain the feature of interest.

With regard to the needs of present day society, it is not possible to conserve all the geodiversity. Moreover, this concept is very wide and incomprehensible for public (Andrasanu, 2009). Cleal (2007) says that one of the ways how to protect and conserve geodiversity effectively is to protect and conserve its valuable part – geoheritage (geologic and geomorphologic heritage) that can be represented by significant geologic and geomorphologic sites.

2.2 Geotourism

According to Dowling (2011, 2013), the geotourism is defined as a form of nature tourism that specifically focuses on landscape and geology – these components are an important part of geodiversity (Gray, 2004). The geotourism promotes tourism to geosites and the conservation of geodiversity and an understanding of Earth sciences through appreciation and learning (Dowling and Newsome, eds., 2010).

First, the geotourism copied the concept of ecotourism (Butler, 2012) – its main aim was to protect the important sites and to prevent the degradation and disturbance of natural processes and issues. Later, the geotourism developed into a holistic concept that is rather people-oriented (Martini, 2012); nevertheless it still respects environmental aspects (respectively geological and geomorphological) and the need of their protection.

2.3 Geoeducation

Today, geoeducation is an integral part of all activities related to conservation and promotion of abiotic nature. Geoeducation can be viewed from three various concepts. The first one is presented by National Geographic according to which a well-rounded geo-education provides young people with a fundamental understanding of how the human and natural worlds work at local, regional, and global scales. The second concept is aimed at training of the next generation of geologist (field trips to most significant sites for students of geology and related scientific fields, these sites are being simultaneously used for primary geological research). The third concept includes geo-scientific education of wide public through field trips, workshops, walks, nature trails, etc. These activities aim at building relationship with given place and understanding of the need for abiotic nature conservation. Nowadays, it is a part of environmental education. Individual educational activities need to be drawn up regionally, and considering the age and previous knowledge of a target group (Bajer, 2015). A proven method is interpretation through the story and practical field demonstration. This methodology has become a part of strategic activities of all geoparks. Geoeducational potential should be involved in assessment of geomorphosites (Reynard, Coratza, Regolini-Bissig, 2009), or every other complex environmental assessment of the site.

3. GEODIVERSITY VALUES AND GEOTOURISM CONCEPTS AS A BASIS FOR THE GEOSITE AND GEOMORPHOSITE ASSESSMENT

Gray (2013) analyses the geodiversity values in an “abiotic system services” context. Here, the brief overview of the values with examples is presented.

1) Intrinsic value: is independent on the human’s evaluation and it refers to the ethical belief that some things are of value simply for what they are (Gray, 2013).

2) Regulating and supporting value: geodiversity plays an important role in the atmospheric processes or flood control, it influences habitats and communities, e.g. acid sandstone predetermine the growth of acidophile and psamophile plants.

3) Cultural value: includes a wide range of meanings – spiritual, historical, aesthetic, artistic etc. The spiritual value is connected to geomythology – an explanation of geological and geomorphological features using the supernatural forces and beings (Vitaliano, 2007). A lot of places of geological and geomorphological interest are connected to the myths, e.g. Říp hill in Central Bohemia, a basaltic knob with the Romanic rotunda of Saint George on the top, is traditionally linked to the legend about the arrival of the old Bohemians to the Czech lands. The genesis of the specific rock formations was often explained as the work of the devil which is reflected in the toponyms (e.g. Čertovy skály/Devil’s Rocks in Eastern Moravia). The archaeological and historical value of geodiversity is supported by the fact that fortification systems, castles or historical settlements were usually built on the elevated landforms for defence reasons (e.g. Trosky castle in northern Bohemia or Vranov castle in southern Moravia). The aesthetic and artistic value refers to visual (and non-visual) appeal provided by geodiversity including a psychological impact on human beings (Gray, 2004). The aesthetic value of geodiversity and landscape was especially appreciated by the romantic artists. The perception of geodiversity is also reflected in folk poetry and music. The cultural value of geodiversity is an important precondition for geotourist activities (Panizza, Piacente, 2008).

4) Economic and functional value: is represented by the use of mineral resources (fuels, metals, and construction materials), utilisation of landforms (e. g. platforms as a suitable place for airports) and utilisation of geodiversity, respectively geoheritage, for geotouristic activities (Pralong, 2005, Dowling, Newsome, 2010). In the Czech Republic, the extraction of precious metals (e.g. silver mines in Kutná Hora town) or construction material (e.g. limestone quarries in Bohemian Karst) has a long tradition. Landforms are also exploited for economic purposes; the typical example is the use of narrow, deeply incised valleys and gorges for dam construction (e.g. Vír dam near the study area). Also the passes and gaps in mountain areas are used as suitable sites where the railways and roads can pass more easily (e.g. Vlárský gap). As mountains, rock cities, significant outcrops and other landforms have always attracted the visitors, geodiversity and its valuable part, geoheritage, can be seen as a resource for tourism that supports regional and local economic development, especially in rural areas.

5) Research and educational value: is related to the understanding of the origin of life and landforms, evolution of the landscape and climate, paleogeographic reconstructions, the records of sediments in lakes or bogs allow tracing the human impact on the landscape, and it can help assessing the effects of current and potential future impacts (Gray, 2013). Geodiversity has a huge educational value, which is usually developed in geoparks.

Table 1 briefly presents some definitions and concepts illustrating the development of geotourism concept during the last twenty years; the shift from the geologically and geomorphologically oriented definitions towards the holistic concepts of geotourism can be observed.

Table 1: The development of approaches to geotourism

Hose (1995)	The provision of interpretive and service facilities to enable tourists to acquire knowledge and understanding of the geology and geomorphology of a site (including its contribution to the development of the Earth sciences) beyond the level of mere aesthetic appreciation.
Hose (2000)	The provision of interpretative facilities and services to promote the values and social benefit of geologic(al) and geomorphologic(al) sites and their materials, and to ensure their conservation for the use of students, tourists and casual recreationalists.
Slomka and Kicinska-Swiderska (2004)	An offshoot of cognitive tourism and/or adventure tourism based upon visits to geological objects (geosites) and recognition of geological processes integrated with aesthetic experiences gained by the contact with a geosite.
National Geographic (2005)	Tourism that sustains or enhances the geographical character of a place – its environment, culture, aesthetics, heritage, and the well-being of its residents.
Dowling and Newsome (2006)	Tourism relating specifically to geology and geomorphology and the natural resources of landscape, landforms, fossil beds, rocks and minerals, with an emphasis on appreciating the processes that are creating and created such features.
Dowling and Newsome (2010)	A form of nature tourism that specifically focuses on landscape and geology. It promotes tourism to the geosites and the conservation of geodiversity and an understanding of Earth sciences through appreciation and learning. This is achieved through independent visits to geological features, use of geo-trails and viewpoints, guided tours, geo-activities and patronage of geosite visitor centres. The geotourism should be geologically based, environmentally educative, sustainable and locally beneficial and it should ensure tourist satisfaction.
Hose (2012)	The provision of interpretative and service facilities for the geosites and geomorphosites and their encompassing topography, together with their associated in-situ and ex-situ artifacts, to constituency-build for their conservation by generating appreciation, learning and research by and for current and future generations.
Martini (2012)	Geotourism allow tourists to know the local geology but also to better understand that this geology is closely related with all the other assets of the territory, such as biodiversity, archaeological and cultural values, gastronomy, etc.
Dowling (2013)	Geotourism is sustainable tourism with a primary focus on experiencing the earth's geologic features in a way that fosters environmental and cultural understanding, appreciation and conservation, and is locally beneficial. Geotourism product protects, communicates and promotes geoheritage, helps build communities and works with a wide range of different people.

Source: Dowling, Newsome eds. (2010), Kubalíková (2013)

Both broader and more restricted definitions include some key features of geotourism. According to the National Geographic Society (2005), they are represented by integrity of place, international codes, market selectivity and diversity, tourist satisfaction, community involvement and benefit, protection and enhancement of destination appeal, land use and planning, conservation of resources, interactive interpretation and evaluation; according to (Dowling, Newsome eds., 2010): geologically based, environmentally educative, tourist satisfaction, sustainable, locally beneficial.

Above mentioned geodiversity values together with the basic aspects and key features of geotourism and geoeducation approaches and definitions can serve as a basis for assessment methods that can be used for geoconservation, geotourism and geoeducation purposes.

A suitable method for assessing the sites should consider these groups of criteria (Kubalíková, Kirchner, 2015, Kubalíková, 2013):

1) Criteria which consider an assessment of the scientific and intrinsic values
2) Criteria which consider an assessment of the exemplarity and pedagogical potential of the site
3) Criteria which consider an assessment of accessibility and visibility of the site and the presence of tourist infrastructure
4) Criteria which consider an assessment of the existing threats and risks, assessing conservation activities or existing legislative protection of the site
5) Criteria which consider an assessment of the added values (ecological, cultural, historic, archaeological, artistic, religious value of a site, aesthetic, landscape and scenic value).

Tab. 2 shows the method that was used for the geosite and geomorphosite assessment in the study area. Some criteria and their assessment are based on already existing methodologies which were widely used for the geomorphosites assessment in various areas (Reynard, Coratza, Regolini-Bissig, 2009). After the assessment of a site, a SWOT analysis of the area or of each site can be done to get the overview of the strengths, weaknesses, opportunities and threats of the sites and study area (Kubalíková, Kirchner, 2015).

Table 2: Proposed method for assessing the geosites and geomorphosites for the geotourism purposes (for every criterion, a value from 0 to 1 can be attributed)

1. scientific and intrinsic values	1.a Earth-science importance and rarity of the site (number of similar sites in the study area, local/regional/national/international significance of the site)
	1.b scientific knowledge of the site (existing scientific papers, monographies)
	1.c morphology, diversity of the site (diversity of landforms – both macro and micro scale)
2. educational values	2.a exemplarity and representativeness of the site (clarity and visibility of the features and processes, site‘s intelligibility to the public, possibility of explaining the corresponding processes)
	2.b presence of educational facilities (leaflets, web pages, information panels, guided tours, specialized excursions for students)
3. economical and functional values	3.a number, distance and quality of tourist services (existing tourist facilities – accommodation, restaurants, shops, information centres)
	3.b accessibility (by individual and public transport, possibility of parking)
	3.c current use of the site (recreation, climbing, important tourist point, a tourist path leading through)
4. conservation values	4.a conservation activities (legal protection, proposals for legal protection, other types of protection)
	4.b risks and threats to the site (both natural and anthropogenic)
	4.c current status of the site, the level of disturbance or degradation, existing management measures to avoid the damage of the site
5. added values	5.a cultural (historical/religious/archaeological) values – the legends, myths, historic events, archaeological aspects, poetry…
	5.b ecological value (relationships to living nature) – the occurrence of protected species, the relationships between the landform and ecosystem
	5.c aesthetic/landscape/scenic value – viewpoints

Source: Kubalíková, 2013, Kubalíková, Kirchner, 2015

4. STUDY AREA

This chapter is based on the research notes (Kirchner, Nováková, Roštínský, 2006, Kirchner, Nováková, 2007, Kirchner, Nováková, Kubalíková, 2009) and on Bajer, Hlaváč, Kirchner, Kubalíková (2014) where the detailed description of the area and significant rock formations is presented. The legends are taken from Zelená Křížová (2011).

4.1 General overview

Žďárské vrchy Highland is situated in the north-eastern part of the Bohemian-Moravian Highland and they form an upper part of it. The geomorphological evolution of this area has been very long and the traces of the pre-Cretaceous alignment, the remnants of Cretaceous sediments and the Tertiary planed surfaces are preserved there. In the Pleistocene the area was significantly modelled by cryogenic processes, the Middle Ages colonization caused an anthropogenic transformation of the landscape and landforms. The main morphostructural features of the relief were conditioned by the tectonic movements during the Carpathian orogeny.

The top parts of Žďárské vrchy Highland reachs the heights of 700-800 m a. s. l.; Devět Skal (Nine Rocks, 836 m a. s. l.) is the highest peak of the area and the second highest point of the Bohemian-Moravian Highland. Other important peaks are: Křovina 830 m, Kopeček 822 m, Malinská Rock 811 m, Žákova Mountain 810 m. The basement consists mainly of Hercynian crystalline rocks of the Bohemian Massif (metamorphic rocks of Svratka and Polička crystalline complex and yards surrounded the crystalline rocks).

Žďárské vrchy Highland has a character of a flat relief highland. From the morphostructural point of view, Žďárské vrchy Highland is an after-Cretaceous asymmetric horst limited by the parallel faults in the NW – SE direction. The orientation of the main wide flat ridges is influenced and conditioned by the fold tectonics and geomorphologically more resistant metamorphic rocks – migmatites and orthogneiss. These ridges are separated by valleys with flat shallow valley ends. Due to the dome-shaped character of the relief, water courses go radially, the radial drainage pattern probably evolved thank to the young tectonic domal uplifts. Due to the existence of transverse tectonic faults, the river network acquired also the rectangular character. The tectonic conditions and the effects of geomorphologic resistance of metamorphic rocks are reflected in the character of the Svratka valley and its tributary Fryšávka. The narrow fault gap sections alternate with river basins where the alluvial plains with naturally meandering watercourse are created, e. g. flood plain of the Svratka River in Milovy basin, flood plain of the Fryšávka River near the village of Kuklík.

The region is an important water divide and headwaters area. The principal European Elbe – Danube Water Divide runs on the watershed ridges. The landforms and other natural conditions, combined with a long-term cultivation of land gave rise to the varied landscape mosaic of forests, meadows, rocky pastures, ponds and small settlements that form a harmonious cultural landscape. Thanks to those qualities, Žďárské vrchy Highland becames the core of the PLA Žďárské vrchy, which was established in 1970.

A unique feature of Žďárské vrchy Highland is the occurrence of isolated groups of rocks or rock formations (Figure 1), which often have the character of towers that dominate the flat upland ridges and increase the diversity of the landscape. A significant number of these rock formations were declared as natural monuments (e. g. Natural Monuments: Devět skal, Milovské Perničky). These rock formations are limited by vertical walls and they often significantly protrude above the surrounding landscape; therefore they are locally called as pulpits. Traditionally, these rock formations are connected with various legends, which have been registered in folk literature. The highest altitude is reached by Drátenická rock (35 m), Čtyřpaličatá rock (30 to 31 m), Malínská rock (20 m). Usually the height of the rock formations oscillates around 15 m.

Figure 1: The occurrence of isolated groups of rocks is the unique feature of the relief of Žďárské vrchy Highland

Source: K. Kirchner (2009)

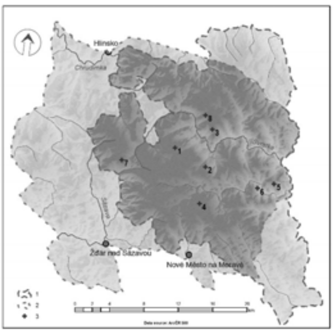
The geomorphological evolution of rock formations is complicated and it is related to the overall development of the wider area. The basic features of the relief were gained through after-Cretaceous period in consequences with the tectonic movements in relation to the folding of the Carpathians. The lifts and subsidences are linked to the transgression of the Cretaceous sea, which probably reached the majority of the area. The Paleogene planed surface in the upper parts of the area began to form and later, due to favourable climatic conditions it assumed the character of a peneplain, sometimes with a considerable cover of weathered material (see too Rypl, Kirchner, Dvořáčková, 2014).

During the subsequent tectonic domal uplift of a horst vault at the turn of Lower and Upper Tertiary, the gradual erosion of weathered mantle and denudation of Cretaceous sediments occurred. When the basal surface of weathering was denuded, the surface type etchplain originated. On the exposed basal surface of weathering some resistant rocks stand out as isolated rock formations and groups of tors. There is also a possibility that high isolated rock formations may have originally developed in the context of deep weathering processes such as inselbergs (Ivan, Kirchner 1999).

In the cold periods of the Quaternary the rock formations were transformed by frost weathering. The rock walls of the frost-riven cliffs and cryoplanation terraces with extensive debris accumulations, rocky and boulder fields and streams were formed. The surfaces of the walls of the rock formations are covered by minor forms of weathering (honeycombs, rock basins and niches, pseudolapies). The caves and tunnels were created along fissures in the rock massive thanks to the gravitational and mechanical weathering processes. Within the thick debris covers, some talus caves are situated.

4.2 Selected geosites and geomorphosites

Figure 2 presents the position of the selected sites within the study area.



Explanation:
1 – border of the geomorphological sub-unit Žďárské vrchy Highland, 2 – border of the PLA Žďárské vrchy, 3 – selected sites: 1 – Devět skal, 2 – Drátěničky, 3 – Milovské perničky, 4 – Pasecká skála, 5 – Prosička, 6 – Štarkov, 7 – Tisůvka, 8 – Zkamenělý zámek.
(Data source: ArcČR 500)

Figure 2: The selected sites within the study area

S1: Devět skal (Nine Rocks)

- the largest rock formation not only in the Žďárské vrchy Highland, but also in whole Bohemian-Moravian Highland
- it consists of many rock formations and together they form a small and unique rock city situated both in the top part of the ridge and on the steep upper part of the eastern slope
- the extensive destruction landforms are characteristic for this site, especially rugged ridges and isolated rocks (tors)
- presence of accumulation landforms (boulder stream) heading to the south
- mezoforms: passes, rock towers, nivation depressions (cirques), boulder piles and streams, extensive accumulations of debris, weathering microforms – rock niches, honeycombs, rock windows
- the site is used for climbing, it is easily accessible on foot

S2 Drátenická skála (Drátenická Rock)

- the main landform is a massive 200 m long rock wall of the north-south direction and a few isolated rock formations; the rock wall is divided into several blocks that are separated by the passes
- one of the highest peaks of the area
- rock towers dominate the surrounding landscape and the highest ones reaches the height of 35 m and 28 m
- interesting structurally conditioned landforms include a tunnel (width 1.5 m, height 1.5 m, length about 5-7 m) in the middle of the wall formed by the physical weathering
- at the bases of the rock walls, the debris/boulder piles are situated, then they continue as boulder streams which join into the boulder sea on the slopes, within the boulder sea, the caverns are situated
- other important mezoforms are shelters type abri and rock windows, rarely the rock walls are covered by honeycombs
- climbing, hiking

S3 Milovské Perničky

- elongated rock ridge divided into several blocks with a height up to 28 m, accompanied by the boulder/debris piles which merge into larger boulder covers
- mezoforms and microforms: small rock towers, passes, mushroom rock, shelters type abri, a large number of weathering pits (Figure 3) up to 30 cm wide, some of them with a discharge channel
- in the past they were believed to serve as a sacrificial recipients for the Slavonic gods, a lot of legends and explanations of the origin of this form is presented (although the origin is clearly natural)

Figure 3: Weathering pits at site n. 3 – Milovské Perničky
Source: P. Roštínský (2006)

S4 Pasecká skála (Pasecká Rock)

- three large rock blocks divided by the deep passes, boulder accumulations (a consequence of rock fall)
- the largest rock block is divided into several elongated blocks that evoke the shape of loaf of bread (the name of this rock formation is "Loaf") – this is a good example of the weathering along the fissures
- mezoforms: rock towers, passes, tectonic mirror, boulder and debris piles, cryoplanation terrace, microforms are represented by small honeycombs
- existence of a legend about the treasure hidden under the rock
- the site is well accessible and used by hikers and climbers

S5 Prosička

- two large rock formations followed by three large boulder streams which joins into the extensive boulder sea (100 x 100 m)
- the rock formations are strongly fissured with the exemplary demonstration of the exfoliation
- mezoforms: debris accumulations, debris caves, small subsidences caused by suffosion, small weathering pits on the upper parts of rock formations, abri
- a wooden cross on the top, existing legends

S6 Štarkov

- consists of 18 significant rock formations which have a character of the towers and which are arranged into the horseshoe formation
- morphologically important rock towers (e.g. Velký a Malý zbrojnoš, Velká věž) reaches up to 21 m
- mezoforms: large boulder stream heading towards the Fryšávka valley, fissure caves, exfoliation, small passes, abri
- on the rock walls, there is an evidence of selective weathering (niches)
- the remnants of the castle: it used the suitable morphology and some rock forms were incorporated into the construction
- numerous archaeological findings, important site from the historic point of view (a typical castle from the Middle Ages that was then abandoned and sometimes used as a basis for local bandits)

Figure 4: The remnants of the castle walls which used the suitable morphology
Source: L. Kubalíková (2009)

S7 Tisůvka (Tisůvka Rock)

- rock rampart rises up from the top part of a flat ridge, the walls (with a length of 60 m) reach the height of 15 m, the rock formations have the character of structurally conditioned frost-riven cliffs
- at the base of the rock walls, some massive shelters type abri were created and the massive boulder and debris accumulations were formed (up to 3 m high), followed by a large cryoplanation terrace which is covered with weathered boulders
- important and unique weathering microforms: rock ledges, rock windows and the unique occurrence of honeycombs (diameter 3-16 cm, depth up to 5 cm)
- it has always been considered a magic place, sometimes it is called Devil's stone, the legend about the origin of the rock says that the Tisůvka Rock is the material for the church that was taken away by the devil, because builders did not pray the God.
- the remnants of forest railway that was used for the transport of the death and damaged wood (a consequence of the large windfall in 1930)

S8 Zkamenělý zámek (Rock Castle)

- the site is composed of six distinct rock formations arranged in a horseshoe arch, open to the northwest, the rock formations are separated by transversal fissures in the direction northeast-southwest
- the highest and dominant rock formation of the site is called the Zámecká tower (22 m high), Pivovar rock formation reaches 15 m, other rock formations do not overpass the height of 10 m
- mezoforms: exfoliation along foliation surfaces, fissure cave, debris/boulder piles which then transforms into a boulder stream, shelter/overhang with a depth of 5.5 m
- small weathering forms – honeycombs, abri, at the top part of the Pivovar formation, there are two destroyed weather pits
- the remains of a Slavic settlement from the VI.–VII. century represent the first traces of human activity in the top part of the Žďárské vrchy Highland (remains of walls and the deep trenches), some of the natural rock formations have been incorporated into the fortification; in the Middle Ages the site could also serve as a watch fort

5. ASSESSMENT AND RESULTS

The above mentioned sites were evaluated using the method proposed above. It was supposed that the sites more suitable for geotourism purposes have to be both geologically or geomorphologically important and attractive from different point of view (historical, cultural, ecological etc.). The results are presented in the Table 3.

Table 3 The results of numerical assessment of the selected sites

Name of the site/ group of the values	S1	S2	S3	S4	S5	S6	S7	S8
1. scientific values	3	1,75	3	1,5	1,75	1,75	2,25	2
2. educational values	2	1,5	2	1,5	1,75	1,5	2	1,75
3. economical values	2	2,5	1,5	3	2	1,5	1	3
4. conservation values	1,5	1,5	2,25	1,75	3	2,25	2,5	2
5. added values	1,75	1,75	2,5	2,25	1,75	2,25	2,5	2,25
Total score	**10,25**	**9**	**11,25**	**10**	**10,25**	**9,25**	**10,25**	**11**

Source: authors

The highest scientific value was obtained by the sites n. 1 and 3 (Devět skal and Milovské Perničky), especially thanks to uniqueness and presence of specific mezo- and microforms. Also the site n. 7 (Tisůvka) was assessed relatively high because of the extensive occurrence of honeycombs.

The highest educational values were also reached by three above mentioned sites because of clarity and representativeness of the main landforms (Devět skal) and mezoforms (Milovské Perničky and Tisůvka). These forms are well visible and identifiable even by the laic public (not only by the scientists), so they have a considerable potential for geoeducational use. The parameter 2.b "presence of educational facilities (leaflets, web pages, information panels, guided tours, specialized excursions for students)" turned out to be unadvisable for this area (respectively selected sites), because for all the sites, the information is accessible both on web and in the printed materials.

The highest economic value was reached by the sites n. 4 (Pasecká skála) and n. 8 (Zkamenělý zámek), as they are situated close to the settlements where the tourist infrastructure is present and they lie several hundred meters of the parking place. However, other sites are also well accessible, as the marked tourist path lead through and the stops of public transport are nearby. All the sites (except S6 – Prosička) are used by climbers which also increase the economical and functional value.

The conservation value included both legal protection and possible threats to the site and the current status of the site. The parameter 4.a "legal protection" was not appropriately chosen as all the selected sites are protected in the category "natural monument". However, the difference was observed when analysing the existing and potential threats and risks and when assessing the current status (or integrity) of the sites. The highest score was reached by the site n. 5 (Prosička), especially thanks to the fact, that the rock form is not used for climbing and the accessibility is not so good. In opposite, the low conservation value and the presence of disturbances acquired the site n. 1 and 2 (Devět skal and Drátenická skála) especially due to the intensive use of the rock forms by climbers, the disturbing and insensible behaviour of some visitors (litter, wild fires, graffiti on the rocks) and the fact that these sites are visited frequently.

The added values were related to the presence of cultural aspects (the historical and archaeological features were assessed as well as the existence of the myths and legends that are related to the site). Also the ecological value was included, although including it into the group of "added value" is disputable and maybe it should be comprised into the group of scientific values (however, the scientific value for the geotourism and geoeducational purposes should be rather oriented towards abiotic components of the sites); this is the subject of consecutive discussion. The highest value was obtained by the site n. 7 (Tisůvka) and n. 3 (Milovské Perničky) thanks to the existence of the legends connected to the forms and a high ecological value; in the case of S3 there exist a number of mythological explanation of the significant mezoforms (weathering pits). Relatively high added value was gained by the sites n. 6 and 8 (Štarkov, Zkamenělý zámek) thanks to the presence of the remnants of settlements and site n. 4 (Pasecká skála) thanks to the existence of legends and a valuable panoramic view which increased its aesthetic value. There were other sites with a valuable and instructive panoramic view, but other values that were incorporated into the "added values" group, were not so high.

The highest total score was reached by the sites n. 3 and 8 (Milovské Perničky and Zkamenělý zámek). These sites are not important only from the scientific point of view, but also they have the significant educational potential (thanks to the presence of significant mezoforms – S3) and important added values (the remnants of the Slavonic settlement and existing legends). On these examples can be seen that the sites suitable for the geotourism and geoeducation should be not only geologically and geomorphologically valuable, but they should include also some added values to be chosen as the possible sites for development of the above mentioned activities.

Generally it can be said that all selected sites can be used for geotourist and geoeducational activities, although some of them are more appropriate than others. Based on this assessment, some geotouristic and geoeducational activities can be proposed in collaboration with the Administration of Protected Landscape Area Žďárské Vrchy.

6. CONCLUSION

Based on the geodiversity values, on the analysis of the geotourism and geoeducation concepts and definitions and on the already existing geomorphosite assessment methods, the modified method for the geosite and geomorphosite assessment for the geotourism and geoeducational purposes was proposed. Some of the criteria turned out to be inappropriate for the study area (e.g. existence of legal protection or existence of the educational facilities) as all the sites acquired the same value. Other criteria are a subject to the discussion with regard to their incorporation within the assessment scheme.

The method was firstly tested in Vizovická vrchovina Highland (Kubalíková and Kirchner, 2015) and it presented relatively good results. Here, in other study area, the results are more debatable thanks to the above mentioned facts.

However, the assessment proved the high potential of selected sites to be used for geotourist and geoeducational purposes. These activities are important both for conservation and economic reasons. Geoeducation can lead to better understanding of the importance of conserving geological and geomorphological heritage and geotourism can also have beneficial influence on the local and regional economic development, attracting visitors to the area.

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LANDSCAPE STRUCTURE CHANGES OF THE BEŠA DRY POLDER AND THEIR ASSESSMENT BY USING OF SPATIAL METRICS (VÝCHODOSLOVENSKÁ LOWLAND, SLOVAKIA)

Martin Boltižiar[1,2] and Matej Mojses[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, e-mail: mboltiziar@ukf.sk

[2] Institute of Landscape Ecology, Slovak Academy of Sciences Bratislava, branch Nitra, Akademická 2, P. O. BOX 22, 949 01 Nitra, e-mails: [2] matej.mojses@savba.sk, [1,2] martin.boltižiar@savba.sk

ABSTRACT

Anthropogenic impacts imposed in study area of the dry polder Beša from 18th century have considerably state of the landscape. We can observe rapid landscape structure changes by progress of an urbanization and agriculture in the researched area. The aim of the paper is the mapping and analysis of the landscape structure changes in years 1770, 1827, 1949, 1988, 2003, 2008 in GIS. By comparing groups of the landscape elements in individual horizons were significantly different. Significant changes were observed in the group of Forest and non-forest areas and Grassland areas permanent group whose share fluctuates significantly. Drainage interventions after 1827 caused the decline in the aquatic ecosystems to about 10% of their original size. Representation of the other landscape elements reflects the natural evolution of society – the expansion of built areas and road networks. Mapping results of the analyzed we used for subsequent country assessment method landscape ecological index that describe the dynamics and quantifying landscape structure. The results showed that, overall, the number of patches, decreasing their average size, has increased patch density as well as the total length of the circuit patches, mainly as a result of vegetation succession after 1989.

Keywords: *landscape metrics, land cover changes, polder Beša, GIS, Slovakia*

1. INTRODUCTION

Landscape ecology deals with the biological, physical and societal causes and consequences of spatial variation in landscapes. New spatial tools such s geographic information systems (GIS) and remote sensing have given geographers and ecologists unprecedented capacity to quantify land cover pattern and understand spatial heterogeneity and landscape structure (Turner, Carpenter 1998).

Land cover and its interrelation to the natural landscape basis is the salient point for the integration of the material and physiognomic attributes of landscape. Its spatial differentiation is close to the structure denoted by Forman, Godron (1986) as landscape elements or ecosystems. Land cover types in regional scale are at the same time close to the basic categories of the land use. Visual attributes of urban and agricultural landscape correspond with their basic functions and indicate the spatial organization of cultural landscape. Analysis of functions is however, indispensable mainly in the categories of forest and semi-natural landscape emphasizing the hierarchy of ecologically significant areas.

Landscape pattern is a mixture of natural and human-managed patches that vary in size, shape and arrangement and is the result of complex interactions of physical, biological and social forces (Forman, Godron 1986, Krümmel et al. 1987, Turner 1990, Lačný, 2012a, b, Hanzes et al. 2013, Oláhová, Vojtek, 2014, Michaeli, et al. 2015, Solár, 2012, Solár, et al. 2014., Šolcová, 2012., Druga, Falťan, 2014, Falťan, et al. 2011, Tarasovičová, et al. 2013).

The pattern emerging from these analyses is that overall landscape texture and patch shape and size are recurring underlying structural components landscape pattern. Li, Reynolds (1995) indicate these five attributes that theoretically describe landscape structure: a) number of cover types, b) proportion of each type, c) spatial arrangement of patches, d) patch shape, e) contrast between patches.

Landscape is a concrete space which developed as a result of various effects and processes of natural or anthropogenic character while these processes and effects had different impact and duration of exposure. Human activities changed natural environment, which got new features a new environment quality originated. According to specific properties, we distinguish three landscape structures: primary landscape structure, secondary landscape structure (historical and current landscape structure) and socio-economic landscape structure.

The aim of our research was to evaluate the trends in the spatial structure of patches in the model area since the second half 20th century. Analysis was made only on that land use layers which were interpreted on the basis of aerial photographs (1949, 1988, 2003, 2008) since the older interpretation of the obtained layers of historical maps lack detail and detail of map elements. Military maps, compared to aerial photographs, have purposely compiled legend, they capture only selected elements of the landscape, are much generalized and not very detailed. Aerial photographs, however, capture the landscape with all its details and their interpretation was uniform.

In the analysis of landscape structure and its changes, we can also focus on the evaluation of the indicators of spatial structure of patches by Forman, Godron (1986), Forman (1995), McGarigal (2002), McGarigal, Marks (1995), Balej (2011), Ivanová (2013), Ivanová, et al. (2012), Vojteková (2013). Patches (polygons) can be characterized using various indicators or indices which are currently an explicit part of some GIS software tools. Unlike the summary changes of some elements of landscape structure (e.g. a change in the proportion of forest, grassland, arable, etc.), the changes in the number of landscape elements in different categories, their average size, distribution, continuity, mosaics etc. are being observed – these characteristics have a significant impact on the functioning of landscape processes (Lipský, Kalinová 2001, Szabó, Csorba 2009).

2. STUDY AREA

Study area belongs administratively to the Košice Region, Trebišov district and almost all of the area is located in the cadastral territory of the village Beša. The boundaries of the studied area are identical to the polder dike, only the northern part was set out by the cadastral boundary. Area has 1756 ha, the flooded area of the polder is 1568 ha. Polder Beša is a dry reservoir belonging to the second largest in the Central Europe with volume 53 mil. m^3 and was built at the turn of the 50th and 60th years in the frame comprehensive treatment of water regime of the Východoslovenská Lowland. The purpose is to reduce the flood wave of the rivers Laborec and Latorica. On the basis of a bilateral agreement between the Slovak Republic and Hungary, the level of the river Bodrog must be kept to a maximum of 936 cm. When this level is exceeded, it leads to filling of the dry reservoir. It has already been filled during the flood situation on the Laborec River eight times, mostly in the spring months in the years 1974, 1979, 1980, 1990, 2000, 2006, 2010 and 2011. In terms of geomorphologic division (Mazúr, Lukniš 1980), it belongs to the Východoslovenská Lowland, subprovince Great Danube Basin, province Východopanónska Basin and subset Panonian Basin. Part of the territory falls to the Ramsar site of Latorica which is a part of the PLA (protected landscape area) of Latorica. In the retention area, there is locates of NATURA 2000 Bešiansky polder (2.65 ha) with habitats and species that are protected. In the dry polder area, there is a dense network of canals, wetlands and flooded material pits creating unique conditions for aquatic and marsh vegetation with a significant number of rare species.

3. METHODS

The production of maps of the landscape structure from the six selected time horizons (1770, 1827, 1949, 1988, 2003 and 2008) was conducted in the geographic information systems (GIS). From the software products, we used the desktop ArcGIS 10.2 with extensions in which we conducted most of the following operations:

- Making selective interpretative key, purpose-built mapping legend, working and output scale of maps,
- Georeferencing – geometric correction of “raw” historical maps and aerial photographs into a single cartographic projection of coordinate system S-JTSK,
- Identification of individual elements of secondary landscape structure based on the interpretation of historical maps from the 1st and 2nd military mapping (1770, 1827) and aerial

color images (1949, 1988, 2003, 2008) which were arranged into a sub-groups and groups (Fig. 1),

- digitalization of spatial data by the method “on screen” (directly on the computer screen) with visual analogue interpretation – creating separate vector layers,
- Verification of the identified elements of the secondary structure of the landscape from the year 2008 in the study area by the means of the field survey,
- Creating the flexible table database that stores all the relevant attribute information on the elements of the secondary landscape structure necessary for other statistical operations,
- Multitemporal analysis of the groups of the secondary landscape elements during 1770–2008,
- Cartographic representation of information layers in an analogue form of output – thematic maps of the secondary landscape structure.

In the study area in terms Ružička (2000), we identified 49 types of landscape elements which we classified into 31 sub-groups and 8 groups:

1. Group of elements of forest and non-forest wood vegetation
2. Group of elements of permanent grassland
3. Group of elements of agricultural crops
4. Group of subsoil elements and the substrate
5. Group of elements and surface water flows
6. Group of residential elements and recreational areas
7. Group of technical elements
8. Group of transport elements

4. LANDSCAPE PATTERN METRICS

Trends of development of the spatial structure of patches was evaluated according to selected indicators by Forman, Godron (1986), Forman (1995) and using specialized statistical program Patch Analyst 2.2 (McGarigal, Marks 1995). Analysis was made on the vectors GIS layers of the time horizons while we examined following landscape metrics: number of patches (NP), mean patch size (MPS), median patch size (MEDPS), patch size standard deviation (PSSD), total edge (TE), edge density (ED), mean patch edge (MPE), mean shape index (MSI), mean patch fractal dimension (MPFD), area weighted mean patch fractal dimension (AWMPFD), patch density (PD). Most of the characteristics were observed both in the whole area and within the individual groups of landscape elements. Their detailed characteristics are the content of the works of the before mentioned authors.

5. RESULTS

In the process of multitemporal analysis of the visual and the subsequent statistical analysis of thematic maps and field survey of the secondary landscape structure of study area during 1770-2008 (, tables 1, 2, Fig. 1-4) we came to a finding that the area was affected by a number of quite significant space-time changes which at the level of groups of landscape elements are analyzed briefly in the following parts of the paper.

Group of elements of forest and non-forest woody vegetation, in terms of area of individual groups of landscape elements, the largest share was reached in the year 1770. The wet floodplain forest covered almost 90 % of the whole territory, except the village itself and its closer area which was agriculturally used mainly to the east of the urban area. In contrast, in 1827 the territory was covered with almost no forest, there were only small woods in southeastern part of the area. The area suffered significant deforestation for the purpose of acquiring land for pastures, meadows and arable land. Since 1949 the areas of forest have only increasing trend. Smaller woods in the mid-20th century were located in the western part of the current polder and also in the form of small woods in southern part and in the Moľva area (sand dune) in the SE part of the territory. Since the end of the century to the present, the share of this group of landscape structure increased from 31 to 43 % due to succession processes. Forests are represented, regarding the composition, mainly by oak-hornbeam forests, near rivers are riparian willow-poplar forests. Large area in the southwestern part of the reservoir is currently covered by commercial forests with areas compartment and belt breaks.

Non-forest woody vegetation outside the urban area is represented by the natural residual stands which for various reasons have not been degraded by agricultural activity.

A group element of permanent grassland in terms of size was the largest group in the period 1827-1949. It occupied an area of almost 1300 ha which is over 70 % of the whole area. The smallest share was in 1770 when almost whole area was wooded and in the study area was not agriculturally used so much. Since 1988, the elements of this group have almost constant share, which is around 45 %, almost half of the area. Currently, their share decreased slightly to 34 %. This group is represented mainly by meadow vegetation towards S, SW, and W from the village of Beša in the polder retention reservoir itself, but mainly by unused grasslands that since 1949, but especially since 2003 are largely overgrown by plants or seeding that are characterized by scattered groups of shrubs and scrub communities, as well as solitaire, mostly willows. These occasionally flooded meadows serve as pasture. Line herbaceous vegetation covers with its crops also the dike of the polder itself.

Group of elements of agricultural crops has except the year 1770, when its proportion was the lowest, relatively equal representation across all horizons and oscillates between the values of 15-20 %. Arable land has, until the collectivization period in the 60s of the 20th century, the character of small-scale fields, later large-block fields. The arable land was always located to the north of the urban area of the community, outside the wet areas and the polder retention reservoir. It is now represented by homogeneous areas of arable land represented by large-block fields. From the other landscape elements, we can find in a lesser extent the small-scale fields, especially near the village. Along with the vineyards and orchards they produce mosaics of patches especially in the SE part of the area. Some of them are already abandoned. This group of elements currently occupies 284,3 hectares which is 17 % of the area.

Group of subsoil elements and the substrate are mostly only small-scale sites of natural or artificial origin, in our case mainly a sand dune – Moľva, located in the eastern part of the area. South to the village, there is a small sandpit which mined sometimes even today. Together, this group has an area of 3,5 hectares which is 0,2 % of the whole area.

Group of elements of water reached the highest area in the year 1827 (4 %). As in the past, it is now also represented by a network of periodic lakes and network of dead branches as well as other smaller streams and channels, but to a lesser extent than in the 19th century.

Group of residential elements and recreational areas is in the study area the village of Beša with characteristic rural buildings, represented mainly by family houses and gardens. The urban area have had since 1770 expansionary trend and for almost 170 years tripled its size. Later there were built mainly administrative buildings, sports grounds, cemeteries and other civic amenities along with the residential vegetation. At present, these elements occupy 2 % of the area.

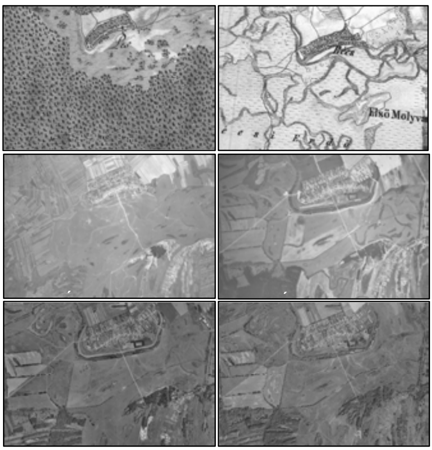

Figure 1: Parts of the used historical maps from the 1st and 2nd military mapping from 1770 and 1827, panchromatic aerial photographs dating from 1949 and 1988, color aerial orthophotos from 2003 and 2008

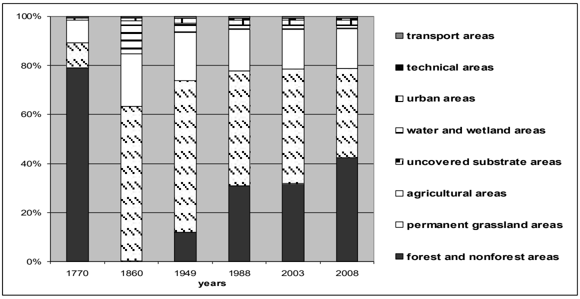

Figure 2: The share of size of groups of individual elements of the secondary landscape structure of study area in %

Table 1: Area of individual groups of landscape elements in ha

Reclassified groups of landscape elements	1770	1860	1949	1988	2003	2008
Forest and no forest areas	1387,1	3,4	211,1	544,0	559,2	743,6
Permanent grassland areas	180,1	1107,0	1086,8	823,2	820,5	641,3
Agricultural areas	161,3	379,9	343,6	299,0	286,2	284,3
Uncovered substrate areas	-	-	5,5	3,5	3,5	3,5
Water and wetland areas	-	236,5	62,3	26,6	25,9	22,6
Urban areas	17,9	20,2	32,8	35,3	35,3	35,3
Technical areas	-	-	0,1	10,1	10,5	10,5
Transport areas	9,7	9,1	14,0	14,3	15,0	15,0

Table 2: Number of patches of individual groups of landscape elements

Reclassified groups of landscape elements	1770	1860	1949	1988	2003	2008
Forest and no forest areas	32	8	53	216	277	313
Permanent grassland areas	7	117	93	187	219	190
Agricultural areas	13	32	29	27	36	34
Uncovered substrate areas	-	1	3	13	13	13
Water and wetland areas	-	56	59	75	75	74
Urban areas	4	16	53	79	79	79
Technical areas	-	-	2	9	9	9
Transport areas	2	5	23	17	16	16
Sum	58	235	315	627	725	727

Group of technical elements in the area evidenced especially from the mid-20th century and it includes agricultural buildings (farms and farmyards), areas of water management as well as other construction and technical objects in the countryside. It also includes smaller landfills located within the boundaries of the village and also outside it, and also field dunghills. Together the elements of this group occupy 2 % of the area.

Group of transport elements was in the past represented mainly by loose network of mostly unpaved field roads. At present, its density is much higher and it is represented by roads – important main roads, roads in residential zone, and paved and unpaved communications. In 2008 they occupied an area of 15 ha which represents 1 % of the study area.

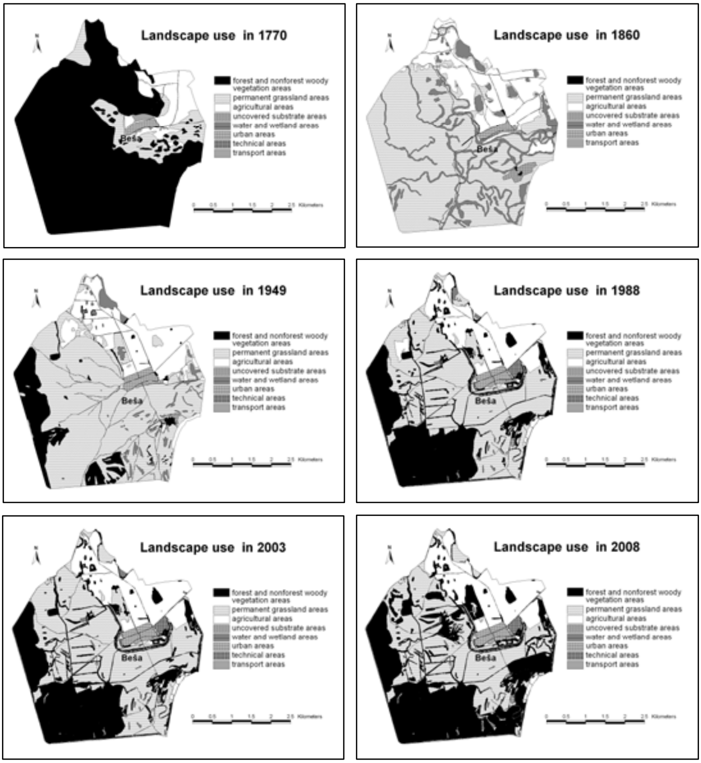

Figure 3: Landscape structure area of Beša polder in selected times horizons (1770–2008)

5.1 Changes of landscape metrics

In 1949 in the area of the Beša polder, the number of patches reached 315 (Table 4) and by 2008 rose to a value of 727 which is a 100 % increase. This phenomenon was mainly due to increase in number or emergence of new areas of forest and non-forest wood vegetation, influence of its succession in recent decades as well as planting trees of economic forest in the southern part of the territory. This phenomenon is also evident in the visual comparison of aerial photographs. Overall, the area of mean patch size was reduced (Table 7) by almost half. Tables 3 with the changes in mean patch size for each group allows the detailed study of the trend of this feature. Reducing the mean patch size was recorded with all areas with the exception of technical elements and elements of transport which increased their size in the younger time horizons). Overall, however, it is conditioned by the emergence of new small succession patches of forest and non-forest vegetation and subsequent gradual reduction or fragmentation of the original vast area of permanent grassland from the year 1949 which is given the stability of landscape structure a positive phenomenon. More representative value has the median patch size. This landscape metrics is generally slightly decreasing in the area (Table 4). Conversely, within the majority of each group of elements (Table 3), we can notice its increase.

Table 3: Landscape metrics of different period at groups of landscape elements

Years	Groups of landscape elements	NP	MPS	MEDPS	PSSD	TE	ED	MPE	MSI
1949	1	53	39822,9	4758,3	108314	44366,9	0,003	837,1	2,1
	2	93	116858	12520,7	333468	170607	0,01	1834,5	2
	3	29	118478	42721,9	153027	49314,6	0,003	1700,5	1,7
	4	3	18486,8	10492,5	12510,7	2505,2	0,001	835,1	1,7
	5	59	10552,7	4319,4	25203	31873,4	0,002	540,2	1,7
	6	53	6179,9	563,3	18899,3	19033,8	0,001	359,1	1,5
	7	2	315,7	171,6	144,1	171,6	0,001	85,8	1,4
	8	23	6098,6	2263,4	9907,7	87964,9	0,005	3824,6	10,6
1988	1	215	25288,3	4940,4	104831	188223	0,011	875,5	2,5
	2	193	42671,5	8830,4	91208,2	263878	0,015	1367,2	2,3
	3	28	106796	13457,8	183882	40683,7	0,002	1453	1,6
	4	13	2663,8	438,4	6447,7	3294	0,001	253,4	1,6
	5	74	3595	2362,1	4265,6	47457,6	0,003	641,3	3,3
	6	79	4473,7	768,7	11953,1	22653,1	0,001	286,7	1,5
	7	9	11228,3	188,7	30762,8	2347,9	0,001	260,9	1,6
	8	16	8919,5	1899,2	15827,9	86093,4	0,005	5380,8	11,5
2003	1	276	20259,2	6410,9	71307,8	253435	0,014	918,2	2,4
	2	223	36795,9	7702,4	87771,3	288355	0,016	1293,1	2,3
	3	36	79493,8	18458	123896	45869,8	0,003	1274,2	1,6
	4	13	2663,8	438,4	6447,7	3294	0,001	253,4	1,6
	5	74	3506,3	2397,4	3727,1	47317,8	0,003	639,4	3,4
	6	79	4473,7	768,7	11953,1	22653,1	0,001	286,7	1,5
	7	9	11626,6	198,4	30640,2	2561,6	0,001	284,6	1,6
	8	15	9983,9	2291,6	17019,8	90752,6	0,005	6050,2	12,4
2008	1	313	23757,8	7071,4	72947,6	312357	0,018	997,9	2,4
	2	191	33578	6268,9	80581,3	233785	0,013	1224	2,3
	3	34	83603,6	20390,7	126286	44845,1	0,003	1319	1,6
	4	13	2663,8	438,4	6447,7	3294	0,001	253,4	1,6
	5	73	3098,1	2397,4	2537,7	45936,4	0,003	629,3	3,4
	6	79	4473,7	768,7	11953,1	22653,1	0,001	286,7	1,5
	7	9	11626,6	198,4	30640,2	2561,6	0,001	284,6	1,6
	8	15	9983,9	2291,6	17019,8	90752,6	0,005	6050,2	12,4

Note: 1 – Forest and non-forest areas, 2 – Permanent grassland areas, 3 – Agricultural areas, 4 – Uncovered substrate areas, 5 – Water and wetland areas, 6 – Urban areas, 7 – Technical areas, 8 – Transport areas

Table 4: Landscape structure changes indices for Beša polder (1949 -2008)

	NP	MPS	MEDPS	PSSD	TE	ED	MPE	MSI	PD
1949	315	55748,3	5424,1	199159,2	405837,5	0,023	1288,4	2,4	0,17
1988	627	28007,5	4195,6	91611,5	654630,3	0,037	1044,1	2,6	0,35
2003	725	24221,7	4694,5	73552,7	754239,3	0,043	1040,3	2,5	0,41
2008	727	24155,1	4759,8	71182,9	756183,9	0,044	1040,1	2,5	0,41

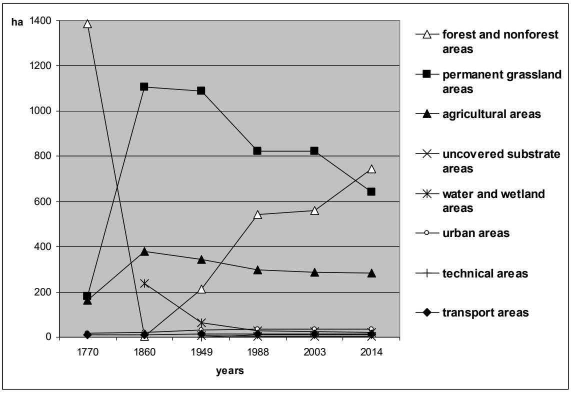

Figure 4: Landscape structure changes (in ha) of area of Beša polder in selected times horizons (1770–2008)

The most significant is in the group of forest and non-forest woody vegetation at the expense of median patch size decrease of the group of permanent grassland. Calculated values of the index of standard deviation of patch size document the fact that there is an overall tendency of equalization of patch size in the study area. The same situation is also in various types of patches groups. The cause can be seen in the above mentioned succession as the number of new patches is increasing. The patches have a tendency to compensate their size, the number of different-sized patches is decreasing. When analyzing the perimeter of patches in the area, we notice a very slow trend of its slight increase which is mainly due to an overall increase of new patches. In each group, the situation is different. When assessing the edge density of patches which represents the proportion of perimeter of patches to their size, we have come to a finding that its value throughout the whole area hardly changed. Differences, however, are evident when analyzing patches of individual classes. The edge density of patches in the group of forest and non-forest vegetation per unit area (ha) increased very significantly due to its gradual expansion to different directions while the edges of areas gradually become more complex. Similar development of edge density of patches is also evident for other groups of elements. In the study area for the last 20 years, the mean length of stabilized. The cause can be seen in a significant increase in the number of new small patches (forest and non-forest woody vegetation) and the disappearance of larger patches from the area (permanent grassland). Index of mean patch shape, which is characterized by complexity or regularity of their shapes, shows that all the patches in the area have a very irregular shape while for the last 60 years this shape is maintained or is not changing. The same situation is in patches within individual groups of landscape elements. Since the area did not recorded new "foreign" types of patches with geometrically completely different shapes which would significantly undermine the finality, the same trend can be expected in the next years. The last landscape metrics that we evaluated was the mosaics (density) of patches. It refers to the horizontal division of the landscape and it is therefore very important structural characteristics. In the study area, the mosaics increased mainly due to vegetation succession, thus creating several new areas (patches) and also several large patches broke into smaller ones. We can say that in the past 60 years, the total fragmentation of the landscape increased.

6. DISCUSSION

Landscape pattern is constantly influenced by many factors and events that reflect the natural conditions and the degree of human impact. Spatial structure of the landscape (shape, distribution) provides specific characteristics by which we can characterize that part of the landscape. If we want to assess the structure of the landscape using the pattern as indicator, we must choose the relevant parameters of pattern.

The driving force of landscape changes are disturbance processes of more or less extent. Slight distortion causes the creation of several smaller patches and corridors which ultimately increase the heterogeneity of the landscape. Result of disturbances of significant size may be the dissolution of several landscape patterns and corridors and ultimately the absolute transformation of the landscape matrix.

The term structure refers to “the spatial distribution of energy, material and species in relation to the sizes, shapes, numbers, kinds and configuration of the ecosystems” (Forman, Godron 1986). Landscape pattern respective structure is a complex product of many underlying processes. And in return structure defines a spatial framework for process manifestation and puts certain constraints on them. Landscape pattern and landscape process have a mutual impact (Bartel 2000).

It is necessary for good understanding of the ecological consequences of changes in landscape pattern to describe the pattern with suitable indices. All indices not are suitable (Hulshoff 1995). Sometimes the indices do not give enough information on changes in the geographical position of the patches and several indices have to be considered in combination with other indices to get meaningful information.

Knowing the development of land use changes is necessary for the purposes of planning of nature and landscape conservation to identify areas of their conflicts with economic use. Human factors (economic, social and political) have played the main role in the continuing development of the landscape structure (Black et al. 1998, Nikodemus et al. 2005, Špulerová 2008, Muchová, Petrovič 2010). Area of the dry polder Beša is a landscape space consisting of different ecosystems (forests, natural meadows and grassland, aquatic ecosystems, and agro-ecosystems). These ecosystems are characterized by high degree of biodiversity. Ecological stability of the landscape is hampered by human activity including artificial flooding of the polder at the time of extreme floods in the region of Východoslovenská Lowland. Other factors that negatively affect the ecological stability of the area are on one side intensive agricultural production (Michaeli, Hofierka, Ivanová 2010). On the other side, it is abandonment of agricultural land after 1989 which is reflected in landscape structure changes. We recorded a gradual overgrowing of meadows and grassland by succession tree species. These trends are typical especially for the former socialist countries of the Central and Eastern Europe. Significant changes in landscape structure over the past 60 years, as a result of intensification of agriculture, can be seen also in other European countries. Many pastures and small fields, with many small biotopes of both linear and point elements have been aggregated into large fields without small biotopes (Ihse 1995, Palang, Mander, Luud 1998, Oroszi, Kiss 2006, Gerard et al. 2010).

Analysis of the development of landscape structure can obtain statistical data about land cover which provide information about landscape macrostructure, but do not provide the correct idea about the current territorial composition of landscape elements. The intensity of anthropogenic pressure on the landscape mosaics has a significant impact on the landscape stability and biotic communities (Lipský 1995, Miller, Brooks, Croonquist 1997, Zagyvai 2008). We can conclude that landscape structure, expressed in land use and land cover, spatial arrangement, shape, size, quality and connectivity of patches, lines and small interactive elements, plays the main role in landscape dynamics.

Landscape changes accordingly in a somewhat chaotic way, while at certain times man tries to steer and redirect the evolution by planned actions. Studying and monitoring all the interfering changes that occur in the landscape is impossible. Also the changes of one component seldom reflect the overall change of the landscape (Antrop 1998). The main task of the polder is to catch the floodwater in flood emergency situations while the magnitude and frequency can not be estimated. Development of landscape structure and land use is somewhat limited by the given facts. For such specific areas is therefore necessary to develop the management actions.

7. CONCLUSION

Satellite imagery and GIS provided the information base, environment and analytical tools to visualize and quantify landscape structural changes simply and quickly (Apan, Raine, Paterson 2002). Mapping the landscape structure is a suitable tool to obtain detailed analytical perspective to a specific territory with an emphasis on maintaining the stability of ecologically sensitive area, sustainable development and land use. The obtained data on changes of landscape structure can serve as a basis for land-planning documentation within the landscape-ecological planning. They are also the basis for the evaluation of another landscape features (e.g. biotic significance territory, landscape heterogeneity).

Landscape ecological indices also showed that they are an appropriate tool for assessing the trend of development of patch properties and prediction of their further development. Overall, the number of patches increased, their mean size decreases, mosaics of landscape increases as well as the total length of the patch perimeter which is mainly the result of vegetation succession. Other structural parameters of patches have not significantly changed over the last 60 years.

Based on the before mentioned facts as well as gained results, we do not understand the research of landscape changes of Beša polder only in the context of the analysis of its condition and structure (statistical-spatial analysis), but also as the study of its development evaluated through the properties of patches of individual groups of elements and their spatial distribution in different time horizons.

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SEVERITIES OF WILDLIFE ATTACKS ON HUMANS IN THE VICINITY OF CHITWAN NATIONAL PARK, NEPAL

Thakur Silwal[1,2], Jaromír Kolejka[1] and Ram P Sharma[3]

[1] Masaryk University, Faculty of Geography, Porici 7, 603 00, Brno, Czech Republic, e-mails: thakur.silwal@gmail.com, kolejka@ped.muni.cz

[2] Tribhuvan University, Institute of Forestry, PO Box 43, Pokhara, Nepal

[3] Czech University of Life Sciences Prague, Faculty of Forestry and Wood Sciences, Kamýcká 129, 16521, Praha 6 – Suchdol, Czech Republic

ABSTRACT

Most of the studies on wildlife attacks on humans made so far have disproportionately focused on species-specific fatal cases, but more explorations are needed to understand the severities of attacks and flow of conservation benefits to the victims. In the vicinity of the protected areas, people may lose their lives, health and assets from attacks by wild animals like rhino (Rhinoceros unicornis), tiger (Panthera tigris), sloth bear (Melursus ursinus), elephant (Elephas maximus) and wild boar (Sus scrofa). This paper focuses on assessing extent of injuries caused by wildlife attacks in the vicinity of Chitwan National Park (CNP), Nepal. The assessment covers a period between 2003 and 2013. We used data acquired from various sources (group discussion (n = 33), interview with key stakeholders (n = 36), field observations, and household questionnaire survey (n = 329) among victims, and their relatives or eye witnesses). This study showed wildlife attacks were significantly correlated to environment of incident site, months and time, social activities, victim's gender, age class and awareness on behaviour of attacking animals. On an average, 30 wildlife attacks on humans occurred in the vicinity of CNP annually. The severity of attacks occurred significantly relationship among attacking species (p < 0.000). The study showed that fatal cases occurred on nine people or 1-people in-3, and 21 people or 2-people in-3 suffered with minor to severe injuries due to physically charged by attacking animals annually. Attacking mega animals like elephant (68%) caused much more vulnerable to lethal attacks on humans followed by tiger (57%), rhino (29%), bear (4%) and wild boar (4%). Significantly high number of fatal cases (84%) occurred on the incident sites, 12% cases at the hospital, and 4% cases on the way to the hospital. People reported that some of them (6-persons) lost their life due to delay in rescue and even lack of first aid treatments. The injured persons were found facing substantially hardship livelihood conditions physically, mentally, and economically at their household levels. Patterns of wildlife attacks appeared significantly uneven across the seasons and months (p < 0.001).This study also showed that uneducated people, fisherman, and forest resource collectors suffered more or received more fatal cases than other people. This study suggests concerned authorities to educate local people /or make them aware on the behaviour of wild animals. The concerned authorities also need to lunch medical trauma centre and support local medical centres for carrying out immediate treatments of the victims at local level.

Key words: Attack prone areas, Awareness on animals' behaviour; Buffer zone; Fatal rates of wildlife attacks; Victims' livelihoods

1. INTRODUCTION

Wildlife attacks on humans are common worldwide in the vicinity of protected areas (Hoare 2000; Dunham et al. 2009; Inskip and Zimmerman 2009; Bajimaya 2012; Carter 2013; Pant et al. 2015). However, the severities of the attack vary with different levels from lacerations and broken bones to serious life-changing injuries and fatalities caused by attacking animals. A concern about severities of attacks (WWF 2015) that may be minor or serious or fatal injuries need to be explored and properly documented for proper mitigation options and flow of conservation benefits to the victims and their dependents. The victims who are physically incapable or handicapped, are frequently turn into family burden due to lack of resources for treatment and care. The injured victims' households are getting harsh and harsh by time in terms of socio-economic conditions mainly. When proper identification and adequate up-to-date documentations of the severities of the attacks are made, mitigation plans of human-wildlife conflicts that involve both preventive and remedial measures in the vicinity of protected areas can be formulated.

In developing countries like Nepal, human population is rapidly increasing including in the vicinities of the protected areas. There is a high dependency of the majority of people living around the protected area on the forests for their subsistence livelihood (Sharma 1991; Shivakoti et al. 1999; DNPWC 2012; Budhathoki 2012). In recent years, deforestation rate of the corridor forests adjacent to the lowland protected areas is alarmingly increasing, but pressure of people relying on the decreased forest resources for their consumption needs also has increased in developing countries. In Nepal's lowland forests, mainly Chitwan National Park (CNP) and its surrounding habitats support country's largest populations of most conflicting animals (WWF 2015), particularly rhino (*Rhinoceros unicornis)*, tiger (*Panthera tigris),* sloth bear *(Melursus ursinus*), elephant (*Elephas maximus*), wild boar (*Sus scrofa*) and so on whose population are on a rise in the recent year (CNP/NTNC-BCC 2015). These animals frequently attack people in and around the CNP (DNPWC 2012a; CNP 2012; Silwal et al. 2013a; CNP 2014; GON; 2015; Pant et al. 2015; CNP/NTNC-BCC 2015). In recent years, BZ community forests have been becoming the extended habitats and attraction for wild animals outside the park (Budhathoki 2003; Budhathoki 2004; Gurung et al. 2008) and dispersal corridors for tigers (Sharma et al. 2011), rhinos, elephant and other animals (CNP/NTNC-BCC 2015; Pant et al. 2015; Koirala et al. 2015) have increased human casualties in the buffer zone (BZ).

Obviously wildlife attacks may never be eliminated, but could be brought to a limit which victims would be ready to accept. The top most priority is remedial actions and instant delivery of relief/ or compensation to the loss caused by wildlife attacks. In Nepal, with the provision of investing 30-50% parks' revenue to address conflicting issues in the BZ (GON 1973; GON 1996; DNPWC 1999; DNPWC 2012). However, the huge amount of money has been allocated for community development works (such as roads, bridge and schools) rather than investing more on reducing conflicting issues (Silwal et al. 2013b) and supports to the victims' household levels. If the local people are under threats by wildlife and lack of genuine supports to the injured victims, the endangered species are also in danger from retaliation (Silwal 2003; Pant et al. 2015). In this situation, only the option is to minimize damages from both sides and maximize human wildlife co-existence though supports where the individual households suffer more and bear the brunt of cost of conservation in nominal benefits. Considering this, government of Nepal initiated to provide relief/ or compensation schemes to the individual victims' households based on examinations made by concerned authorities (GON 2015). The amount of relief to the victims varies from $100 to $5000 depending on the extent of severities.

Even though there have been a number of studies conducted on human-wildlife conflicts and others connected to wildlife in the CNP (Sharma 1991; Gurung et al. 2008; Carter 2013; Pant et al. 2015; Koirala et al. 2015), they have not dealt with severities and victims' livelihood conditions in the vicinity of CNP or their reporting on the recent human-wildlife conflict dynamics is still inadequate. Also the studies made so far have not looked into the extent of severities and the factors affecting severities due to wildlife attacks. This study, therefore, aims at identifying factors of severities caused by attacks of various wild animals in and around CNP. The incidents of respective victims were analyzed for a period between 2003 and 2013 in order to (i) document severities of attack (minor, serious and fatal injuries) by affecting factors; (ii) examine extent of injury of the serious victims; and (iii) suggest severity prevention and mitigation options which could also be useful to improve human-wildlife co-existence in the vicinity of CNP.

2. MATERIALS AND METHODS

2.1 Study area

The study was carried out in vicinity of CNP in Nepal (Fig. 1). The CNP is extended with an area of 932 sq km over parts of Siwalik range and floodplains (DNPWC 2012a). This park connects varieties of wildlife habitats of Valmiki Tiger Reserve of India to the south to *Mahabharata* foothills to the north through *Brandabhar* biological corridor which is the only remaining north-south corridor to provide opportunities to travel safely for getting experience of lowland and upland ecosystems. The CNP harbors most endangered animals like rhino, tiger, elephant and rich varieties of birds and reptiles.

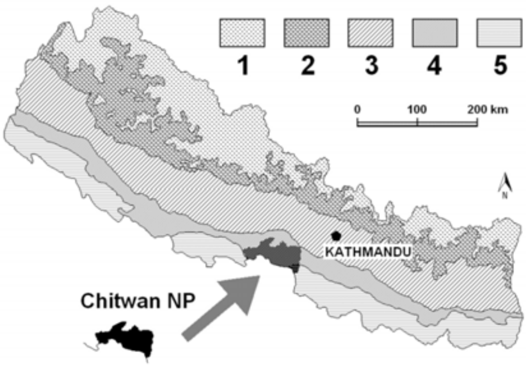

Figure 1: Location of CNP and BZ with coverage of physiographic zones
Legend: 1. high Himalaya, 2. high mountain, 3. mid-mountain, 4. siwalik, 5. terai

Buffer zone of the CNP extends over an area of 750 sq km consisting of 45% forests and 55% agricultural lands of vicinity to the park (GON 1996; DNPWC 2012). The buffer zone is delineated to fulfill the requirements of forest products to the local communities and intended to reduce pressure of the park to the local communities and vice-versa (GON 1996). There are 0.25 million people living with more than 0.15 million livestock adjacent to CNP depends highly on forest resources (DNPWC 2012; CNP 2014). Access to the forests for animal grazing, lopping of tree branches for fodder, collecting fire-wood, leaf-litters and other non-timber forest products are basic components of daily livelihoods of the local communities (Sharma 1991; Shivakoti et al. 1999; DNPWC 2012). A large part of BZ forests has been handed over to the communities as community forests (CFs). Due to well management, the CFs became extended habitats outside the park and dispersal corridors for wildlife and also increases human casualties (Budhathoki 2003; Budhathoki 2004; Gurung et al. 2008; Sharma et al. 2011; CNP/NTNC-BCC 2015). The CNP has been facing highest conflicts including human casualties among all the protected areas of Nepal annually (Silwal et al. 2013a; DNPWC 2010).

With declaration of the BZ, Nepalese government lunched community based approach to reduce wildlife damages including human casualties with participatory approaches (GON 1973; GON 1996; DNPWC 1999; DNPWC 2012). Local communities have been mobilized to implement the programs with overall responsibility for planning, resource distribution and implementation processes to reduce conflicts through Buffer Zone Management Committee (BZMC: legally elected local people’s entity) (GON 1996; DNPWC 1999; DNPWC 2012).

2.2 Data

This study adopted both qualitative and quantitative methods to collect information about injured and fatal cases of wildlife attacks on humans. The severities caused from wildlife attacks were mainly grouped in three categories based on nature of injury e.g. minor (An injury is minor or lacerations, if victims get recovered after treatment without any losses or damages of the body parts), servus (An injury is serious or broken bones to serious life-changing injuries, if victims requiring hospitalization, has to take medicine for long time and lost functional life or body part(s) and death (GON 2015). The method of data collection involves preliminary field visits, organized meetings of concerned people, key stakeholder interview and questionnaire survey, and various secondary sources (published and unpublished reports). The study covers a period between 2003 and 2013.

Preliminary field visit We carried out preliminary field visits and organized meeting with local stakeholders (park managers and communities) to share our study objectives and gathered basic information related to both injured and fatal cases of the wildlife attacks. We preferred making preliminary visit as it builds up good rapports with locals, and people can get opportunity to share their life events easily. We consulted CNP, BZMC, and BZUC office bearers and obtained name lists of victims, their home address and status, and other information about wildlife attacks. Because, the buffer zone office is responsible to maintain the records and victims have been applying for relief/or compensation at the CNP office through respective buffer zone committee from the local level. The amount of relief/or compensation to the victims provided is determined by CNP authority after on-the-spot examination of injuries or death and do not differentiate among specified specific species (GON 2009; GON 2013; GON 2015). We had an opportunity to incorporate feedbacks from all local stakeholders and further improved our methods of getting information.

Group discussion We carried out group discussion meeting (n = 33) with local communities were organized at the most wildlife affected settlements before household survey. The participants were BZUC office bearers of respective areas, wildlife victims, community leaders and local communities to explore community attitude and priorities. Discussion issues were trend of wildlife damages including human casualties, consequences of attacks on victims' livelihood and household level, potential options for rescue and immediate medical treatments to the victims, and process of relief/ or compensation schemes. The size of the group ranged from 13 to 20 individuals and time of discussion was 1:00-3:00 hours. The discussion helped to enable to cross examination of data from different stakeholders and useful to interpret the results.

Key stakeholder interview We conducted informal interviews with key stakeholders to conform the evidence. For this study, the park officials (warden, rangers), BZMC/ BZUC office bearers, conservation partners were considered to get their opinion on rescue and immediate medical treatments, victims' livelihoods, existing policies and practices for providing supports to the victims' households level. All together 36 persons (6 park officials, 16 BZUC chairpersons, 9 BZUC office secretaries, 2 representatives of conservation partners, 2 Village Development Committee (VDC) – A small territorial political boundary which consists of 9 wards at the local level, ex-chairpersons and 1 former park officer) were interviewed using separate semi-structured questionnaires for 1:00 to 2:00 hours.

Questionnaire survey We prepared questionnaires in Nepalese native language based on anecdotal information concerning wildlife attacks on human, pre-tested and finalized it after some feedbacks received from our preliminary surveys. We conducted door-to-door questionnaire survey with injured persons (n = 116) for cases of injuries and close relatives or eyewitnesses (n = 213) of the attacks after getting respondent's verbal consent to participate for interview, and none of the listed respondents declined to be ready for interview. If the injured person was not present and incapable, other senior members of the family or close relatives or eyewitness neighbors were requested for interview. Some of them are physically incapable or handicapped and therefore even unable to get standing from the bed. We documented each respondent's consent as "yes" on the questionnaire after an assurance of the confidence of his/her privacy information received. Information about the attacks included victim's name, gender, age, education, occupation, attacking animal, incident site, types of injuries, death place (if fatal case), activity at the time of attack, rescue and immediate medical treatment, daily livelihood conditions. After questionnaire survey was over, we conducted field observations and examined the incident sites thoroughly with the help of victim (minor injured) or victim's representative.

Based on information from various sources (field observations, discussions with park officials and local stakeholders, literatures), we mainly focused on the following factors for severities of wildlife attacks on humans:

- Incident environment sites – village, farmland, community forest, park forest and others (waterhole, trail, grazing/marginal land).
- Distance of incident sites from the park boundary – ranges from 0-1 km, 1-2 km, 2-3 km and more than 3 km.
- Date and time: year, month and season. The season in CNP was categorized as winter (December to February), spring (March to May), summer (June to August), and autumn (September to November) (e.g. Sharma 1991). General time of day (i.e. day and night); time period was categorized in to five i.e. morning (06:00-09:00), late morning (09:00-12:00), afternoon (12:00-15:00), evening (15:00-18:00) and night (18:00-06:00) (e.g. Gurung et al. 2008; Dhanwatey et al. 2013). However, the day light and night time was taken into consideration by seasonal time differences because of morning and night time varies from winter to summer months. During the summer months 5:00 am is very bright and 19:00 is still daylight, and while in winter it is the other way round. Hence, the victims were asked for day and night time before to categorize respective time interval.

- Victims' gender (male and female) and age (general age class grouping: minor (below 9 years old), teen (10-17 years), adult (18-59 years), senior (above 60 years) (e.g. Mayer 2013).
- Education status: (i) never been to school or illiterate, (ii) been to school (up to 5 years), (ii) been to school (6 to 10 years) and (iv) been to school or college (above 10 years or higher education).
- Occupation: (i) agriculture, (ii) salary holder (government or non-government), (iii) student and others (fishing, firewood selling, daily wage labor); social association: (i) alone and (ii) with friend(s).
- Activities at the time of attacks were categorized into (i) cattle herding, (ii) walking, (iii) NTFPs (non-timber forest products) collection (iv) farm work (crop guarding, working) at cropland, (v) fishing, (vi) sleeping/ house work, and (vii) others (using toilet, forest watcher) (e.g. Dhanwatey et al. 2013; Nielsena et al. 2013).

The data and information obtained from various methods were further verified by presenting the preliminary results of this study to the park authorities and buffer zone representatives.

2.3 Analysis

We performed both qualitative and quantitative techniques for data analyses using simple descriptive statistics in *Excel* and SPSS v. 22.0. Using a null hypothesis of equal distribution frequency among seasons (and months), we generated the number of attacks expected in each season (and month) by dividing the total number of attacks by the number of seasons (and months), and observed and expected number of attacks and consequences were compared by the chi-squared test (Montgomery et al. 2001). Finally, we used the OL models based on factors influencing and/or being correlated to severity of attacks as discussed above.

3. RESULTS AND DISCUSSION

3.1 Severities of attack, animal types and locations

We recorded (n = 329) all different levels of injury from lacerations and broken bones to serious life-changing injuries and fatalities caused by respective wildlife attacks on humans in and around CNP between 2003 and 2013. There were 16-48 attacks reported per year (on average 30). Our results showed the probability of 30% or about 1-in-3 chance of occurring fatal rates and 2-in-3 (n = 21) suffered from minor to severe injuries due to physically charged by respective wildlife species annually (Fig.2a). The significant number of fatal attacks (84%) occurred on the spot of incidents, 12% at hospital and 4% on the way to hospital (Fig. 2b). However, people reported that some of the victims lost their life (6 persons) due to delay in rescue and even lack of first aid treatments. Some of the victims in southern sector (Madi) could not get treatment up to 12 hours due to lack of proper medical facilities and remoteness.

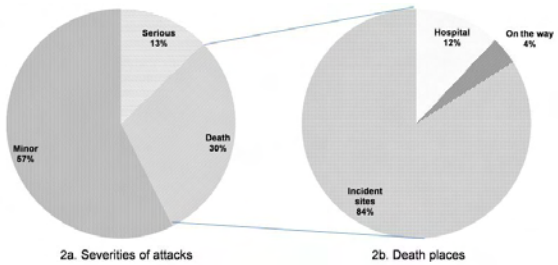

Figure 2: Severities of wildlife attacks (n = 329) and death cases (n = 98) in and around CNP between 2003 and 2013

Several studies (e.g. Tiger: (Gurung et al. 2008; Carter 2013) and Elephant: (Pant et al. 2015) have recorded injury and death cases caused from wildlife attacks on humans around the CNP. Often, these studies focused on single species. However, nine species were found to have attacked people:

rhino, tiger, sloth bear, elephant, wild boar, leopard (*Panthera pardus*), gaur bison (*Bos gaurus*), sambar deer (*Rusa unicolor*) and marsh crocodile *(Crocodylus palustris*). The severity of attacks occurred significantly relationship among attacking species ($\chi2 = 93.4$, df = 12, $p < 0.000$). Of the total fatal cases, about 40% caused by tiger, 38% by rhino, 20% by elephant, 2% by sloth bear and 1% by wild boar. However, the severity rates within respective attacking species occurred differently. The highest fatal rates occurred from elephant (68%) and followed by tiger (57%), rhino (29%) and equally of bear and wild boar (each at 4%). Attacks from rest of the animals occurred only minor to serious injuries. Similarly, among the severity cases, rhino occurred highest cases (41%) and followed by bear (29%) and tiger and elephant (of each 12%) (Fig. 3). This result did not corroborate with other studies. The fatal cases caused by elephant was lower than the attacks in central Nepal (Pant et al. 2015) but the fatal cases caused by tiger was higher than in Tadoba-Tiger Reserve in India (Dhanawatey et al. 2013). However, Mayer (2013) reported about three-folds higher fatalities (15%) caused by wild boar with our result of fatalities caused by wild boar (4%). So, we can conclude that the attacking charged by mega species was more vulnerable or harder effect to the victims than smaller species.

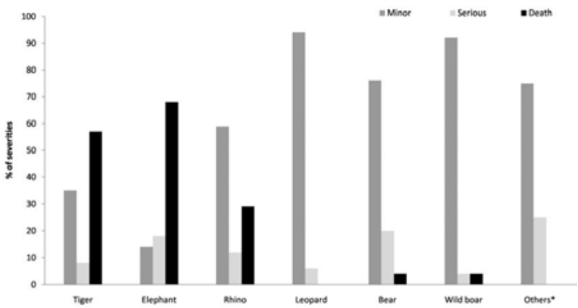

Figure 3: Severities of attacks from respective wildlife species

Mostly attacks (86%) occurred within 1 km of park boundary. However, the rate of fatal cases was highest (41%) at away from 3 km and followed by 1-2 km, within 1 km and 1 case at the 2-3 km from the park boundary (Fig. 4). The result indicated that wide ranging behaviour of mega species like rhino, elephant and tiger occurred beyond 3 km from the park. However, it was inverse relationship between distance from the park boundary and frequencies of wildlife attacks (Gurung et al. 2008; Dhanawatey et al. 2013; Pant et al. 2015).

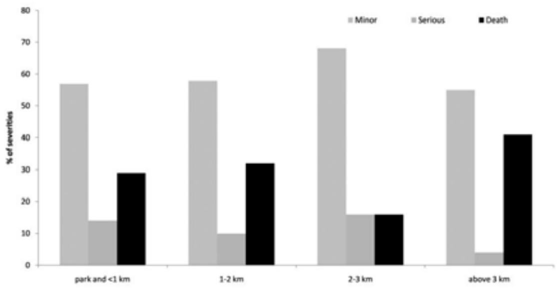

Figure 4: Severities of attacks at the incident places and distance from park boundary

Similarly, fatal rate of attacks among the site environments occurred highest in community forests (39%) and followed by park-forest, village, farmland and others (Fig. 5). Because, CFs are became extended habitats to wildlife and alternative forests to the local people to supply their basic needs (Budhathoki 2003; Gurung et al. 2008) which increased probabilities of attacks due to common place for resource use. In the BZ, the highest number, about 2 fatal cases every year, occurred in Ayodhyapuri and followed by Gardi, Megauli, Dibyanagar, Gitanagar and Rajhar VDCs.

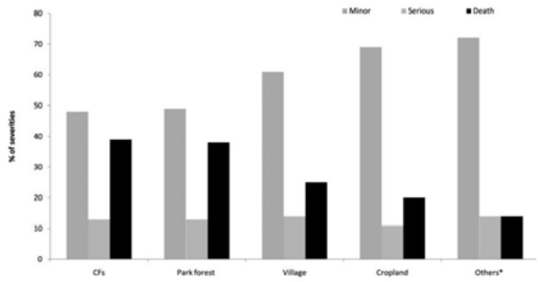

Figure 5: Severities of attacks by environments of incident sites

3.2 Temporal patterns of severities

Attacks occurred throughout the year and 24-hour a day but the rate of severities varied monthly (Fig.6). The relationship among the attacking wildlife species and monthly severities varied significantly ($\chi2$ =98.546, df=66, p<.006). Most of the attacks (91%) in November caused by three-mega species like tiger (37%), rhino (27%) and elephant (27%). The highest rates of fatal cases (55%) occurred in November and followed by August (46%), June (38%) and September (36%). This result coincide with elephant occurred highest attacks during November in central Nepal while elephants come to the human settlements to forage paddy matured season (Pant et al. 2015). More than one-third of total fatal cases (34%) were in summer season. About 2-people in-5 (38%) of the fatal attacks were in evening and followed by night (34%) and late morning.

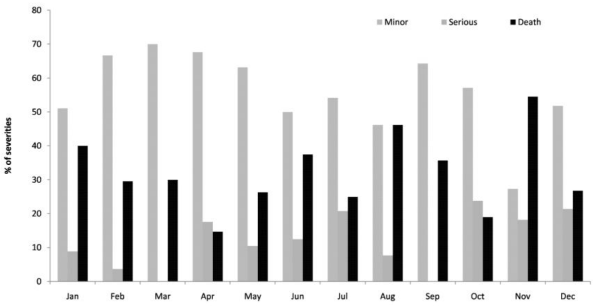

Figure 6: Severities of attacks across monthly patterns

3.3 Socio-demographic characteristics of severity

Severity rates had significantly uneven patterns across gender ($\chi2$ = 8.94, df = 2, p < 0.01), education level ($\chi2$ = 29.8, df = 6, p < 0.00; Table 1). More fatal rates in male (32%) but the serious rates were higher in female (22%). About 40% fatal rate and 20% serious injuries were uneducated people. As per the social association (friends or alone), the fatal rates were higher while victims alone (33%) than victims with friend (28%). Mostly at the age of juvenile and senior victims were more suffered from attacks. Highest numbers of serious injury (19%) and death (33%) cases were of senior people i.e.

above 60 years old age group. Likewise, the adult age group was occurred 9% serious injury and 30% fetal cases. The teenagers were 20% death and rests of others were minor injured (Table 1).

Table 1: Severities of attacks by socio-demographic characteristics of the victims

Factors	Minor		Serious		Death		Total	
Gender	No.	%	No.	%	No.	%	No.	%
Male	144	58	24	10	79	32	247	100
Female	45	55	18	22	19	23	82	100
Education level								
Never been to school	78	48	20	12	66	40	164	100
Been to school up to 5 years	48	60	18	22	14	18	80	100
Been to school 6 to 10 years	53	74	4	5	15	21	72	100
Been to school (>10 years /or university)	10	77	0	0	3	23	13	100
Age categories								
Minor (below 9 years)	1	50	0	0	1	50	2	100
Teen (10-17 years)	20	80	0	0	6	20	26	100
Adult (18-59 years)	147	58	32	12	76	30	255	100
Senior (above 60 years)	21	46	10	22	15	32	46	100
Social association (with friends/ alone)								
With friend	142	60	27	12	67	28	236	100
Alone	47	51	15	16	31	33	93	100

There was significant relationship among severities and activities at the time of attacks ($\chi 2 = 30.33$, df = 12, $p < 0.002$; Fig. 7). The fatal rates of attacks were about two third (64%) of fisherman who were fishing or way to fishing and about one third of each NTFPs (forage/firewood) collector at CFs and park forest, house work/or sleeping and others* (toilet, forest watcher). The incidents while working at the forests and sleeping hours resulted higher chances to had fatal and serious cases due to delay in rescue and even first aid treatment.

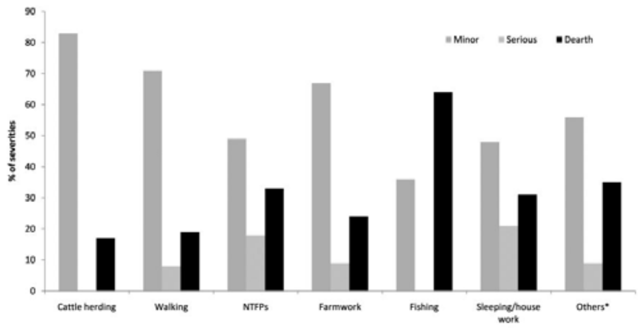

Figure 7: Severities of attacks by victims' activities at the time of attack

3.4 Extent of injury of serious victims

The recorded 13% (n = 42) serious victims were suffered seriously in different ways of harsh condition of life changing injuries caused by respective attacking animals (Fig. 2a). Out of them some (n = 12) some of were able to recover their previous life after 4-5 weeks of regular treatments. About 3-people in-4 victims (n = 30), aged of 20 to 80 years, are very hardly spending their daily life and hard to express in words. The extent of injuries sustained to the human victims included fractured/ broken bones/ pain on body parts, lost of legs/ hands/ or parts of body and mentally disturbed (Table 2). Most victims sustained injures to single part of the body like hand, legs, head and facial features etc. In general, injuries caused by tiger, leopard and bear characterized multiple penetrating wounds caused by teeth and jaws. Some tissue loss due to very aggressive bites also occurred. The wild boar and crocodile attacked by teeth. However, the rhino, bison gaur and sambar deer attacked by head/snout/ horn (s) and hooves. Similarly, the elephant attacked by trunk/ task and hooves. Some of the victims were being brutally butted/ ramped or trampled during the attacks. Such trauma was reported to be manifested as severe internal injuries/bleeding and concussions. Some of victims from such cases resulted being paralyzed and mentally disturbed. We found injured persons were facing substantially harassments in different ways of hardship livelihood conditions physically, mentally, and economically.

Besides victims' personal condition, it was reported that the attacks not only affected to the injured persons but also directly concerned with their family and social relations. We observed that victims' households are becoming harsh conditions due to occasional loss of lives and property. Victims are frequently turned into family burden because of lack of resources for treatment and care. Most of the victims those have had main role in family income which results from an asset to liability. Some of the schools going children of victims have to dropout due to financial crisis. To response this issue, park authority provided scholarship amount of $100 to the student who lost their guardians from animal attacks (CNP 2014). However, it seems very nominal to support for continuation their education and basic needs (e.g. expenses for foods, cloths, medicines etc). Furthermore, it was also reported that sometimes children dropout their school due to teasing from their friends by using negative adjectives to their parents disabilities like son/daughter of legless/ handless/ eyeless etc. It is pity that the innocent children have had to bear the cost of conservation. This causes negative impression in childhood mind and might be committed for revenge towards respective species through poisoning, firing, trapping etc.

Table 2: Extent of injury and nature of serious victims attacked by respective wildlife animals

Attacking animals	**Victims' gender/ age (year)**	**Extent of injury**	**Medical terminology of the injury** (Whiting and Zernicke 2008; Danny and Edwards 2009)
Rhino	Male (20)	Legs fractured	(b/l) lower limbs fracture
Rhino	Male (23)	Mouth problem (angled)	Dislocation of temporomandibular joint
Rhino	Male (30)	One leg lost	Traumatic amputation of (lt/rt) lower limb
Tiger	Male (30)	Wound on mouth	Orofacial injuries
Rhino	Male (31)	One hand functionless	Paralysis of (rt/lt) upper limb
Sloth bear	Male (35)	Mentally disturbed	Post traumatic mental disorder/illness
Rhino	Male (40)	Leg became too much thin	Muscular atrophy of legs
Sloth bear	Male (40)	Right hand not function well	Dysfunction/ disability of upper limb (rt)
Rhino	Male (41)	Legs not function well	Dysfunction/disability of lower limbs
Rhino	Male (49)	Legs not functioning well	Dysfunction/disability of lower limbs
Elephant	Male (53)	Backbone problem/ pain	Vertebral/spinal cord injuries (backache)
Rhino	Male (54)	Ribs broken	Ribs fracture
Rhino	Male (58)	Hands and legs functionless	Quardiplegia
Rhino	Male (65)	One hand functionless	Paralysis of (rt/lt) upper limb

Sloth bear	Male (67)	Hands and legs not function, body pain and mentally disordered	Dysfunction/ disability of limbs, backache, post traumatic mental disorder
Crocodile	Male (73)	Legs not functioning well	Post traumatic disability of lower limbs
Rhino	Male (80)	Cannot even stand, sitting/ or sleeping on bed	Unsteady gait (post traumatic)
Rhino	Female (25)	Problem in backbone pain	Vertebral/spinal cord injuries (backache)
Tiger	Female (28)	Leg weak	Neuro-muscular damage of lower limb
Sloth bear	Female (32)	Hair lost on head	Traction alopecia (hair was pulled out along with scalp)
Tiger	Female (41)	Lost left hand thumb figure	Traumatic amputation of the thumb (lt.)
Sloth bear	Female (48)	Hair lost on head	Traction alopecia
Elephant	Female (49)	Hand broken	Hand fracture
Rhino	Female (50)	Legs functionless	Paralysis of lower limbs. (paraplegia)
Elephant	Female (52)	Hair lost on head and mentally disordered	Traction alopecia (hair was pulled out along with scalp), post traumatic mental disorder
Sloth bear	Female (52)	Hands not functioning well	Dysfunction/disability of upper limbs
Wild boar	Female (56)	Hand useless	Dysfunction/ disability of upper limbs
Tiger	Female (61)	Ribs broken	Ribs fracture
Rhino	Female (70)	One leg lost	Traumatic amputation of (lt/rt) lower limb
Sloth bear	Female (70)	No leg movements	Lower limbs paralysis/paraplegia

4. CONCLUSION AND MANAGEMENT IMPLICATIONS

The severities of the wildlife attacks occurred significantly correlated to environment of incident sites, attacking species and victims' awareness on behaviour of attacking animals. The fatal cases occurred on nine people or 1-people in-3, and 21 people or 2-people in-3 suffered with minor to severe injuries due to physically charged by attacking animals annually. Attacking mega animals like elephant (68%) caused much more vulnerable to lethal attacks on humans followed by tiger (57%), rhino (29%), bear (4%) and wild boar (4%). Significantly high number of fatal cases (84%) of the victims occurred on the incident sites, 12% cases at the hospital, and 4% cases on the way to the hospital. People reported that some of them (6-persons) lost their life due to delay in rescue and even lack of first aid treatments. This study showed that uneducated people, fisherman, and forest resource collectors suffered more or received more fatal cases than other people.

This study provides information that can help stakeholders to formulate strategies for reducing severities of the attacks. Particularly, the site environments of incidents (Fig. 5) and monthly patterns (Fig. 6) of severities provides guidance to the policy makers and field managers to intervene options for reducing wildlife attacks through improvement of the existing rescue and treatment practices in the surrounding human landscapes. The programs need to be improved in focusing particular species and high-risk areas and months. For example, experience of a live monitoring system using mobile phone alert system for elephant away in Valpari in southern India (Karanth et al. 2012). Enhancing treatment facilities and reducing serious and fatal cases should be the first management priority.

Furthermore, park authority needs coordinate conservation partners to increase their efforts and funds for conflict issues (e.g. subsidies for biogas, community house for grain storage, house improvement, electric fence, night guards etc.) in high-risk areas. Addressing these issues is fundamental to balance individual as well as social needs through dedicated policy and practices for conservation. Thus, to reduce severities of attacks in CNP and similar landscapes, though the physical and social settings may vary, the possible suggestions are (i) training local communities of high-risk areas to make them educate about behavior and movement patterns of specific-species on how to escape from risk and movements (spatial and temporal). Inadequate knowledge of respective attacking animal's behavior, people come into direct contact with animals to defend their crops and properties when attacks occurred; (ii) regulate people's movements at the high-risk areas at least during the vulnerable periods of respective animals; (iii) create effective schemes for financial supports to the victims' families regularly; and (iv) lunch medical trauma centre and support local medical centres for carrying out immediate treatments to the victims at local level.

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ANNEXES: RELATED TABLES

Table A1: Severities caused by respective attacking animals in and around CNP between 2003 and 2013

Severity types		Tiger	Elephant	Rhino	Leopard	Bear	Wild boar	Others*	Total
Minor	Count	24	4	72	17	45	24	3	189
	% within types of severity	12.7%	2.1%	38.1%	9.0%	23.8%	12.7%	1.6%	100.0%
	% within attacking animals	35.3%	14.3%	57.1%	94.4%	76.3%	92.3%	75.0%	57.4%
	% of Total	7.3%	1.2%	21.9%	5.2%	13.7%	7.3%	0.9%	57.4%
Serious	Count	5	5	17	1	12	1	1	42
	% within types of severity	11.9%	11.9%	40.5%	2.4%	28.6%	2.4%	2.4%	100.0%
	% within attacking animals	7.4%	17.9%	13.5%	5.6%	20.3%	3.8%	25.0%	12.8%
	% of Total	1.5%	1.5%	5.2%	0.3%	3.6%	0.3%	0.3%	12.8%
Death	Count	39	19	37	0	2	1	0	98
	% within types of severity	39.8%	19.4%	37.8%	0.0%	2.0%	1.0%	0.0%	100.0%
	% within attacking animals	57.4%	67.9%	29.4%	0.0%	3.4%	3.8%	0.0%	29.8%
	% of Total	11.9%	5.8%	11.2%	0.0%	0.6%	0.3%	0.0%	29.8%
Total	Count	68	28	126	18	59	26	4	329
	% within types of severity	20.7%	8.5%	38.3%	5.5%	17.9%	7.9%	1.2%	100.0%
	% within attacking animals	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
	% of Total	20.7%	8.5%	38.3%	5.5%	17.9%	7.9%	1.2%	100.0%

(chi-sqiure=93.395; df=12; p<.000)

Table A2: Temporal patterns of wildlife attacks by respective animals in and around CNP between 2003 and 2013

Months		Tiger	Elephant	Rhino	Leopard	Bear	Wild boar	Others*	Total
January	Count	8	4	21	0	8	2	2	45
	% within month of incident	17.8%	8.9%	46.7%	0.0%	17.8%	4.4%	4.4%	100.0%
	% within attacking animals	11.8%	14.3%	16.7%	0.0%	13.6%	7.7%	50.0%	13.7%
	% of Total	2.4%	1.2%	6.4%	0.0%	2.4%	0.6%	0.6%	13.7%
February	Count	4	0	12	1	6	4	0	27
	% within month of incident	14.8%	0.0%	44.4%	3.7%	22.2%	14.8%	0.0%	100.0%
	% within attacking animals	5.9%	0.0%	9.5%	5.6%	10.2%	15.4%	0.0%	8.2%
	% of Total	1.2%	0.0%	3.6%	0.3%	1.8%	1.2%	0.0%	8.2%
March	Count	9	1	8	5	7	0	0	30
	% within month of incident	30.0%	3.3%	26.7%	16.7%	23.3%	0.0%	0.0%	100.0%
	% within attacking animals	13.2%	3.6%	6.3%	27.8%	11.9%	0.0%	0.0%	9.1%
	% of Total	2.7%	0.3%	2.4%	1.5%	2.1%	0.0%	0.0%	9.1%
April	Count	6	0	10	6	8	4	0	34
	% within month of incident	17.6%	0.0%	29.4%	17.6%	23.5%	11.8%	0.0%	100.0%
	% within attacking animals	8.8%	0.0%	7.9%	33.3%	13.6%	15.4%	0.0%	10.3%
	% of Total	1.8%	0.0%	3.0%	1.8%	2.4%	1.2%	0.0%	10.3%
May	Count	7	1	12	0	12	5	1	38
	% within month of incident	18.4%	2.6%	31.6%	0.0%	31.6%	13.2%	2.6%	100.0%
	% within attacking animals	10.3%	3.6%	9.5%	0.0%	20.3%	19.2%	25.0%	11.6%
	% of Total	2.1%	0.3%	3.6%	0.0%	3.6%	1.5%	0.3%	11.6%
June	Count	4	1	5	0	3	3	0	16

	% within month of incident	25.0%	6.3%	31.3%	0.0%	18.8%	18.8%	0.0%	100.0%
	% within attacking animals	5.9%	3.6%	4.0%	0.0%	5.1%	11.5%	0.0%	4.9%
	% of Total	1.2%	0.3%	1.5%	0.0%	0.9%	0.9%	0.0%	4.9%
July	Count	5	1	11	4	1	1	1	24
	% within month of incident	20.8%	4.2%	45.8%	16.7%	4.2%	4.2%	4.2%	100.0%
	% within attacking animals	7.4%	3.6%	8.7%	22.2%	1.7%	3.8%	25.0%	7.3%
	% of Total	1.5%	0.3%	3.3%	1.2%	0.3%	0.3%	0.3%	7.3%
August	Count	3	0	6	0	3	1	0	13
	% within month of incident	23.1%	0.0%	46.2%	0.0%	23.1%	7.7%	0.0%	100.0%
	% within attacking animals	4.4%	0.0%	4.8%	0.0%	5.1%	3.8%	0.0%	4.0%
	% of Total	0.9%	0.0%	1.8%	0.0%	0.9%	0.3%	0.0%	4.0%
September	Count	4	2	5	0	3	0	0	14
	% within month of incident	28.6%	14.3%	35.7%	0.0%	21.4%	0.0%	0.0%	100.0%
	% within attacking animals	5.9%	7.1%	4.0%	0.0%	5.1%	0.0%	0.0%	4.3%
	% of Total	1.2%	0.6%	1.5%	0.0%	0.9%	0.0%	0.0%	4.3%
October	Count	4	5	8	0	2	2	0	21
	% within month of incident	19.0%	23.8%	38.1%	0.0%	9.5%	9.5%	0.0%	100.0%
	% within attacking animals	5.9%	17.9%	6.3%	0.0%	3.4%	7.7%	0.0%	6.4%
	% of Total	1.2%	1.5%	2.4%	0.0%	0.6%	0.6%	0.0%	6.4%
November	Count	4	3	3	0	1	0	0	11
	% within month of incident	36.4%	27.3%	27.3%	0.0%	9.1%	0.0%	0.0%	100.0%
	% within attacking animals	5.9%	10.7%	2.4%	0.0%	1.7%	0.0%	0.0%	3.3%
	% of Total	1.2%	0.9%	0.9%	0.0%	0.3%	0.0%	0.0%	3.3%

December	Count	10	10	25	2	5	4	0	56
	% within month of incident	17.9%	17.9%	44.6%	3.6%	8.9%	7.1%	0.0%	100.0%
	% within attacking animals	14.7%	35.7%	19.8%	11.1%	8.5%	15.4%	0.0%	17.0%
	% of Total	3.0%	3.0%	7.6%	0.6%	1.5%	1.2%	0.0%	17.0%
Total	Count	68	28	126	18	59	26	4	329
	% within month of incident	20.7%	8.5%	38.3%	5.5%	17.9%	7.9%	1.2%	100.0%
	% within attacking animals	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
	% of Total	20.7%	8.5%	38.3%	5.5%	17.9%	7.9%	1.2%	100.0%

(chi-sqiure=98.546; df=66; p<.006)

ASSESSING QUALITY OF SOIL MAPS AND POSSIBILITIES OF THEIR USE FOR COMPUTING VEHICLE MOBILITY

Martin Hubáček[1], Lucie Almášiová[1], Marie Břeňová[1], Martin Bureš[1] and Eva Mertová[1]

[1] Department of Military Geography and Meteorology, University of Defence, Kounicova 65, Brno, Czech Republic, e-mail: martin.hubacek@unob.cz

ABSTRACT

Soils are one of the very important layers of the landscape and have a significant impact on human civilization. Soils affect plant growth, environmental quality, food production, water regime and many other domains. The influence of soils on possibility of movement of vehicles is very important especially for the military and integrated rescue systems.

The aim of this paper is to explain the basic effects of soils on the movement of vehicles, their relation to other components of landscape and weather phenomena. Researching the issue proceeds with comparing the quality of different soil maps and verification of data in maps using soil probes in selected locations. The main data sources are the Special military database of soils and the Digital soil map at scale 1 : 50 000. The comparison results reveal significant differences in soil classification and representation of soil areas in these two sources. Although the Digital soil map shows higher reliability in comparison with collected soil probes, measured passability results are not clear in this case. Further measuring of passability and analysing other meteorological elements will be a prerequisite for a final assessment of the effect of soils on passability of vehicles.

Key Words: *Cros Country Mobility (CCM); Soils Map; Geodatabase; passability*

1. INTRODUCTION

Soils are one of the very important elements of a landscape and they have a significant impact on human civilization. Soils considerably affect plant growth, environmental quality, food production, water regime and many other domains. Influencing food production and vegetation represents perhaps the most important function of soils [1] [2]. Soil characteristics have a significant impact on the water regime [3] [4], air quality and the formation of ecosystems [5]. From the perspective of human civilization, soils represent a significant component influencing its development and even the existence or non-existence in some areas. Greater interest in studying soils emerged in the 19th century, when Russian geologist V. V. Dokuchaev laid the foundations of soil science or pedology [6]. Since then a considerable attention is dedicated to studying soils. The current research is focused on mapping using digital methods [7] [8], surveying soil erosion [9] [10], mapping landslides [11] [12], and many other problems. The research which is realized at the Department of the Military Geography and Meteorology at the University of Defence in Brno focuses on another domain. It is related to the mission of the department to educate military geographers and meteorologists and also to its long-term orientation to investigation of the influence of terrain on vehicle movement [13] [14] [15] and determining the coefficients of vehicle deceleration caused by the individual terrain elements [16] [17] [18]. This activity is related to mobility which is one of the essential functionalities of military units and rescue services. The vehicles of these units cannot use solely roads during crisis situations, but they are often forced to use alternative options such as moving on forest roads or tracks or even in the open terrain. Mobility in the terrain depends on many factors [13] [15]. In terms of the impact of the terrain on passability the soils are one of the most important components of a landscape affecting mobility and it is essential to address the soil conditions when studying terrain.

2. SOIL CHARACTERISTICS AND THEIR INFLUENCE ON MOVEMENT

Soil types and textural class are among the most important soil properties, which are distinguished by the physical properties of soil. They are a set of characteristics resulting from interrelations between the solid, liquid and gaseous components of soil [19]. Soil types are characterized especially by a structure and characteristics of the soil horizon, and by intensity of soil-forming processes that are affected by climatic conditions. Textural class are described by granularity of mineral particles determining their physical properties. They are classified according to percentage of clay grains of dimension 0.01 mm and smaller. Soil classes are classified according to the granular composition as follows [6]:

- Sand (0-10% of particles smaller than 0.01 mm);
- Loamy sand (10-20% of particles smaller than 0.01 mm);
- Sandy loam (20-30% of particles smaller than 0.01 mm);
- Loam (30-45% of particles smaller than 0.01 mm);
- Silty clay (45-60% of particles smaller than 0.01 mm);
- Clay (more than 60% of particles smaller than 0.01 mm).

The individual soil types and textural class greatly affect the terrain passability. In terms of terrain passability, it is important to assess soil properties, such as the following [13]:

- cohesion and hardness of the soil;
- permeability of soils;
- mechanical properties (dustiness, durability, stability on slopes, …).

Terrain passability is also affected by the soil thickness. It is determined by nature of parent rock and intensity of rock weathering. The soils are divided in terms of thickness as follows:

- shallow soils (soil depth less than 0.3 m);
- moderately deep soils (soil depth from 0.3 to 1.0 m);
- deep and very deep soils (soil depth higher than 1.0 m).

Other soil properties are not significant for assessing the terrain passability and at present they do not enter the Cross-Country Mobility (CCM) models. The main problem of terrain passability modelling is the availability and reliability of soil maps.

3. MAPPING SOILS

Unlike mapping of other landscape features, mapping of soils is very difficult. Until recently, it was represented solely by collecting of soil samples (soil pits). Collection and subsequent analysis is expensive, time-consuming, and organizationally demanding. For detailed mapping of the entire national territory, it is necessary to collect large amounts of soil samples. For this reason, soil maps of individual states, areas or regions are very different in terms of their content and detail. It is therefore possible to see very detailed maps created over small regions or maps of medium scale and small scale in case of large areas or entire countries [20] [21]. A comprehensive overview of soil maps in Europe provides [22]. Thanks to development in geoinformatics and remote sensing methods of data collection in recent decades so-called digital soil mapping methods begin to grow in importance. These are based on the use of multispectral data, GIS tools, and analysis of other data rather than soil data [7] [8]. These methods allow obtaining information about soil in a continuous form comparing to information generated from discrete sampling locations. Thus soil mapping gets considerable attention and it is experiencing a renaissance in many countries of the world.

A comprehensive agricultural soil survey took place in the former Czechoslovakia in 1960s and 1970s [23]. Nearly one million soil samples were collected during that campaign. Hundreds of thousands of soil samples were collected in the following decades in projects of agricultural land melioration, forest soil mapping, and land valuation. Results of these soil samples were used for production of many soil maps for the territory of the Czech Republic. So-called working originals depicting the soil sample locations on topographic maps at scales 1 : 5 000 and 1 : 10 000 are probably the most detailed products. There are also other products at scale 1 : 10 000 such as Basic soil map cartograms (ZPM), Cartograms of soil texture and waterlogging (KZSZ), Proposal for increasing soil fertility (KNO) and others. These products were used in 1977 for production of the Soil map of the Czech Republic at scale 1 : 200 000 and later the Soil maps of the Czech Republic at scale 1 : 50 000 were also produced. Many of these products are available today also in a digital form or their digitizing is in progress [24].

Among digital soil databases, the vector Value Soil Ecological Unit (BPEJ) database at scale 1 : 5 000 is probably the most detailed soil database in the Czech Republic. It is administrated by the Research Institute for Soil and Water Conservation (VÚMOP) in Prague [23]. This database is considered to be one of the most detailed soil evaluation systems in the world. The Complex Soil Survey vector database at scale 1 : 200 000 is another soil database which provides information about soil types and granularity [11 MER]. The Digital Soil Map at scale 1 : 50 000 (DSM 50) covers most of the Czech territory and it represents the most detailed digital database providing information about soil types and soil-forming substrate. The Army of the Czech Republic uses the Special Military Database of Soils (SMDoS) produced by the Military Geographic and Hydro-meteorological Office (MGHMO). It was created in 1990s and was based on the Synthetic Soil Map at scale 1 : 200 000. The database contains data covering the whole territory of the Czech Republic and provides soil polygons with attributes describing the three fundamental soil properties:

- soil type;
- soil-forming substrate;
- textural class (granularity).

The primary purpose of using the database was the analysis of military vehicle mobility in the terrain. Despite the fact, that at the time of introduction of the SMDS it was expected to refine the information at selected areas and to extend its coverage to foreign territory along the border of the Czech Republic [24], no works were realized up to the present time.

The SDMS is at this time the only soil database having direct relationship to the terrain passability. The experts from the Research Institute for Soil and Water Conservation created a method of assessing the terrain passability using the data from the SDMS [25] [26]. This method allows computing passability of a particular area with respect to the amount of precipitation. It is possible to create a map of the influence of soils on the movement of vehicles (Fig. 1). The individual colors represent the following parameters:

- Green – GO in all weather conditions;
- Orange – SLOW GO in wet season;
- Red – NO GO in wet season;
- Black – NO GO throughout the year.

The wet season is defined as follows: rainfall in a liquid state greater than 40 mm during three days in the period from October to April and rainfall greater than 70 mm during three days in the period from May to September.

Due to the sources of data and production technology (described in [26]) the accuracy of depicting the polygons is low. The structure of soil polygons is usually supported by the river network and the inaccuracy of polygon locations usually does not exceed 100-200 m. However, the polygons without adjacency of river network may exhibit the inaccuracy several times higher. This finding is confirmed by the soil samples collected during the recent mapping of the terrain passability.

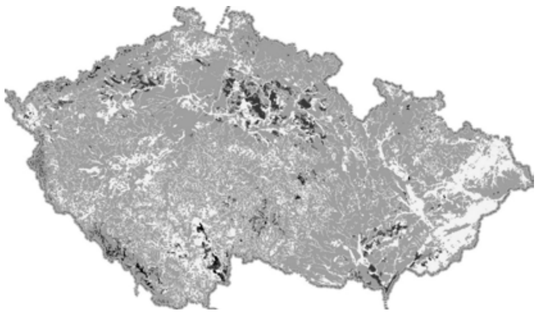

Figure 1: Map of soil influence on the movement of vehicle
Source: Autor (data MGHMO Dobruška)

4. MEASURING SOIL CARRYING CAPACITY AND COMPARING SOIL SAMPLES WITH DATA IN SOIL DATABASES

Many stages of measurement were carried out in past years while dealing with a problem how a soil affects passability. One of them was focused on the measurement of soil carrying capacity within the Czech Republic and region of the Central Europe. Because measurement procedure takes in account different kind of soil system classification than is used in Czech Republic soil mapping, it was necessary to allow certain generalization of soil classification and choose appropriate location. In this stage, 12 types of location were chosen in cooperation with scientists from the Mendel University (Table 1).

Table 1: Comparison of primary soil types in the tested locations

Locality	Soil probe	SMDoS	DSM 50
The first phase of measuring passability of soils			
Vatín	Cambisols	Cambisols	Cambisols
Gayer	Stagnosols	Cambisols	Gleysols
Podrážek	Leptosols	Leptosols	Cambisols
Živanice	Cambisols	Cambisols	Regosols
Veltruby	Fluvisols	Fluvisols	Fluvisols
Staré Splavy	Entic Podzols	Cambisols	Cambisols
Strašín	Haplic Luvisols	Albeluvisols	Haplic Luvisols
Turovec	Stagnosols	Gleysols	Stagnosols
Horní Bolíkov	Cambisols	Gleysols	Cambisols
Olšany (JI)	Gleysols	Stagnosols	Albeluvisols
Pohořelice	Chernozems	Chernozems	Chernozems
Popice	Chernozems	Chernozems	Chernozems
The second phase of measuring passability of soils			
Ochoz u Brna	Stagnosols	Gleysols	Albeluvisols
Křtiny	Gleysols	Cambisols	Gleysols
Olšany (OL)	Chernozems	Phaeozems	Phaeozems
Štětovice	Histosols	Histosols	Histosols
Tovačov	Phaeozems	Phaeozems	Phaeozems
Troubky	Fluvisols	Fluvisols	Fluvisols
Chropyně	Fluvisols	Fluvisols	Fluvisols
Záhlinice 1	Gleysols	Phaeozems	Gleysols
Záhlinice 2	Fluvisols	Phaeozems	Phaeozems

Source: Autor (Only primary soil types, transferred to the classification scale WRB according to Nemecek [28])

The main location criteria were:

- Soil conditions (soil type and soil texture class) is affected by soil-building processes;
- Geologic and geomorphologic conditions of Czech Republic with regard to the soil-forming substrate;
- Climate conditions like average rainfall, air temperatures and other factors (inversion, rain shadow ...);

- Vegetation cover;
- Melioration of the land.

In these locations the measurement of soil carrying capacity was carried out in years 2009 – 2013. The taking of soil probes and their laboratory analysis was carried out in these measurements. The goal was to determine the physical and chemical characteristics of soil, to specify soil types, soil texture class and dampness of soil. The measurements were divided to three periods:

- Dry;
- Moist;
- Wet.

The definition of these periods is different from the definition used for the formulation of soil passability in UDB. It arises from methodical procedures for the definition of passability using penetrometer E-960 Soil Trafficability Set in the USA army and NATO forces [27] and The NATO Reference Mobility Model.

The results of the measurements in these locations shown, that most of selected soils are easily drivable for basic vehicles of Army of Czech Republic during a year both in dry or wet conditions. Only some types of vehicles have specific issues in wet conditions. Specific soils did not make the location undrivable even in extreme meteorological conditions. Bigger issues in vehicle movement may occur in sum of several geographic issues. The combination of issues and how to proceed is described in Rybansky [13].

Nine locations with undrivable conditions were selected with regards to upper mentioned findings. Except already described criteria, the selection was mainly based on long-term practical experience gained during the analyse of soil probes and the tests of vehicle mobility in terrain. Another criterion was the usage of soil grading procedures in SMDoS [26]. The outcome is nine locations on the Moravian area. They were focused on in the year 2014. Up until now there were three rounds of soil carrying capacity measurements due to long-lasting droughts. The first one in winter 2014, second in March of 2015 and the last is summer of 2015. The soil analysis was carried out simultaneously with passability measurements. Not only it confirmed the legitimacy of selected area, but it also provided the verification of soil characteristics reliability in already applied soil maps.

The information about soil characteristics attained from the soil probe analysis was afterwards compared with the information about soil type and soil texture class stored in SMDoS. The comparison of findings shown that there are big differences in the findings, especially in-between the soil types. During the first stage it occurred in the half of cases. From six different classifications there were three partially similar and three very distinguished. In soil texture classes the comparison shown better outcomes and difference were found only in one probe. Other cases can be nailed down to different method of classification and they are non-significant. In second stage are outcomes similar with five probes being different (out of nine) and only three have significant difference. That is the reason why more suitable data sources of soil passability analysis were looked for. From accessible date sources the digital soil map 1 : 50 000 seems most suitable. This map does not include soil texture class, but soil types marking, that is part of SMDoS shows bigger incredibility, is far more specific. It is shown in figure 2. Here is the distribution of soil types in the SMDoS and DSM 50 on the tested areas near Brno. The comparison of information on soil types was carried out using data on geoportal of the Czech Geological Survey (CGS). The results of comparison are better than in case of SMDoS even though there is not a 100% match (Table 1). In regard to similar soil types, there is a difference in five cases for the first stage. In second stage there is a difference in three cases, but two of those are marginal. Despite of these inconsistencies in the soil type classification, the DSM 50 appears as more suitable foundation for the soil type selection. That is why the comparison of data from DSM 50 and SMSoS was allowed.

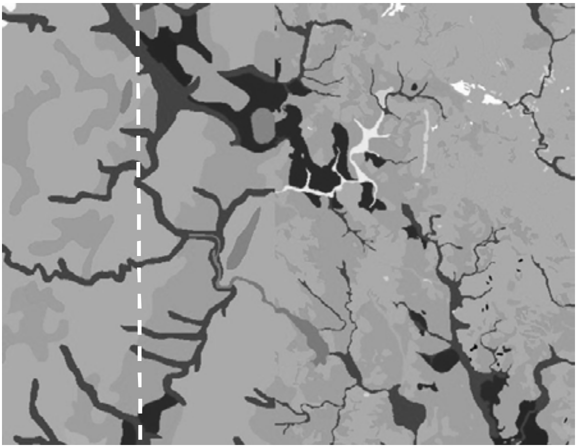

Figure 2: Display of soil types on the tested area (left part SMDoS, the right part DSM 50)
Source: Autor (data MGHMO Dobruška and CGS)

The area westward from Brno was chosen for the data comparison. It allowed the acquisition of DSM 50 data. Data from SMDoS are accessible throughout the whole Czech Republic. Because DSM 50 does not contain soil texture classes, only the soil types were compared. The comparison itself was covered in bachelor thesis and three methods were chosen:

- The comparison of the percentual ration of the soil types (the comparison of size of soil types in the whole area);
- The match of soil type polygons SMDoS with equivalent area in DSM 50;
- The comparison of soil types classification a marking of area borders in database with regards to soil probes.

The first basic and easiest comparison is to verify the percentage of individual soil types in the SMDoS and DSM 50. Conversion of area size of the individual polygons was performed before the comparison, because their shape and size could change during previous operations (clipping, transformations). Then the percentage of individual polygons was calculated in SMDoS and DSM 50 separately. Since DSM 50 is not in the same classification system as SMDoS, polygons of individual soil types were summarized only by the primary soil type and soil subtypes were not considered.

Table 2: Comparison of primary soil types in the tested area, method one

	SMDoS		DSM 50		
	[m^2]	[%]	[m^2]	[%]	[%] of SMDoS
Antroposols	42118527	9.1	2111477	0.5	5
Phaeozems	696914	0.2	2407660	0.5	345
Chernozems	14265551	3.1	19268318	4.2	135
Fluvisols	38124386	8.3	34795767	7.5	91
Gleysols	3768517	0.8	9711265	2.1	258
Haplic Luvisols	96456786	20.9	116931561	25.4	121
Cambisols	241591897	52.4	218479220	47.4	90
Albeluvisols	14885541	3.2	44126356	9.6	296
Leptosols	2231966	0.5	1879341	0.4	84
Stagnosols	378693	0.1	2194838	0.5	579
Rendzic Leptosols	4434566	1.0	2302180	0.5	52
Greyc Phaozems	-	-	276768	0.1	-
Water	2363700	0.5	2341777	0.5	99

Source: Autor (Only primary soil types, transferred to the classification scale WRB according to Nemecek [28])

In Table 2 it can be seen that the percentage of individual soil types in the SMDoS and DSM 50 in many cases differ significantly. These differences are shown in the last column, providing the percentage of the area occupied by different soil types in DSM 50 of the total area of the same soil type in SMDoS. Values approaching 100% indicate the highest percentage match. Relatively large difference can be found in Phaeozems, Gleysols, Albeluvisols, Stagnosols or rendzic Leptosols. Interesting is a significant difference in the case of build-up area. The reason why the development of individual databases differs on such great value is that the SMDoS are defined as polygons of Anthroposols, i.e. as a compact built-up area, while in DSM 50 this type is taken just as a sole area, which naturally takes on a map a smaller area. It is difficult to explain why other soil types differ so much too. Some soil types depicted in DSM 50 even do not exist in SMDoS. More illustrative representation is provided in Figure 3.

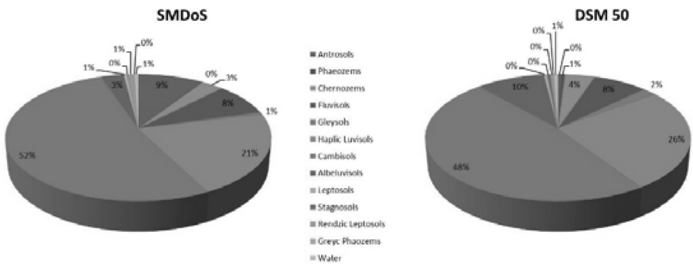

Figure 3: Comparison of primary soil types in the tested area, method one
Source: Autor

The second approach of comparing focused on the territory covered by each soil types. Data in DSM 50 was gradually cut off by polygons of individual soil types of SMDoS. The resulting layer would ideally have the same classification as soil type layer for clipping. The results show significant differences between individual soil types (Table 3). The largest compliance over 60% reported Cambisol, Chernozem, haplic Luvisols and waters.

Table 3: Overlap of primary soil types between databases

	SMDoS	DSM 50	
	[m^2]	[m^2]	[%]
Antrosols	42118527	2027420	4.8
Phaeozems	696914	0	0.0
Chernozems	14265551	10116378	70.9
Fluvisols	38124386	15440520	40.5
Gleysols	3768517	740873	19.7
Haplic Luvisols	96456786	62579200	64.9
Cambisols	241591897	173583506	71.8
Albeluvisols	14885541	8591801	57.7
Leptosols	2231966	760610	34.1
Stagnosols	378693	170673	45.1
Rendzic Leptosols	4434566	797965	18.0
Water	2363700	1893763	80.1

Source: Autor (Only primary soil types, transferred to the classification scale WRB according to Nemecek [28])

Conversely, compliance of rendzic Leptosols and Gleysols compliance is less than 20%. Soil type Phaeozem does not have any databases match. These results correspond well with the detection of the first comparison on the basis of percentages. Because the individual polygons are very different in shape, the analysis with respect to their shape in one soil type was performed. Some soil types are bound to the water streams and theirs distribution in the map and the field has the form of a very elongate polygon unlike other, whose surfaces are regular and their shape when simplified view approximates a circle or square. This detailed examination focused solely on the soil types, which are occurred as elongated and regular shapes. The remaining soil types have all polygons in one of the categories, and this comparison is therefore meaningless for them. In addition Albeluvisols all remaining tested soil types were found differences in matching in classification databases between elongated and regular shapes (Table 4). Except water, the observed differences are not so pronounced that it can be unequivocally stated that the soil type will show a higher match, depending on the shape of polygons.

The last comparison was carried out by taking soil probes of terrain profile Zastávka – Rosice, located in the reference area and subsequent processing of samples in soil science laboratory of Mendel University in Brno. Along with taking the samples, penetrometric measurements were carried out that were used to determine the soil carrying capacity in a given locality. a total of 13 soil probes has been collected in the selected profile. Soil types were determined According to the analysis and in particular soil types, on which are focused the comparing of soil databases. In figure 4 are shown locations of soil probes on an aerial photograph.

Table 4: overlap of primary soil types depending on the shape of the polygon

	Shape of polygons	
	Regular shape [%]	Elongated shape [%]
Fluvisols	11	43
Gleysols	27	17
Cambisols	64	72
Albeluvisols	64	65
Water	0	82

Source: Autor (Only primary soil types, transferred to the classification scale WRB according to Nemecek [28])

Figure 4: Localization of soil probes
Source: Autor (data MGHMO Dobruška)

Comparison of soil probes indicates compliance against the DMP in six cases, compared with SMDoS it is only in three cases. In contrast, comparison of soil texture class showed 100% concordance with this attribute. Soil types which coincided are shown in Table 5. This table provides information about the overall comparison of the two map products with the results of field measurements. The differences are caused by the different classifications but also inaccurate delineating boundaries of individual soil areas. This knowledge is important in case of computing vehicle mobility. Analysis of soil samples was used to verify the quality of soil data and simultaneously confirmed detection obtained from the measurement of soil carrying capacity. The boundaries between soils are not usually sharply defined in terrain. Many of landscape forming and soil-forming factors affects the deployment of boundaries areas between the soils very often. This fact is important to take into account for various soils analyses.

Table 5: Comparing the results of the field survey with soil databases

Locality	Soil probe	SMDoS	DSM 50
Zastávka 1	Cambisols	Fluvisols	Albeluvisols
Zastávka 2	Cambisols	Fluvisols	Albeluvisols
Zastávka 3	Cambisols	Fluvisols	Haplic Luvisols
Zastávka 4	Haplic Luvisols	Fluvisols	Haplic Luvisols
Zastávka 5	Haplic Luvisols	Fluvisols	Haplic Luvisols
Zastávka 6	Fluvisols	Fluvisols	Fluvisols
Rosice 7	Fluvisols	Fluvisols	Fluvisols
Rosice 8	Fluvisols	Leptosols	Leptosols
Rosice 9	Cambisols	Leptosols	Leptosols
Rosice 10	Cambisols	Leptosols	Cambisols
Rosice 11	Cambisols	Leptosols	Cambisols
Rosice 12	Cambisols	Leptosols	Leptosols
Rosice 13	Cambisols	Leptosols	Leptosols

Source: Autor (Only primary soil types, transferred to the classification scale WRB according to Nemecek [28])

5. CONCLUSION AND FURTHER RESEARCH

The existing soil databases represent an important source of data on soils. Their origin and content, however, varies greatly depending on location, data collection methods, and technology of creating the database. Even in the Czech Republic, where most soil maps and databases are based on extensive soil mapping carried out in the 2nd half of the 20th century, the information on soils differs. The analysis of the two data sources described in this paper reveals significant differences in these databases which have several reasons:

- different map scales;
- different methods of creation;
- different sources of geographic information;
- different soil type classification scales.

Despite all these facts, it is possible to state that depicting soil types on the DSM 50 is more accurate than depicting the soil types in the SMDoS being currently used in the Army. And also, despite the large number of differences in soil classification compared to collected soil samples the DSM 50 shows significantly greater reliability. This fact is reflected mainly in the areas of very small polygons of soils having considerable effect on the terrain passability.

Interesting finding was reached in the case of information concerning Fluvisols. This soil type showed the best correspondence between databases in the first test, but correspondence of only 40 % was reached in a direct comparison of classified polygons. This was also evident in collecting the soil samples, where only 2 of 13 samples were classified as Fluvisols. The soil types were classified similarly in the DSM 50. In the SMDoS, however, Fluvisols was classified in 8 of 13 cases.

Collected soil samples will help solve another problem which is the way of expressing of uncertainty when determining the influence of soils at boundaries of individual polygons [29]. It was provisionally solved by setting a fixed distance for diffusion of soil between adjacent polygons. The soil samples enabled understanding of other factors determining wether the boundary between the polygons is crisp or the soil types blend. This will be a subject to further investigation in other locations.

The issue of reliability of information on soils is only one of many problems in dealing with the impact of soils on terrain passability. Nevertheless, it is very important and the comparison described in this paper will be used for further research. The findings will allow combining data of various sources and determining their weights. In addition to information about soils, information about weather [30] [31] and elevation [32] will enter computation. Currently, these are analysed separately.

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THE CHANGES OF LAND COVER IN SELECTED LOCALITIES OF MIDDLE SPIŠ

Eva Michaeli[1], Monika Ivanová[1], Vladimír Solár[1] and Jana Juhaščíková[1]

[1] Department of Geography and Applied Geoinformatics, Faculty of Humanities and Natural Sciences, University of Prešov in Prešov, ul. 17. novembra 1, 081 16 Prešov, Slovak Republic,
e-mails: eva.michaeli@unipo.sk, monika.ivanova@unipo.sk, vladimir.solar@unipo.sk, lipjanka@gmail.com

ABSTRACT

The important feature in the present landscape-ecological research is to study the spatial structure of the landscape on the basis of changes the land cover in course of historical development. Justification arises especially from the aspect of the maintaining landscape ecological stability and the sustainable development as well as the landscape potential. The important role has at the same time the research of socio-economic impacts on the landscape. In the contribution we decided to compare the changes in landscape structure in the years 1958 and 2009 on the small part territory in Middle Spiš around the city Krompachy (old locality of industry with many ecological loads) and the rural village Kolinovce. For evaluating changes in the landscape structure we used topographic maps from 1958 (scale 1: 50 000) and orthophotomaps from year 2009. The changes in the landscape structure we evaluated by the process of overlaying layers the classes of land cover. The absolute and percentage differences in extending areas of the individual land cover classes for the relevant period of time is expressed by means of contingency tables transformation.

Key Words: *landscape structure, land cover, assessments of changes*

1. INTRODUCTION

The appearance of current landscape is the result of the continual and long-term human influence (in our latitudes from Epiatlantic) on the original natural landscape (Žigrai 2000).Its physical state reflects the land cover classes that represent materialized projection of natural-spatial features and current land use (Feranec and Oťaheľ 2001). A good indicator for the assessment of the intensity of social impacts is the changes in the landscape structure. They represent a sequence of different states of physical nature that bind to a certain time horizon (Feranec and all 1997). With the development of geographic information systems this issue appears more often in our and foreign literature. The methods of multitemporal analysis allow to evaluate the changes, dynamics and trends of developement in land cover and also in the landscape by the mutual comparison between the map layers from different time horizons. The multitemporal analysis reflects the character of these changes, their intensity and direction, therefore, its importance in the study of contemporary landscape increases (Franklin, Forman 1987, Gardner et al. 1987, Feranec, Oťaheľ, 1999, Jaeger 2000, McGarigal 2002, DiBari 2007, Sertel et al. 2008, Ivanová 2013, Ivanová, Michali and Boltižiar 2013, Michaeli, Ivanová and Koco 2015, Hruška 2015).

2. THE RESEARCHED TERRITORY

Model territory is administratively located in the district of Spišská Nová Ves. It is situated on the contact zone of the Hornádska kotlina (basin) and Volovské vrchy (Mts). It represents a genetically, morphologically, ecologically very contrast region of which the largest part nearly 90% lies in mountain landscape of Volovské vrchy and only 10% in landscape of Hornádska kotlina (basin). Geological structure of the area is very varied. It is built by the geological-tectonic unit of Gemericum that consists of the gelnická and rakovecká sequences (phyllites, quartzite, porphyrite, granite, crystalline limestone and basalts) which they consists of Early Paleozoic layers of rock (Paleozoic basement). Late Paleozoic layers of the rock (Carboniferous and Permian unit) lies discordantly on Early Paleozoic basement and they are consists by conglomerates, sandstones, organogenic limestone. In Late Paleozoic layers are the deposits of magnesite, siderite, and iron ore of hematite and in rocks of Permian in Petrova hora Formation are deposits of pitchblende and other bearings of uranium ore. On these structures is tectonic unit of surface nappes (Spiš nappe from Triassic limestone, dolomite complex, Maheľ 1986). In Volovské vrchy (Mts.) since the Middle-Ages had been mined gold, silver, copper, mercury and iron ore. The most important mining sites are in studied area the valley of the Slovinský potok (brook). Compared to Volovské vrchy (Mts.) Hornádska kotlina (basin) is younger of the entire development cycle. It was formed in the Tertiary by the sea transgression of flysch geosyncline that reached the highest range in the Eocene. The flysch sequences of Inner Carpathian Paleogene were formed of the complex of rhythmically alternating layers of claystone, sandstone and conglomerates. In Late Tertiary and Quaternary era the units of morpho-structures had been formed by the denudation and tectonics. Varied geological structure is reflected in the relief of the territory. Volovské vrchy (Mts.) have a rugged upland relief with an altitude of 450-925 m above sea level and the Hornádska kotlina (basin) has smoothly modeled slightly wavy relief of uplands and flat relief of river plains and river terraces (370-500 m above sea level) in studied space.

According to Climatic regionalization of the Slovak Republic Volovské vrchy (Mts.) belongs to a Cool climate area, district C1, which is moderately cold with an average temperature in July 12-16 ºC. Surroundings of city Krompachy belong to the Temperate climate zone, district M2, which is slightly warm slightly moist with cold winters, with an average temperature in July above 16 ºC (Map of Climate regions of The Slovak Republic, Lapin et al. 2002).

The most important river represents on the northern edge of the territory the Hornád (river) with the Slovinský potok (brook) that flows into the Hornád in Krompachy. Soil cover is formed mostly of Dystric Cambisol (World reference base for soil resources 2014, International soils classification system). On floodplain of Hornád and its tributaries there are Dystric Fluvisols and in uplands of Hornádská kotlina (basin) there are Albic-Dystric Luvisols. The majority part of Volovské vrchy (Mts.) is forested, mainly by spruce blended with a fir. Beech and oak stands are linked to small southern peripheral of mountain ranges. Forest communities have undergone a significant phytocoenological transformation in late 18^{th} century and in the first half of the 19^{th} century. Hornádska kotlina (basin) is deforested, agricultural use of the landscape. The researched area is negatively influenced by mining activity with the next complex processing of especially iron and copper ores. The city Krompachy belongs to the major industrial sites in the Middle Spiš. In Krompachy and surroundings were polluted for many years by mining operations and metallurgical plants for processing of iron ore and non-ferrous metals, in recent decades, mainly copper and mercury. The main sources of pollution in the studied area are factory "Kovohuty" in Krompachy and copper mines in Slovinky. The factory "Kovohuty" have the chimney 200 m high, which allows the scattering of emissions of SO_2 into the considerable distance and so polluting the surrounding mountain ranges and damaged the ecosystems of the forests. Critical pollutants in air, water and soil are heavy metals (Hg, As, Pb, Cd) and sulfur oxides, because the metal-bearing ores are sulfides. In the Krompachy and in the nearby Rudňany together have produced in the past about 35 000 tons of emissions per year, which caused permanent damage of the territory (Čech, Michaeli, Krokusová and Ivanová, 2015). Other forms of threat landscape structure are the landfills of industrial waste. They occur in near of the factory "Kovohuty" (the landfill "Halňa" with solid waste contains lead, arsenic and cadmium, liquid waste contains cyanide which are stored in concrete tanks so called blue pools, the landfill of ash by thermal power plant in Krompachy has estimated volume at 760 000 m^3). Outside of the industrial area of the factory "Kovohuty" in Krompachy there is a Flotation tailing pond Slovinky (it's water constructions with the highest dam in the Slovak Republic, 114 m above sea level and covers an area of 14 ha and reclaimed part creates 2.7 ha, the tailing pond represents the rest of mining and flotation of copper ore). The current state of ore tailing pond Slovinky is an environmental threat for city Krompachy (Michaeli and Boltižiar 2010, Krokusová, 2013).

3. METHODS OF LAND COVER ASSESSMENT

The assessments of changes in land cover were conducted on the base of comparison of individual land cover layers in years 1958 and 2009. The current landscape structure was identified by the vectorization of orthophotomaps from the year 2009 the land cover layer for the year 1958 was acquired by georeferencing and vectorization of military topographic map of scale 1: 25000. To identify land cover classes was necessary to adapt in detail the legend Corine Land Cover (CLC) used for the processing of data layers from whole Slovak territory (Bosard et al. 2000, Feranec, Oťaheľ 2001) to take account of the size and specifics of model territory. Therefore, we used for the investigated area the legend of the fourth level CLC processed for the needs of landscape research in a more detailed scale for the PHARE countries (Feranec, Oťaheľ 1999). Although the analyses were considered the fourth hierarchical level legend CLC, for clarity, we present the results of the assessment of land cover changes on the second hierarchical level. In the legend of the fourth hierarchical level are also included some specific land cover classes required for mapping in the model area: discontinuous area with predominantly multi-floor buildings without gardens, the areas of landfills of industrial and municipal waste, the areas or woody vegetation and waterside vegetation. The digitization of data is often associated with random errors. For this purpose we used in ArcMap application of ArcGIS 9.1 software the control of topology, thus we eliminate overlapping or areas currently absent. We also reviewed the final area of the examined area. The evaluation of changes was taken place by the overlaying of layers in GIS software ArcView 3.2. From the overlaying layers through a script we calculate contingency tables of transformation of individual land cover classes in both absolute and percentage terms.

4. RESEARCH RESULTS

Land cover of investigated territory has undergone significant changes especially in the late 18th and mid-19th century in connection with the development of mining and metallurgy. Changes in the time period 1958-2009 (maps 1, 2, in table 1 are listed the various changes in land cover classes in light gray color are highlighted the unchanged areas and in dark gray color are highlighted the most significant of changes) were reflected earlier in the change of phytocoenological structure of forests class, compared to the original composition that has been influenced mainly by planting spruce as fast-growing trees (instead of the original climax communities of beech forests harvested to produce charcoal and mining stiffeners past). From the original forest communities they retained only a small area in the northern part of the investigated territory. In 1958, in the studied area had the largest representation the coniferous forests whose area was in 2009 decreased by 427.8 hectares at the expense of mixed forests.

Changes were also in the classes grasslands mainly without scattered trees and shrubs that are transformed from 29.5% (119.8 hectares) into coniferous forests with continuous canopy (3.1.2.1). This class has been extended also to expense of the natural scrub (about 46.8% transformation). Soil cover of the examined area is highly contaminated by emissions from industrial manufacturing of the factory “Kovohuty” in Krompachy. In the years 1992-1994 were removed some areas from the agricultural land fund and grassed on the area of about 63.5 hectares. In the class of the arable land without dispersed trees and shrubs in the years 1958-2009 there was a marked decline namely 70.3% (31.5 hectares) of it was transformed into a mosaic of fields, meadows and cultures with scattered houses (cottages). Another significant step that influenced the overall character of the landscape structure was the building of Ski resort in Plejsy. While before the formation of the Ski resort the city Krompachy had mainly industrial and service functions and residential function after the construction of the Ski resort also gained the recreational function. The class of artificial surfaces is represented by technicized and urbanized surfaces which are for 57 years has significantly changed. The city Krompachy noticed the growth of settlement building to the south along the line of the Slovinský potok (brook) valley, but also laterally. The most significant increase occurred in the northwestern part of the urban area along the newly built road connecting the Ski resort Plejsy with the city. From extent of the industrial and commercial areas registered in 1958 nearly 17 % (exactly 16.9 %) was transformed into the Tailing pond Slovinky and an industrial landfill “Halňa” located on the right bank of the Hornád (river) on the north border of the built-up area of city. The main reason of this transformation was inaccurate noticing of situation on the military topographic map from 1958, where the boundaries of the Tailing pond and industrial landfills were not separately identified. The build-up area of the village Kolinovce has grown on both banks of the Hornád (river). The settlement area grew westward along the road and southwards to the railway line. The class of the built-up area summary of classes 1.1.2.2 and 1.1.2.2 for the years 1958 and 2009 was increased by approximately 79.4%, which in absolute terms represents approximately 37.7 hectares.

By the extensive mining and metallurgical activities was created two classes of land cover: the stone-pits and the industrial waste landfill areas. The researched territory has very damaged environment from the long-term exposure extreme pollution from production activities of the metallurgical industry. Tailing ponds and landfills of industrial waste and MSW (municipal solid waste) occupy 29.6 ha. For a more comprehensive evaluation of the development of land cover changes we were compared the area of land cover classes on the second hierarchical level. By the shades of purple and red color in Graph 1 we visualized the industrial and urbanized areas, by yellow and brown the agricultural areas, by green the forest and semi-natural areas and by blue the water. The Graph 1 shows that the extent of the area with the agricultural function has significantly decreased from 1958 to 2009 (year 1985 – 111.9 hectares a year 2009 – 4.3 hectares). Overall, during the time period 1958-2009 the proportion of the extent of arable land has decreased by 96.2% and the extent of grassland by 43.6% (Fig. 1). The reduction of the extent of arable land has been caused by contamination of soil cover from industrial activity and by its removal from agricultural land. The forest and semi-natural areas on the second hierarchical level were represented by the classes of forest and scrubland and grassland classes. From 1958 to 2009 we noticed their growth. The proportion of the mentioned land cover classes has increased due to overgrowing grasslands by the liner and solitary vegetation. Changes in the class of water were not significant. In the years 1958-1960, their extent had been reduced approximately by 4.4 ha (20.3%, Fig. 1).

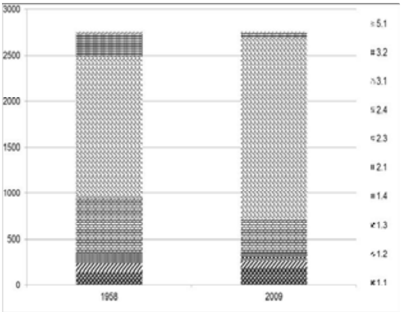

Figure 1: Changes in land cover in ha

Explanation: 1.1 urbanized (settlement) area, 1.2 industrial, commercial and transport areas, 1.3 areas of mining, landfills and construction, 1.4 areas of settlement (non-agricultural) vegetation, 2.1 arable land, 2.2 permanent crops, 2.3 grass areas, 2.4 heterogeneous agricultural areas, 3.1 forests, 3.2 shrubs and grass areas, 5.1 inland waters. Source: (own research)

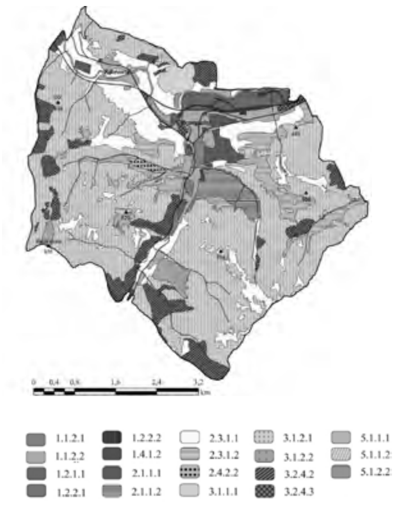

Figure 2: Land cover in 1958

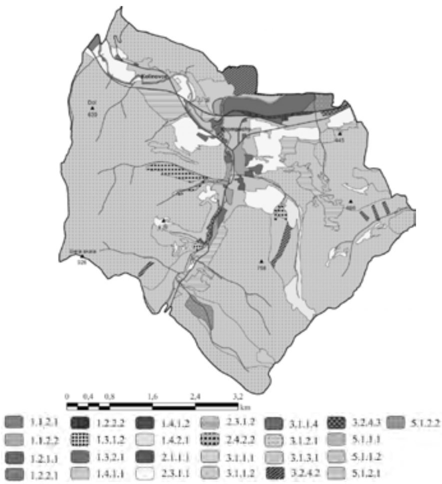

Figure 3: Land cover in 2009

Explanation to the figures 1 and 2:
1.1.2.1 discontinuous built-up area with multi-story buildings mostly without gardens 1.1.2.2 discontinuous area with family houses mostly with gardens, 1.2.1.1 industrial and commercial areas, 1.2.2.1 road network and adjacent areas, 1. 2.2.2 rail network and adjacent areas, 1.3.1.2 quarries 1.3.2.1 areas of landfills (dumps) 1.4.1.1 parks, 1.4.1.2 cemeteries, 1.4.2.1 areas of sports, 2.1.1.1 arable land largely without scattered (linear and solitary) vegetation, 2.1.1.2 arable land mostly with scattered (linear and solitary) vegetation 2.3.1.1 grasslands mostly without scattered trees and shrubs, 2.3.1.2 grassland with scattered trees and shrubs, 2.4.2.2 mosaic of fields, meadows and permanent crops with scattered houses (cottages) 3.1 .1.1 deciduous forests with continuous canopy, 3.1.1.2 deciduous forests with discontinuous canopy, 3.1.1.4 areas of wood vegetation and banks vegetation, 3.1.2.1 coniferous forests with continuous canopy, 3.1.2.2 coniferous forests with discontinuous canopy, 3.1.3.1 mixed forests formed by variety of trees with continuous canopy, 3.2.4.2 natural shrub 3.1.4.3 shrub forests, 5.1.1.1 rivers and brooks, 5.1.1.2 channels 5.1.2.1 natural lakes, 5.1.2.2 store water bodies

Table 1 Changes in land cover during the time period 1958-2009 (v ha)

Land cover classes	1.1.2.1	1.1.2.2	1.2.1.1	1.2.2.1	1.2.2.2	1.3.1.2	1.3.2.1	1.4.1.1	1.4.1.2	1.4.2.1	2.1.1.1	2.3.1.1	2.3.1.2	2.4.2.2	3.1.1.1	3.1.1.2	3.1.1.4	3.1.2.1	3.1.3.1	3.2.4.1	3.2.4.3	5.1.1.1	5.1.1.2	5.1.2.1	5.1.2.2	Together
1.1.2.1	16,6	0,1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**16,7**
1.1.2.2	7,2	98,5	2,8	0	0	0	0	2,3	1,0	0	0	2,6	4,1	0,1	0	0	0,5	4,4	0,3	0,2	0,1	1,5	0	0	0	**125,5**
1.2.1.1	0	0,4	52,3	0	0,8	0	11,3	0	0	0	0	1,1	0,2	0	0	0	0,6	0	0	0	0	0,3	0,1	0	0	**67**
1.2.2.1	0	0	0	10,7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**10,7**
1.2.2.2	0	0	1,7	0	12,7	0	0,6	0	0	0	0	0	0	0	0	0	0,1	0	0	0	0	0	0	0	0	**15,1**
1.4.1.2	0	0,2	0	0	0	0	0	0	2,5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**2,8**
2.1.1.1	0,9	3,4	3,4	0	0	0	0	0	0	0	3,2	31,5	0	0	0	1,6	0	0,5	0,2	0	0	0	0	0	0	**44,7**
2.1.1.2	0	17,3	0	0	0	0	0	0	0,6	12,9	0	24,2	0	4,8	0	0	0	6,3	1,1	0,1	0	0	0	0	0	**67,2**
2.3.1.1	0,4	23,9	3,8	0	0	0	0	0	0,4	19,7	0,8	108,6	72,8	0	6,4	0,7	1,8	119,8	37,3	5,3	0	2,2	0,3	0,1	1,0	**405,2**
2.3.1.2	1,0	3,4	0	0	0	0	0	0	0	0	0	27,6	44,5	12,8	3,2	0	0	51,9	45,6	0	0,3	0	0	0	0	**190,3**
2.4.2.2	0	0	0	0	0	0	0	0	0	0	0	0	0	8,3	0	0	0	0,3	0	0	0	0	0	0	0	**8,6**
3.1.1.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	18,2	0	0	6,8	1,8	5,1	0	0	0	0	0	**31,9**
3.1.2.1	0	1,2	0	0	0	0,7	4,2	0	0	6,6	0	2,2	4,7	1,4	6,1	0	0	1003,5	427,8	13,7	0	0	0	0	0	**1472,1**
3.1.2.2	0	1,5	0	0	0	0	0	0	0	0	0	0	7,6	0	0	0	0	27,3	0,1	0	0	0	0	0	0	**36,4**
3.2.4.2	0	0,2	0	0	0	0,8	11,8	0	0	2,1	0	0	0,4	0	15,4	0	0	107	67,0	18,8	5,2	0	0	0	0	**228,7**
3.2.4.3	0	1,5	1,5	0	0	0	1,2	0	0	0	0	1,1	0	0	0	0	1,1	0	0	0	5,2	0,3	0	0	0	**11,9**
5.1.1.1	0	1,7	2,5	0	0	0	0,5	0	0	0	0,4	1,9	0	0	0,1	0	1,8	0	0	0	0,1	8,3	0	0	0	**17,4**
5.1.1.2	0	0,6	0,2	0	0	0	0	0	0	0	0	0	0,4	0	0	0	0	0	0	0	0	0	0,3	0	0	**1,4**
5.1.2.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,1	0	0,2	0	0	0	0	0	0	0	2,6	**2,9**
Together	**26,2**	**153,7**	**68,2**	**10,7**	**13,5**	**1,5**	**29,6**	**2,3**	**4,4**	**41,4**	**4,3**	**200,7**	**134,7**	**27,3**	**49,4**	**2,3**	**6,0**	**1327,7**	**581,2**	**43,2**	**10,9**	**12,8**	**0,7**	**0,2**	**3,6**	**2756,5**

Explanation: 1.1.2.1 noncontinual built-up area with multi-storey buildings mostly without gardens 1.1.2.2 noncontinual area with family houses mostly with gardens, 1.2.1.1 industrial and commercial areas, 1.2.2.1 road network and adjacent areas, 1.2.2.2 rail network and adjacent areas, 1.3.1.2 quarries 1.3.2.1 areas of landfills (dumps) 1.4.1.1 parks, 1.4.1.2 cemeteries, 1.4.2.1 areas of sports, 2.1.1.1 arable land largely without scattered (linear and solitary) vegetation, 2.1.1.2 arable land mostly with scattered (linear and solitary) vegetation 2.3.1.1 grasslands mostly without scattered trees and shrubs, 2.3.1.2 grassland with scattered trees and shrubs, 2.4.2.2 mosaic of fields, meadows and permanent crops with scattered houses (cottages) 3.1 .1.1 deciduous forests with continuous canopy, 3.1.1.2 deciduous forests with discontinuous canopy, 3.1.1.4 areas of wood vegetation and banks vegetation, 3.1.2.1 coniferous forests with continuous canopy, 3.1.2.2 coniferous forests with discontinuous canopy, 3.1.3.1 mixed forests formed by variety of trees with continuous canopy, 3.2.4.2 natural wort, 3.1.4.3 shrub forests, 5.1.1.1 rivers and brooks, 5.1.1.2 channels 5.1.2.1 natural lakes, 5.1.2.2. artificial lakes

5. DISCUSSION AND CONCLUSION

The land cover changes in researched region originated mainly from the second half of the 18th and early 19th centuries. They were mainly related to mining and processing of copper and iron ore which has been associated with the cutting down the beechwood. Land cover changes in the term 1958-2009, which can be considered from the viewpoint of the above activities in the region as a relatively short time, are also significant. As a result of mining and industrial activities there were created specific land cover classes belonging to the urbanized and technicized areas. These are areas of tailing ponds, the landfills of the dangerous and municipal waste (ecological loads), stone-pits, which together represent an area of 31.1 hectares. The biggest and dangerous ecological loads include flotation “Tailing pond” of Slovinky in cadastral territory of Krompachy (originated in 1969, here had been stored the flotation sludge extracted from copper ores and slag from Kovohuty for 30 years, area of 16.5 hectares, 2.7 hectares are reclaimed part, the volume of sludge is 4.8 mil. m^3) and the second largest environmental load in Slovakia is landfill of dangerous waste “Halňa” nearby of Kovohuty in Krompachy (area of 10 ha, 1.7 mil. tons of dangerous industrial and municipal waste, today reclaimed and monitored from the aspect of leakage of contaminated water into the Hornád (river). The landfill "Halňa" was founded in the mid of 18^{th} century. After World War II., when it came to industrial development, is here mainly exported iron ore slag and wastes of metallurgy of copper and zinc. Since the mid-60s of the last century there were stored the sludge from the production of copper, zinc, manganese and sulfuric acid. Southeast part of the landfill was later used for municipal waste. Solid wastes contain besides the heavy metals also the other such as lead, arsenic and cadmium. Liquid wastes containing cyanide are stored in concrete pools. The municipal waste is stored from 1964 on an area of 1.4 hectares with an expected capacity of 160 000 m^3. The territory belongs to the class V. class of environment level and it is heavily and extremely polluted. The negative impact of mining and industrial activity was also reflected in arable land. In time period 1958-2009 this land cover class underwent to the significant changes. While in 1958 it occupied 111.9 hectares, due to contamination of soil cover by heavy metals had been gradually removed from agricultural land and the crop production had been banned. In 2009 the arable land occupied only 4 hectares.

Significant intervention in the landscape structure was observed in the class 2.3.1.1 grasslands largely without scattered trees and shrubs which of the area decreased in connection with the gradual conversion to the forest communities. It was a transformation in favor of class 3.1.2.1 coniferous forests with continuous canopy, which increased their area of approximately 29.5% (119.8 hectares). The changes were also noticed in functional use. Originally industrial and mining region changed after the mining activity subdued in 1999 into the area of the high long-term unemployment. It was assumed that changes in the economic situation of the region could be transformed by the building up the Ski resort Plejsy. Since 1991 the area of the ski resort has become the internationally sought-after center of Alpine skiing thanks to with extensive investments. In recent years, the resort has been significantly completed. The highest attendance was recorded in the years 2001-2003, but during the last two years the traffic significantly decreased annually by about 20 000 visitors.

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CHANGES OF THE STRUCTURE OF HIGH-MOUNTAINOUS LANDSCAPE INFLUENCE ALPINE SKIING ACTIVITIES

Iveta Rakytová[1] and Ivana Tomčíková[1]

[1] Department of Geography, Faculty of Education, Catholic University in Ružomberok,
Hrabovská cesta 1, 034 01 Ružomberok, Slovak Republic,
e-mails: iveta.rakytova@ku.sk, ivana.tomcikova@ku.sk

ABSTRACT

Slovakia is a country with the representation of different landscape types. One of them is the high-mountainous landscape, which is in terms of its use a simultaneously unique and vulnerable.

The aim of the paper is monitoring of the changes in the structure of the high-mountainous landscape influence alpine skiing activities for example the resort Jasná Chopok North. It is a ski resort with national importance situated in the Low Tatras National Park. In the past, in the analyzed area was dominated activities, mainly connected with pasturage and timber harvesting. Since the 70s of the 20th century has seen a tourism boom which led to the construction of infrastructures ensuring a ski activities – building up of the mountain transport facilities (cableways, ski lifts, chair lifts) and slopes.

Key words: *structure of high-mountainous landscape, development of tourism, the resort Jasná Chopok North*

1. INTRODUCTION

Slovakia is a landscape with a spectrum of mountainous and high-mountainous areas, in which intensively develop tourism, particularly in the resorts of winter tourism. The study area is the resort Jasná Nízke Tatry, specifically the northern part Jasná Chopok North tourist resort. It is a frequetly visited high mountain area, which is situated from the spruce forest vegetation zone up to the sensitive alpine meadows and bare rocks zone with unique natural resources and the incidence of rare and endemic species. The studied area is one of the most important Slovak resorts lying in the Low Tatras National Park – both in the Low Tatras protected bird area and the territory of the European significance Ďumbier Low Tatras.

The main aim of paper was to analyse the changes in the structure of the high-mountainous landscape developed from alpine skiing activities for example the resort Jasna Chopok North. Other objectives were to describe the history of the development of tourism in Demänovská Valley, where lies study area, characterized by natural conditions, as well as transport infrastructure of the resort.

High-mountainous landscape structure is a type of fossil landscape structure, therefore it is very sensitive and vulnerable. All processes which are currently in progress in the landscape, cause its changes. The most destructive natural processes include water erosion and snow avalanches, which cause destruction of the surface. Their effect is compounded by the action of anthropogenic impacts, especially land-clearing (cutting down the forest on the slopes, vegetation cover stomping on hiking trails in and around tourist facilities etc.).

2. DATA AND METHODS

Secondary landscape structure was evaluated in three time periods (1949, 2007, 2013). Data were gathered by photo-interpretation of aerial photos. For 1949 year we used grayscale aerial photos on which geometric transformation and georeferencing was applied. For 2007 we used colour orthophotos in scale 1:5000 provided by EUROSENSE Slovakia as well as State base maps in scale 1:10 000. For 2013 we tracked changes in landscape using satellite images available via Open Layers plugin in QGIS. In April 2014 we verified interpreted data and latest changes in landscape by field survey. Photo-interpretation, basic quantification and overlay analysis were done in QGIS 2.2. The basic criteria for vectorization were set up as follows: minimum size of vectorized area is 625 m2 and minimum width of vectorized line is 5 m.

For classification of secondary landscape structure we used the legend by Petrovič et al (2009). Their classification contains 193 classes of secondary landscape structure divided into six groups: 1 Tree and scrub vegetation, 2 grasslands, 3 agricultural crops, 4 bedrock outcrops and raw soils, 5 surface water and wetlands, 6 settlements and built-up areas. In the analyzed area we have identified the 15 landscape classes.

The model area – Demänovská Valley and Jasná resort Nízke Tatry, mainly its northern part – has been selected on the basis of progressive changes over the past five years, particularly including a fast development of tourism and associated changes.This area used for hiking and skiing to the highest altitudes (Ďumbier peak 2,043 m, Chopok peak 2,024 m), belong among especially valuable areas and lies in alpine national park – the Low Tatras National Park (NAPANT).

Uniqueness and significance of Demänovská Valley lies in its two main functions and their mutual interaction. Firstly, it is extremely important conservation of natural values and secondly, the recreation and tourism of international importance in excellent natural conditions suitable for free as well as bound tourism. A contradiction between the nature conservation and economic objectives, between the tolerable load capacity of the area by incoming visitors and the tourism itself, between the preservation of natural beauty providing an excellent tool for the recovery of mental and physical strength and recreation, relaxation and recovery itself often dealt with in the area.

3. THE DEVELOPMENT OF TOURISM IN DEMÄNOVSKÁ VALLEY

The first historical references to the analyzed area come from the 13th century, when Demänovská valley began to appear and visit the seekers of gold, silver and other metals. The first written record of the Demänovská valley dates from 12th May 1299, when the existence and appearance of the Dragon cave was documented (it is called the Ice cave today). At the end of 13th and the beginning of 14th century several villages in the mouth of the valley were founded (Bodice, Pavčiná Lehota, Ploštín, Demänová, Palúdzka). The first human settlements in the valley were probably chalets and shepherd's huts built by incomming shepherds and woodcutters. Objects at the end of the valley, which were used for digging out iron ore, in particular hematite and siderite, originated from around the 18th century. Mining was stopped in the 19th century. There remained comfortable mining trails and some submerged tunnels after minning.

At the beginning of the 20th century, the valley was began to be associated with the development of tourism, which especially the discovery of caves contributed to.

In 1719, Juraj Buchholtz junior personally explored the Demänovská Ice Cave. This Ice cave was the main impetus for the development of tourism in Demänovská Valley. Already in 1885, there was the first wooden hostel built under the cave entrance. After a fire in 1906, a new and still standing “Stone cottage” was built in its place. The discovery of the cave launched the construction of tourism facilities such as transport, roads and provision of basic services and access trails.The interest in the valley increased dramatically after the discovery of the Cave of Freedom and the partial sclosure for tourists in 1924. In 1935, a road from Liptovský Mikuláš, which ended just below the caves, was expanded and asphalted.

Places located higher in the valley area – Lúčky, Repiská, Vrbické pleso – were only accessible by foot or carriage during the first World War.

Except for a few private chalets and cottages, there were no other objects of tourism. In 1935, a serpentine hiking trail from the end of Demänovská Valley to Krupovo seat was built and a small hut at Vrbické pleso was built three years later. Attenuation of the development of tourism and sports occurred during the World War II. After the war, the construction and expansion of tourism facilities occurred in the upper part of the valley. The key for the development of tourism in Demänovská Valley was the construction of the first chairlift from Jasná to Chopok in the 1949.

Hotel buildings and reconvalescent homes for recreation, relax and sports began to be built in the vicinity of the valley station. The construction of technical facilities and services like new ski lifts, ski and cross-country ski trails, as well as services like Mountain Rescue Service with the Centre of avalanchine prevention began. The road from Jasná to Vrbické pleso was extended. After the construction of ski resorts, skiing at the resorts Záhradky and Otupné was started. Construction of new objects was carried out in parallel, in part Repiská, in the middle of the valley.

The resort was a part of the town Liptovsky Mikulas and it’s town part – Demanova – until 1964. The increase in permanent population as well as the overall development of the Demänovská Valley were the impetus to the creation of a separate municipality Demänovská Dolina which dates back to the 1st July 1964. The area of the new municipality was defined as the cadastral areas of Demanova and Bodice and the grouping of all recreation facilities located in Demänovská Dolina.

The current ski resort is under the administration of Tatra Mountains Resort (TMR). Originally, before the revolution in 1989, it belonged to the management of the state enterprise Javorina, and, in 1992, a stock company called SKI Jasna was estabilished with the National Property Fund of the Slovak Republic, which was the predecessor of TMR, which owned half of the Slovak insurance company, and the other half was sold in small-scale privatization. That included all-lifts and four hotels in the area. In 2003, there was a change in the trade name to Jasna Low Tatras, stock company, and, in 2009, shareholders decided to rename the company to Tatry Mountain Resorts, stock company (*http://www.tmr.sk/data/modules/document.manager/documents/_users/oznamenia/Tatry_mountain_resorts__a.s/2005/2006_09_30Vyrocnasprava2005.pdf).*

4. JASNÁ CHOPOK NORTH RESORT

The Jasná Nízke Tatry resort, particularly its northern part Jasná – Chopok North, it is the largest and most important recreation centre in Slovakia. It is situated in the highest part of the Demänovská Valley in the north of the Low Tatras, in the Žilina region, in southern part of the district of Liptovský Mikuláš (Figure 1,2).

This resort is divided into three smaller centres interconnected by cableways and ski lifts: Záhradky centre (900-2,004 m a.s.l.), Biela Púť (1,117-2,004 m a.s.l.) and Otupné centre (1,141-2,004 m a.s.l.).

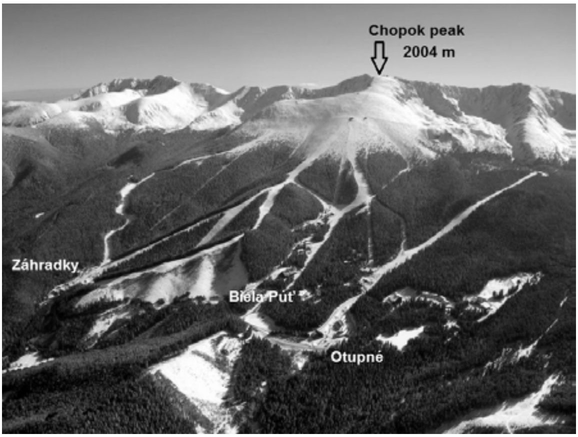

Figure 1: View of the resort Jasná Chopok North (from peak Siná)
Source: autors

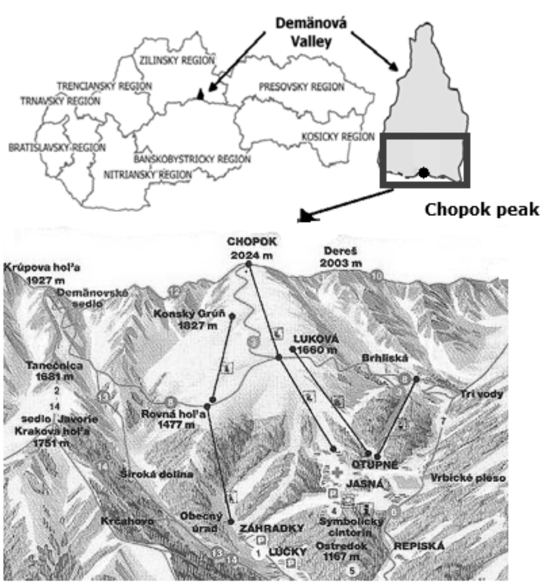

Figure 2: Location of ski resort Jasná in Slovakia
Source: autors

4.1. Natural conditions

From geological point of view the most important building elements of the Demanovská valley are crystalline core, Mesozoic units and Quaternary sediments. The tourist resort is situated in the southern part, which is formed by the crystalline complex (granodiorites, less paragneisses) with typical shapes of periglacial processes and strong glacial erosion. The quaternary sediments include a fluvioglacial deposits and glacial moraines. In terms of elevation southern part of the valley belongs to the high highlands (the height span 1501 m and more). The study territory under the climate classification of Slovakia is located in a cold area in its two sub-regions: in the cool mountain sub-region (C2) with an average annual temperature from 10 to 12 °C and cold mountain sub-region (C3) with an average annual temperature below 10 °C (Lapin et al., 2002). A relatively large forest cover area and exposure of the slope has an impact on the temperatures, too. Forests diminish temperature differences between summer and winter, exposure of the slope has an effect on temperature variation between different illuminated slopes of the valley. The average annual precipitation total in the period 1981-2007 constituted 1325 mm (station Jasná), 1158 mm (station Luková) and 1139 mm (station Chopok). The greatest long-term average precipitation totals occur in the summer months (June and July). The lowest totals are within the winter semester. Altitude of various parts of the territory and the location of the prevailing rain carrier flow convection (more precipitation falls on the windward slopes) has an impact on the amount of rainfall. The snow cover is mostly formed at the end of September and by the end of May it is gone. In the area of the main ridge, period of snowfall takes an average of 250 days. Within the general flow of air, the wind conditions of Demänovska valley are conditional by orographic increase or decrease of the wind. These are especially winds, which occur on both sides of the main ridge of Low Tatras. The lateral slopes have more complex distribution of winds as the bottom of the valley. The average wind speed increases with increasing attitude. The ridge areas are dominated mainly by north-south flow (or sometimes from the southwest and northwest) (Šavrnoch, 1978).

The Demänová valley is drained by the river Demänovka (left tributary of Váh river) and its tributaries Zadná Voda and Priečny Potok. Demänovka has a length of 18.3 km and stream flows into Váh river in Liptov basin, west from Liptovsky Mikulas. The catchment area has 62.6 square kilometers. It springs in the boulder under Krúpova hoľa, takes a left tributary Luková, which springs under Chopok, and from the right side takes Podrožianka, stream Krčahovo. Then it takes, on the western edge of Lúčky, from the left side Priečny potok, springing also under Chopok, with a collecting area of 3.41 square kilometres. Demänovka river flows to the karst region in Lúčky (950 m), where is – depending on the size of flow – partly or fully immersing into the underground. Under Poľana springs Zadná Voda, which catchment area covers 15.8 square kilometres and takes on tributaries Hlboká, Vyšná and Nižná Šuľkovianka, Kobylia, Ploská and, before the entrance into the karst area, takes from the right Otupianka, stemming under the hills of Dereše. At a height of 839 m n. m., part of the water dives underground. In the underground, it flows into Demänovka. In karst area (Lúčky and Repiská area) the water flows, depending on the size of the flow, completely or partly into the underground through dives. On the surface, only a dry trough remains, inundated by persistent rainfall or during spring snowmelt (Šavrnoch, 1978). Demänovka and its tributaries have participated in the formation of Demänová cave system – the system of nine levels. Total underground flow of Demänovka – from massive waterline to the seepages – is long about 3 km, than flows on the surface, and in the high of 700 m Demänovka leaves the Low Tatras and enters the Liptov basin. The average annual flow rates at the mouth of Demänovka in Liptov basin in the years 1969 to 2009 were 812-1861 $l\ s^{-1}$ (Blaškovičová et al., 2011). Almost the whole Demänová Valley belongs to the highlands of snow-rain drainage regime with high water levels in April-June, the highest flow rates in May and the lowest flow rates in January and February. Areas of main ridge of Low Tatras have transiently snow drainage regime of high water levels in April-July, respectively in August, the highest flow rates in May and June and the lowest flow rates in January and February. The average annual runoff is 25 to 35 $l\ s^{-1}\ km^{-2}$ (Droppa, 1976, Šavrnoch, 1978). In the valley of Zadná Voda is situated a tarn Vrbické pleso. It is 4.16 meters deep, has an area of 6873 m^2 and it is the largest natural lake in the Low Tatras. Smaller lakes are in glacial kettles of Luková and under Dereše.

In dependence of the difference of the rock substrate, rugged terrain and climatic conditions in Demänová valley, several soil types have been created. On the basis of crystalline complex, above the forest line, are Lithic Leptosols modal, accompanied by the cambisols, podzols and local podzolic soils. Humus horizont of these soils is strongly gravelled and stony. Up to 1400-1500 m are widespread podzolic soils Cambisols, accompanied by Lithic Leptosols soils. In dependence of the relief there are different subtypes of rendzinas on the carbonate base (Šály, Šurina, 2002). Depending on the geological structure of the area, variety types of soils have been created. On crystalline rocks sandy-loam soil incurred (Šavrnoch, 1978).

Demänová valley, according to phytogeographical division of Europe (Plesník, 2004), belongs in Holarktis, in his divisions it belongs to the Euro-West Siberian sub-region and Central European provinces. In terms of the phytogeographical division of Slovakia (Futák, 1972) it belongs in the Western Carpathian flora (Carpaticum occidentale), to the circuit of flora of high (central) Carpathians (Eucarpaticum) and its district of Low Tatras. The majority of the Demänová valley is covered with forests. On the territory there are alpine communities on silicates, subalpine mountain pine communities on acidic substrates, pine forests blueberry, fir and spruce-fir forests, spruce-pine forests with occurrence of larch, in the east there are dropped beech forests in mountainous areas. The vegetation is divided into several stages. Fir-beech degree up to 800-850 m, fir-beech and spruce, which goes up to 1000-1050 m; spruce degree extends up to 1400-1500 m; degree dwarf pines extends to an altitude of 1800 m and it build on alpine meadows.

The territory of Demänová valley from zoogeographical subdivisions belongs to the province of the Carpathian Mountains (Montium carpathorum) – the Low Tatras circuit. Since the Demänová valley vegetation zones are represented from alpine zone to the subalpine zone až po pásmo podhorské, it provides favourable conditions for different species. Apart from several species of beetles, butterflies, amphibians and birds; ungulates, for example deer (*Cervus elaphus*), roe deer forest (*Capreolus capreolus*), wild boar (*Sus scrofa*) and predators, for example brown bear (*Ursus arctos*), lynx (*Lynx lynx*) and wolf (*Canis lupus*) live here as well. In the high altitudes lives mountain marmot (*Marmota marmota*) and Tatra chamois (*Rupicapra rupicapra tatrica*).

5. CHANGES IN LANDSCAPE STRUCTURE OF THE ANALYSED AREA

Skiing and tourism have a long tradition in Demänovská Valley. The first skis werebrought here by the skinner Kornel Stodola in the late 19th century. They were used especially by foresters and postmen in mountain areas for work. Gradually, the inhabitants of the region showed increasing delight in skiing, especially from the highest point – Chopok.

Since the construction of the first lift in the analyzed area, marked intervention in the structure of the landscape occured. In Figure 3 and Table 1 and 2, we can see that during the years 1949-2013, the impact of human activities was mainly reflected in elements related to tourism activities. Changes occurred by increases in areas with the following elements: Uncategorized destructed areas (mainly slopes), hotels and pensions, and moreover paved roads, cableway routes cableway stations and parking places.

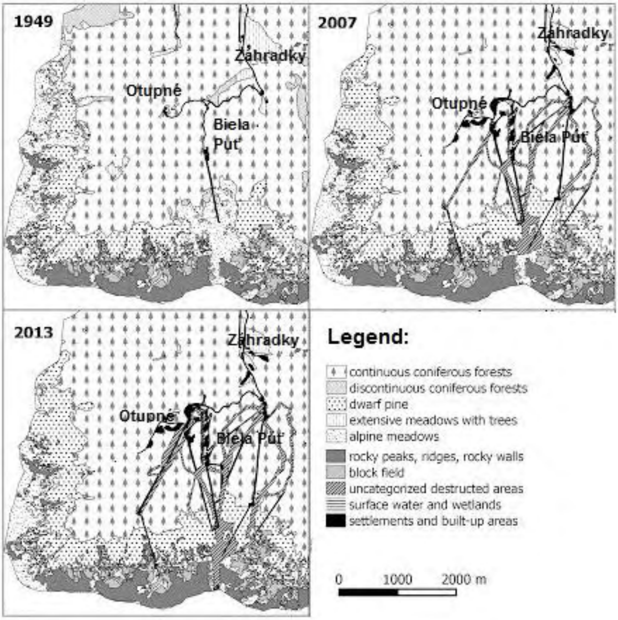

Figure 3: Landscape structure in 1949, 2007 and 2013 of the ski resort Jasná Chopok North
Source: autors

In 1949, the first section of the cableway to Chopok (Von Roll) was put into operation and in 1954, the second section Luková – Chopok with the length of 1090m was opened. A cableway was in operation on the northern side of the peak Chopok on the I. and II. section of the cableways route: Jasná – Luková – Chopok (1226 – 1670 – 2004 m). In 1957, both sides of the Chopok peak were already united (south to north) by cableways. This interconnection was in operation until 1988, when due to the unsatisfactory technical parameters, both cableways had to be decommissioned. It operated on the slopes Pretekárska, Májová and Spravodlivá.

Nevertheless, we can conclude that the ski resort in Jasná was the only one that at least marginally met the criteria imposed on the number of cableways in the Alps resorts. For this reason, in the mid seventies, the local transport system was decided to be modernized. In the first period of the modernization, two sections of the cableway Záhradky – Rovná hoľa and Rovná hoľa – Konský Grúň were built (length 1660 m and 1060 m, broken line) by the French company Poma (shortened name of Jean Pomagalski). Poma cableways were imported and assembled by the company Tatrapoma in Kežmarok. Subsequently, the lower part of the cableway Jasná – Luková was reconstructed and gradually also ski lifts (Table 3) and slopes were built – with names Turistická, Fis slalom, Tourist, Majstrovská, Biela Púť and later Jelení Grúň in the part Záhradky.

Table 1: Condition of secondary landscape structure Demänovská valley – area of ski resort Jasná in selected periods

description of the element	1949		2007		2013	
	ha	%	ha	%	ha	%
continuous coniferous forests	1338,68	51,51	1428,94	54,98	1402,39	53,97
discontinuous coniferous forests	34,64	1,33	2,24	0,09	2,25	0,09
dwarf pine	476,77	18,34	519,95	20,01	519,48	19,99
extensive meadows with trees	68,25	2,63	21,96	0,84	20,75	0,80
alpine meadows	412,8	15,88	260,49	10,02	249,94	9,62
rocky peaks, ridges, rocky walls	152,21	5,86	152,25	5,86	152,22	5,86
block field	100,54	3,87	100,45	3,87	100,30	3,86
uncategorized destructed areas	0,11	0,00	76,4	2,94	106,39	4,09
tarns	0,62	0,02	1,69	0,07	1,69	0,07
water reservoirs for snow	0,00	0,00	0,79	0,03	0,78	0,03
hotels and guesthouses	0,1	0,00	4,99	0,19	5,79	0,22
cottage settlements	6,33	0,24	6,7	0,26	6,43	0,25
main roads	1,56	0,06	2,31	0,09	2,49	0,10
moreover paved roads	0,11	0,00	4,28	0,16	4,44	0,17
forest and field roads	3,49	0,13	0,65	0,03	0,59	0,02
parking places	0,34	0,01	2,49	0,10	2,58	0,10
cableway routes	1,93	0,07	10,11	0,39	17,17	0,66
cableway stations	0,43	0,02	2,22	0,09	3,23	0,12

Source: autors work

Table 2: Changes in secondary landscape structure in the Demänovská Valley Demänovská valley – area of ski resort Jasná in the years 1949-2013

description of the element	%	%	%
	1949/2007	2007/2013	1949/2013
continuous coniferous forests	6,74	-1,86	4,76
discontinuous coniferous forests	-93,53	0,45	-93,50
dwarf pine	9,06	-0,09	8,96
extensive meadows with trees	-67,82	-5,51	-69,60
alpine meadows	-36,90	-4,05	-39,45
rocky peaks, ridges, rocky walls	0,03	-0,02	0,01
block field	-0,09	-0,15	-0,24
uncategorized destructed areas	69354,55	39,25	96618,18
tarns	172,58	0,00	172,58
water reservoirs for snow	0,00	-1,27	0,00
hotels and guesthouses	4890,00	16,03	5690,00
cottage settlements	5,85	-4,03	1,58
main roads	48,08	7,79	59,62
moreover paved roads	3790,91	3,74	3936,36

forest and field roads	-81,38	-9,23	-83,09
parking places	632,35	3,61	658,82
cableway routes	423,83	69,83	789,64
cableway stations	416,28	45,50	651,16

Source: autors work

Status and changes in the period of 1949-2007

In the period of 1983-1984, the gondola cableway Otupné – Brhliská was built, which was the first and for a long time the only gondola cableway in Slovakia built by Tatrapoma. It was built according to the latest technologies. The cableway Otupné – Brhliská was supposed to be the first section. After its completion, a second section from Brhliská up to the peak Dereše (peak lying in the vicinity of Chopok) was to be built. But it was never built. The slopes Rodinná and Vrbická were built.

In 1989, four-seats chair lifts were built by Tatrapoma on the route Otupné – Luková and the slope Otupné. In the summer of 1996, the three-seats chair lift Otupné – Luková was replaced by four-seats detachable cableway from the brand Doppelmayr.

In 1997, after disengaging the northern branch of the cableway (Koliesko – Luková – Chopok), the first section on the north side of the cableway route Jasná-Luková was replaced by four-seats chair lift.

Of great importance for the further development of the resort was the change of the owners in 2003, when the TMR company became the new owner of the resorts. Claims for quality of ski resort were grown, it was led to the further modernization. A new modern 8-seater Doppelmayr chairlift was built.

Its route was extended from 1588 to 1960 meters to the Hotel Grand, thus the lower lift station got closer to the hotel and thus also to one of the main parking places of the resort. It was put into operation in 2009.The development of the resort also helped the development of accommodation facilities (until 2007, 13 hotels were estabilished, the oldest one in 1950).

Table 3: Length and level of difficulty of ski slopes in resort

Level of Difficulty	Length (m)	in precent
easy	9240	38,1
medium	10063	41,5
difficult	4941	20,4
together	24244	100,0

Source:http://www.lgtrade.sk/en/jasna[cit. 15. 6. 2015]

Status and changes in period 2007-2013

In 2010, the operation of the new 6-seats chairlift Záhradky – Priehyba started. In 2012, the new FUNITEL was put into operation on the north side of Priehyba and a new chairlift on the south side of the peak Chopok was built. So, after 15 years, both sides of Chopok were joined by cableways.

So Priehyba became the transport node, where an existing 6-seater chairlift from Záhradky meets the aforementioned FUNITEL and TWINLINER – a new ground cableway that unites Biela Púť to the lower station Funitels.

This allowed a smooth ride from the parking lot to the top of the peak Chopok (http://tram.rusign.com/cz/ld.htm#2.07. Jasná – Luková – Chopok – Kosodrevina – [cit. 15. 6. 2015]; http://tmr.sk/data/upload/short.messages/v-prvy-vikend-svojej-prevadzky-nove-6-sedackove-lanovky-dokazali-svoju-technicku-pripravenost._3_20130713_100447.pdf[cit. 15. 6. 2015]).

In January 2014, a 6-seater chairlift Lúčky – Vyhliadka that connected Záhradky and the lower situated Lúčky was put into operation. So skiers can ski directly from the parking lot on Lúčky. At the same time, the slope Lúčky and traverse Turistická – Lúčky which connects the aforementioned resorts was built.

Currently, we are talking about a single resort named Jasná Low Tatras, which is the largest resort in Slovakia with the best natural conditions for skiing and snowboarding. The current status of cableways a ski lifts lifts can be seen in Table 4 and Figure 4.

Table 4: Cableways and Ski Lifts in ski resort at present

Cableways/ Ski Lifts	Length in metres	Elevation in metres	Lower station m a.s.l.	Upper station m a.s.l.	Capacity	Type
Priehyba – Chopok peak	2,130	655	1,349	2,004	2,480	cabin
Grand – Brhliská	1,960	312	1,113	1,425	2,400	cabin
Jasná – Priehyba	360	124	1,225	1,349	324	cabin
Záhradky – Rovná Hoľa	1,720	463	1,028	1,491	2,700	chairlift
Záhradky – Priehyba	1,285	342	1,038	1,380	2,400	chairlift
Biela Púť – Jasná	816	101	1,117	1,218	1,800	chairlift
Jasná – Luková	1,251	544	1,126	1,670	1,800	chairlift
Otupné – Luková	1,725	514	1,156	1,670	1,200	chairlift
Rovná Hoľa – Konský Grúň	1,720	352	1,491	1,843	900	chairlift
Lúčky – Vyhliadka	1,879	344	943	1,287	2,460	chairlift
Záhradky	750	198	1,038	1,236	900	ski lift
Pekná vyhliadka	908	295	1,295	1,590	800	ski lift
Jasná – Luková	684	291	1,240	1,531	840	ski lift
Otupné – Zrkadlo	613	132	1,170	1,302	830	ski lift
Brhliská	324	28	1,387	1,415	400	ski lift
Otupné	405	69	1,153	1,222	500	ski lift
Children Ski Lift, Biela Púť	70	4	1,146	1,150	150	ski lift
Children Ski Lift, Biela Púť	70	4	1,146	1,150	150	ski lift
Children Ski Lift, Lúčky	120	7	943	947	250	ski lift

Source: lanovky.sk [cit. 15. 6. 2015]

In this period, the resort also included five new hotels, with three four-stars ones :Chalets Jasná de Luxe, Hotel FIS and Hotel Wellness Chopok.

The studied area includes 24244 m of slopes, from witch 9,240 meters (38,1 in precent) are easy, 10063 m (41,5 in precent) central and 4941 m (20,4 in precent) have a higher difficulty.

Table 5: Ski slopes in ski resort

Záhradky	*Length (m)*	*Vertical Rise (m)*	*Level of Difficulty*
Pretekárska	2000	820	medium
Pretekárska	606	139	difficult
Turistická	2900	422	easy
Slalomový svah	1200	327	difficult
FIS	3363	815	medium
Jelení Grúň	1500	314	medium
Lúčky	365	41	easy
Traverz FIS – Priehyba	850	40	easy
Traverz Turistická – FIS	70	-	medium
Traverz Turistická – Lúčky	750	150	easy
Biela púť	*Length (m)*	*Vertical Rise (m)*	*Level of Difficulty*
Májová	1450	436	medium
Spravodlivá	1800	436	difficult
Biela púť	925	101	easy
Majstrovská	1335	436	difficult
Traverz Luková – FIS	330	100	medium
Traverz Jelení Grúň –Koliesko	300	25	easy
Otupné	*Length (m)*	*Vertical Rise (m)*	*Level of Difficulty*
Derešský kotol	950	205	medium
Otupné	870	132	easy
Vrbická	1680	268	easy
Traverz Koliesko – Otupné	600	75	easy
Traverz Vrbická	400	-	medium

Source:http://www.lgtrade.sk/en/jasna[cit. 15. 6. 2015]

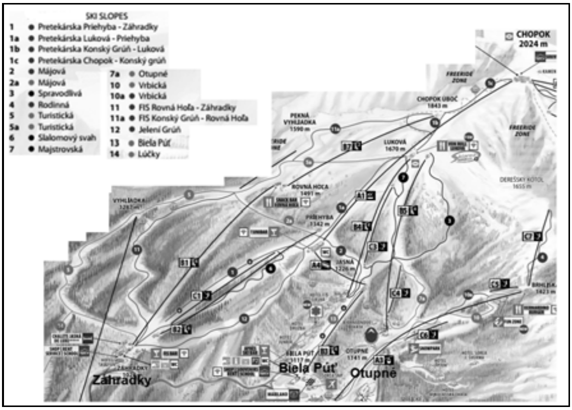

Figure 4: Ski slopes in resort Jasná in Slovakia
Source: autors
Adapted by: http://www.jasna.sk/uploads/media/jasna_map_a3_260215web.pdf. [cit. 15. 6. 2015]

6. CONCLUSION

In general, changes in landscape structure in the studied area were particularly reflected by building cableways and their stations, slopes, accommodation and catering facilities as well as parking lots. Since Jasná resort Nízke Tatry is regarded a resort of a nationwide and even supranational importance, the infrastructure providing the needs for the visitors had to be gradually adapted to this change. The most appreciable boom of the resort occurred under the current resort owner Tatra Moutains Resorts joint-stock company (TMR), which has invested a vast amount of money in modernization and construction activities in the past six years.

Comparing the maps in Figure 3, it can be concluded that in the area above the upper forest border, the impact of activities related to tourism does not show significant changes in the land cover. Dwarf pine growing here has not been considerably cut down to create slopes, because skiing here is possible only in case of a sufficiently thick snow cover hiding the dwarf pine. The most noticeable destruction can be seen near Luková cableway station (1,670 m a.s.l.) and Priehyba (1,380 m) due to their constructions. Destruction and treading down the surrounding vegetation is caused mainly by tourists in a summer season when taking a shortcut out of hiking trails. This leads to soil erosion at steep slopes of alpine areas.

On the other hand, the most significant changes were recorded below the upper forest border and is related both to building of tourism material-technical base and rising anthropization pressure, including ground adjustment (deforestation, artificial grassing of ski slopes, etc.), as well as destructive processes resulting from rising influx of visitors. The least stable areas are those previously deforested and then artificially vegetated ones accounting particularly for ski slopes at present. It is possible to observe visible forms of land cover destruction, i.e. the areas affected by water and anthropogenic erosion on the ski slopes nearby hiking trails and tourist facilities.

The downhill skiing and snowboarding itself poses no significant destruction to the soil environment and vegetation covering. However, major negative impact is caused by an adjustment of ski slopes using tracked vehicles and artificial snow slopes (rise in thermal conductivity of soil, lack of oxygen exchange between soil and atmosphere environment due to a compacted snow cover, excessive overwetting of surface soil layers, increased susceptibility to soil erosion, shortening of a growing season).

Construction activities – construction and reconstruction of cableways pillars, excavations for electrical lines, water and sewage pipes, etc. – is the next activity representing a significant impact on local ecosystems showing destructive effects on the soil environment and plant communities. In 2011–2012, when Funitel aerial lift was being constructed, unpaved roads for cars and construction machines were built up to the top of Chopok peak. At present they serve as hiking trails in summer and as a part of the ski slopes in winter.

Moreover, in 2013 the map was changed also by the construction of facilities providing gastronomic, accommodation, relaxation, sports and other services. It has also resulted into a considerable intervention in the local ecosystem and destructively influenced the soil environment as well as plant communities. However, the major impact is posed by summer tourism, when ski slopes are used by hikers as well as bikers.

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BROWNFIELD ABANDONMENT EXPRESSED BY CHANGES IN LAND COVER (1996–2012) – CASE STUDY OF BRNO, CZECH REPUBLIC

Hana Skokanová[1] and Marek Havlíček[1]

[1] Silva Tarouca Research Institute for Landscape and Ornamental Gardening, Lidická 25/27, 602 00 Brno, Czech Republic, e-mails: hana@skokan.net, marek.havlicek@vukoz.cz

ABSTRACT

Brownfields are sites previously used for numerous economic activities where the activity ceased to exist resulting in the abandonment of brownfields. This abandonment can be clearly seen in the state of individual sites expressed by deterioration of present buildings and slow vegetation succession on unsealed surface. The rate of abandonment can be easily captured by time series of aerial photographs. This contribution presents partial results of a project focusing on developing methodology for optimizing decision-making processes used in brownfield redevelopment. In particular, it focuses on changes in land cover in brownfields located in city of Brno, Czech Republic, that occurred between 1996 and 2012. In total, 124 brownfields have been identified and were classified according to their previous use: industrial, agricultural, military, railway, civic amenities, residential and other. Land cover changes were researched on the basis of orthophotos from three periods (1996, 2003, 2012) and we distinguished bare surfaces (without vegetation), surfaces with herb vegetation, woody vegetation, sealed surfaces, buildings, water and mixed surfaces. Results show that in 1996 buildings dominated with herb vegetation being the second most widespread surface. This corresponds with the fact that majority of brownfields was normally used. In 2003 surfaces with buildings and sealed surfaces decreased while bare surfaces increased; this period shows first marks of larger abandonment. Finally, 2012 reflects advanced brownfield abandonment expressed by increase in surfaces with both herb and woody vegetation. Regarding previous uses, railway, agricultural and residential brownfields displayed the highest rates of dynamic changes, while brownfields from civic amenities, other uses and industrial brownfields had the smallest dynamics. Between 1996 and 2003, transition to bare surfaces dominated in agricultural, industrial, residential and civic amenities while in military and railway brownfields transition to surfaces with herb vegetation and in other brownfields transition to surfaces with woody vegetation were predominant. Between 2003 and 2012 the situation was much simpler – with the exception of military and other brownfields where there was highest increase in the area of bare surfaces, vegetation succession in both stages (herb and woody) dominated.

Key Words: *brownfields; abandonment; land cover changes; orthophotos; Brno.*

1. INTRODUCTION

One of the present challenges for urban planners and developers is represented by underused, abandoned, derelict and often contaminated lands and premises, so-called brownfields (Frantál et al., 2015). These localities usually emerge as a result of several factors: a shift in industrial sectors (from traditional industries, such as mining, heavy and textile industries, to more modern ones), collapse of regimes (e.g. socialist regime in Central and Eastern Europe), global economic stagnation, investments fall, transfer to countries with lower labour costs, etc. (Frantál et al., 2015; Frantál et al., 2013; Kunc et al., 2014).

With decreasing availability and increasing price of agricultural or natural developable lands in highly populated areas and with increasing environmental public awareness about potential ecological burden, these sites are often sought to be regenerated. The regeneration of brownfields usually focuses on commercial, cultural, residential or industrial activities. However, there are increasing efforts to turn brownfield sites into green spaces. This is true especially in large cities with high concentration of population where green spaces can have positive effect on population well-being (Bowler et al., 2010; Georgi and Dimitrou, 2010; Lafortezza et al., 2009).

Since brownfields are not isolated objects, they are affected by their surroundings and spatio-temporal attributes play significant role in any interpretation of their nature and status (Frantál et al., 2015).

Aerial photographs represent a very good source for capturing both spatial and temporal attributes. They provide good resolution data and therefore allow clear identification of brownfields (see e.g. Skála et al., 2013) and their sequences can show the rate of their abandonment expressed by demolishing/collapse of existing buildings and overgrowing by vegetation. Use of high resolution aerial or satellite photographs for capturing land cover changes both in rural and urban settings has been very well documented in many studies (e.g. Dallimer et al., 2011; Gerard et al., 2010; LaGro and DeGloria, 1992; Skaloš and Kašparová, 2012; Yeh and Huang, 2009; Yin et al., 2011).

The aim of this article is to investigate which land cover changes occurred in different types of brownfields situated in the city of Brno, Czech Republic, during past 16 years and how quickly can vegetation overgrow brownfield sites. It also discusses if brownfields with high proportion of woody vegetation can be incorporated in green infrastructure of Brno.

2. STUDY AREA

The city of Brno is the second largest city of the Czech Republic with approximately 370,000 residents. It is the geographical and administrative centre of the South Moravia Region, which borders with Austria in the south and Slovakia in the south-east (Frantál et al., 2015). It has been intensively industrialized during the 19th and 20th centuries; at the end of the 19th century textile industry dominated while during the 20th century machinery engineering and chemical industry played significant role. Focus on industry was particularly emphasised during the socialist regime (1948-1989). The urban development was determined by the centrally planned economy, which supported development not only of heavy and engineering industry but also railway transportation, the military sector, agricultural cooperative farms, and an intensive development of prefabricated housing estates (Musil, 2001). With the collapse of socialist regime, in the so called transformation period, many serious problems occurred, among others brownfield emergence. Despite the fact that Brno has been transformed quite successfully, especially in regard to the development of new industrial sectors, universities, technological parks, innovation centres and other spheres supported under the "knowledge city" brand (Frantál et al., 2015), brownfields still remain in the city and their regeneration tends to be quite difficult due to various factors, such as complicated ownerships, large size, low attractiveness or potential ecological burdens. On the other hand, because Brno does not belong to so called shrinking cities, its progressive urban development creates relatively feasible opportunities for brownfields regeneration (Frantál et al., 2015).

3. MATERIALS AND METHODS

For identification of brownfields we used a database of existing brownfields which was provided by the Brno Municipality (2013) and consisted of 124 non-regenerated brownfields. The database included only brownfields with an area greater than 0.5 ha. Spatial distribution of the brownfields can be seen in Figure 1.

The database provided information about basic site characteristics such as location, name and description of a site, area size, information about the original use, current use, property relations, estimated extent of contamination, and available infrastructure (Frantál et al., 2015). Based on the information about original use, brownfields were grouped to seven types: agricultural (facilities of abolished socialist agricultural cooperatives; 14 localities in total), industrial (previous industrial sites and vacant factory complexes; 61 localities), military (training grounds, barracks, hangars, etc.; 9 localities), railway (former sites or storehouses with railway material, localities along railway; 7 localities), civic amenities (educational, sport, cultural and other community facilities; 19 localities), residential (former/unfinished blocks of flats; 1 locality) and other (previously used parking lots and garages, scrap-yards, unidentified facilities; 13 localities).

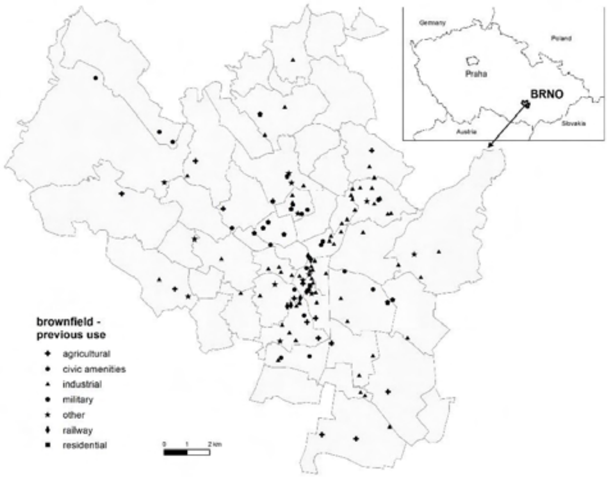

Figure 1: Location of different types of brownfields in Brno
Data source: Brno City Municipality (2013), Graphic elaboration by authors

For analyses of land cover changes orthophotos from three periods were used: 1996, 2003 and 2012. Orthophotos from 1996 and 2003 were provided by Regional authority of South Moravian Region and orthophoto from 2012 by Czech state administration of land surveying and cadastre. These orthophotos had resolution 50 cm/px (1996, 2003) and 25 cm/px (2012) and captured situation in summer of respective years. From these orthophotos, three digital vector layers showing spatial distribution of land cover were acquired by manual vectorization using backward editing method. In this method the layer with land cover polygons from 2012 served as a baseline for the older orthophotos. In the following interpretation, only new lines were added and such created polygons were labelled with a respective class of land cover. In the polygons that did not change, attributes from the newer layer were copied (for more details about this procedure see also Gerard et al., 2010). We used this procedure to ensure that changes in the borders of individual polygons were real and not a result of shifts potentially generated during the orthorectification process. Using the procedure also ensured near identical geometry of individual polygons and therefore can be used in object-based data model typical for INSPIRE Directive (Řezník, 2013). The minimal mapping unit was set to 1 m^2 in order to capture detailed land cover of smaller brownfields.

Due to character of brownfield sites and processes that can occur in them, seven land cover classes were distinguished: bare surfaces (including bare development areas, arable land, abandoned mining sites, and gravel or sand playgrounds), surfaces with herb vegetation (areas with initial vegetation, grasslands, grassed strips, grassed playgrounds, etc.), surfaces with woody vegetation (forests, woods, shrubs, groups of trees, orchards, alleys and other linear woody strips), mixed surfaces (gardens and garden colonies, vineyards, and secondary home colonies), sealed surfaces (manipulation areas, parking plots, roads, railroads and other areas with asphalt or concrete), buildings (residential, commercial, sport, industrial, agricultural, military and other, ruins), and water surfaces (water courses, water reservoirs, and ponds).

Based on the land cover layers we were able to calculated not only gross gains/losses of individual land cover classes but were also able to produce maps of land cover change processes that allowed us to identify number of changes between land cover classes, processes that occurred between two adjacent periods and area of land cover classes that did not change.

For assessment of incorporating brownfields with larger proportion of woody vegetation into existing green infrastructure we have used territorial plan of Brno municipality which provides information about existing as well as planned green areas in Brno. To identify suitable brownfields, brownfields where some parts were supposed to be converted to green areas and where woody vegetation cover in 2012 exceeded 25 % of total area were chosen as indicators.

4. RESULTS

4.1 Land cover in 1996

1996 represents a certain milestone where majority of identified brownfield sites still served their original purpose or the original use was stopped shortly before this year. In other words, the effect of short-term abandonment and recession of human activities was not strongly reflected in the condition of studied sites. This is also reflected in the proportion of individual land cover classes in all brownfield types. Buildings dominate as they cover one third of the total area of brownfields. Herb vegetation is the second most widespread land cover (21 % of the total area), followed by sealed surface (19 %) and woody vegetation (8 %). Bare surfaces cover significantly smaller area (less than 8 % of the area) and mixed surfaces can be found only at 2 % of the brownfield sites. Proportion of individual land cover classes in brownfield types is shown in Figure 2.

Buildings dominate in industrial and residential brownfields and are significantly present also in brownfields with civic amenities, agricultural and other brownfields. In other brownfields, **sealed surfaces** are predominant land cover class. They cover nearly 40 % of this type. This is due to the character of sites that belong to this type since they are represented mainly by parking sites. On the other hand, the smallest area with sealed surfaces occurred in residential brownfields.

Surfaces with **herb vegetation** are most widespread in agricultural brownfields; in some sites it covers more than half of a site. Agricultural brownfields also have the highest proportion of bare surfaces. Herb vegetation is quite pronounced also in brownfields with civic amenities and in railway brownfields. Surfaces with **woody vegetation** cover second largest area in residential brownfields (40 % of the total area). In the rest of brownfield types, except agricultural brownfields, the proportion of woody vegetation ranges between 15 and 27 %. Some individual sites can have even higher proportion of woody vegetation cover (e.g. 40 % in one military site, 70 % in one industrial site). Agricultural brownfields have the smallest area covered by woody vegetation.

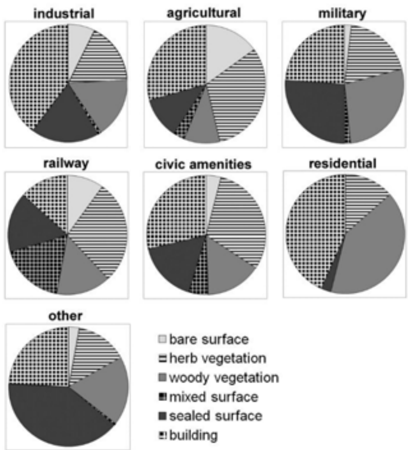

Figure 2: Proportion of land cover in individual brownfield types in 1996
Source: Own calculations

As mentioned above, **bare surfaces** cover quite significant proportion in agricultural brownfields. Larger areas with bare surfaces are also typical in railway and industrial brownfields; in other brownfields the proportion of bare surfaces is insignificant and in residential brownfields they do not occur at all. **Mixed surfaces** also cover insignificant area. The only exception is represented by railway brownfields where mixed surfaces cover nearly 18 % of the total area and are therefore second most widespread land cover class. This is caused by the fact that garden colonies in the vicinity of railways were also included in this type of brownfields.

Military brownfields represent a special case regarding proportion of individual land cover classes in 1996. With the exception of bare and mixed surfaces, land cover classes cover more or less same area with very slight dominance of woody vegetation followed by sealed surfaces.

Water surfaces both in the terms of water bodies and water courses were present only in industrial and agricultural brownfields. However their area is insignificant and therefore they were not included in graphs. This is true also for years 2003 and 2012.

4.2 Land cover in 2003

2003 shows first visible consequences of underuse and recession of human activities in the researched sites from a medium-term perspective as the sites experience a slow transition to deteriorating and decaying brownfields. In general, area of buildings and sealed surfaces decreases while bare surfaces significantly increase. Area of herb vegetation also slightly grows with area of woody vegetation remaining more or less the same. Mixed surfaces also cover smaller area.

Buildings still dominate in residential and industrial sites (Figure 3) even though the area slightly decreases. The most drastic decrease in the area of buildings is typical for agricultural brownfields; still they cover nearly one quarter of the total area and therefore represent second largest land cover class. Similar proportion of buildings can be noted in military and other brownfields and brownfields with civic amenities. **Sealed surfaces** still dominate in other brownfields. In military brownfields, they occur on one quarter of the total area. The highest decrease of sealed surfaces concerns railway and industrial brownfields.

Herb vegetation covers largest areas in railway and agricultural brownfields where it is present on more than one third of the total area. Higher increase of herb vegetation is typical also for residential brownfields; here the proportion rises for 8 % at the detriment of woody vegetation. Herb vegetation also increases in military and industrial brownfields; however, in these types the increase is not very high. On the other hand, other brownfields and brownfields with civic amenities experience a slight decrease of herb vegetation. The highest decrease of surfaces with **woody vegetation** can be seen in residential brownfields. In contrast, the highest increase of this land cover class is typical for agricultural and railway brownfields. In agricultural brownfields, it is the fourth most widespread land cover class. In railway brownfields, it is the second largest land cover class which is caused by abandonment of garden colonies in the vicinity of railways and their overgrowth, i.e. transition of mixed surfaces to woody vegetation.

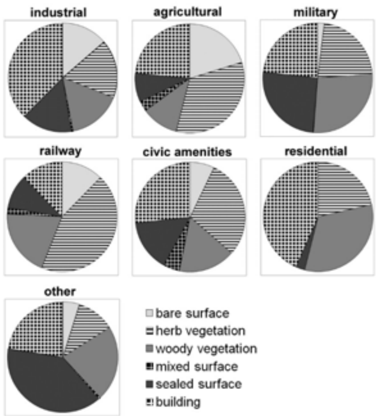

Figure 3: Proportion of land cover in individual brownfield types in 2003
Source: Own calculations

The highest increase of **bare surfaces** occurs in industrial and agricultural brownfields. Smaller increases are typical for railway brownfields and brownfields with civic amenities. Growth of bare surfaces reflects demolition of many buildings and other objects and subsequent transformation of sites into new development sites. Unfortunately, interpretation of an orthophoto cannot answer what proportion of increase in bare surfaces is a result of this controlled activity and what is a spontaneous decay of buildings. Concerning **mixed surfaces**, their proportion decreases in all brownfields, with the highest decrease being typical for railway brownfields.

4.3 Land cover in 2012

In 2012, brownfields show marks of advanced abandonment which is associated with long-term absence or significant recession of human activities. Sites have been abandoned for quite a long time which in many cases leads to deterioration of buildings and necessity of their redevelopment. Also vegetation succession progressed which is reflected in the significant increase of woody vegetation and increase in herb vegetation. Overall, 2012 shows an increased dynamics of land cover classes in all brownfields with the highest changes noted for residential and military brownfields.

In general, area of **buildings** distinctively decreases. The highest decrease of this class is typical for residential and military brownfields; the lowest for other and railway brownfields. Buildings dominate only in industrial brownfields where they cover one third of the total area (Figure 4). It is the second most widespread class in residential brownfields, brownfields with civic amenities and agricultural brownfields (here covers similar area as bare surfaces. Also **sealed surfaces** decrease, with the exception of agricultural brownfields. The highest decrease is typical in military, other and railway brownfields. Despite quite substantial decrease of the area, this class dominates in other brownfields.

Herb vegetation still dominates in agricultural and railway brownfields and in brownfields with civic amenities. The highest increase in the area of this class is typical for military brownfields. Slight increase occurs in industrial and residential brownfields. In contrast, this class decreases in other brownfields. Overgrowing by **woody vegetation** predominates in railway, industrial, other and agricultural brownfields. Increase in the area of woody vegetation is present also in the brownfields with civic amenities but the rate is smaller. In contrast, military and residential brownfields experience decrease of woody vegetation. Despite this fact, the class is the second most widespread class in military brownfields.

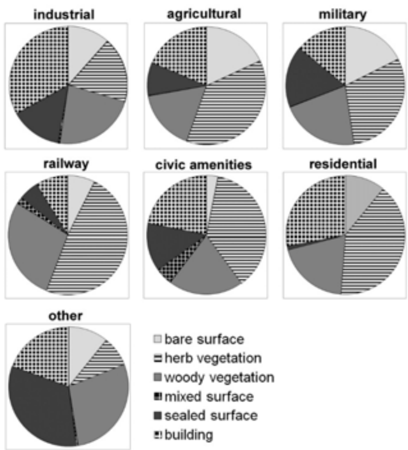

Figure 4: Proportion of land cover in individual brownfield types in 2012
Source: Own calculations

One of the indicators of slow abandonment and recession of human activities can be represented by increase of **bare surfaces**. This is the case of military brownfields where the class significantly grows, as well as other brownfields and residential brownfields; in this type bare surfaces occur for the first time. On the contrary, industrial, agricultural and railway brownfields and brownfields with civic amenities manifest decline of bare surfaces. This documents together with increase of herb and woody vegetation an advanced degree of deterioration and decay of these sites. Area of **mixed surfaces** still decreases (e.g. some agricultural brownfields) or remains the same (e.g. military and railway brownfields). In case of brownfields with civic amenities, mixed surfaces even slightly increase.

4.4 Land cover changes and underlying processes

Calculation of land cover changes revealed that 60 % of the total area did not change throughout the research period. The most stable areas were present in brownfields with civic amenities, other and industrial brownfields. Consequently the highest dynamics was typical for railway brownfields. In agricultural brownfields, half of the sites was stable while the other half showed dynamic development (Table 1). These stable plots were mainly buildings or surfaces with herb vegetation. Buildings represented stable plots also in industrial and residential brownfields, while plots with herb vegetation remained stable also in brownfields with civic amenities and railway brownfields. Military brownfields had many stable plots with woody vegetation and other brownfields with sealed surfaces.

Table 1: Area (%) of stable and dynamic plots in brownfields

Land cover changes	Stable (%)	Dynamic (%)
Agricultural	50	50
Industrial	63	37
Civic amenities	72	28
Residential	52	48
Military	59	41
Other	65	35
Railway	31	69
Total	60	40

Source: own calculations

Assessment of land cover change processes between 1996 and 2003 revealed the highest dynamics for railway and agricultural brownfields with the most pronounced transition to bare surfaces, typical for agricultural, industrial and residential brownfields and brownfields with civic amenities (Table 2). In other brownfields the most common transition was to woody vegetation while in military and railway brownfields it was to herb vegetation; in railway brownfields this process concerned the largest area of all brownfields as well as processes. Second most widespread processes between 1996 and 2003 were transition to herb vegetation (agricultural, industrial and residential brownfields), transition to woody vegetation (civic amenities, military and railway brownfields) and transition to sealed surfaces (other brownfields).

Table 2: Land cover change processes (%) in brownfields between 1996 and 2003; 1 – stable plots, 2 – transition to woody vegetation, 3 – transition to herb vegetation, 4 – transition to bare surfaces, 5 – transition to sealed surfaces, 6 – transition to buildings, 7 – transition to mixed surfaces

1996–2003 (%)	1	2	3	4	5	6	7
Agricultural	69,1	3,4	11,3	12,6	2,8	0,8	0,0
Industrial	79,2	2,9	5,8	9,2	2,1	0,8	0,1
Civic amenities	83,9	4,3	4,1	4,8	1,6	1,1	0,3
Residential	95,1		8,2	11,3		0,0	
Military	91,8	2,0	4,5	1,1	0,4	0,2	
Other	82,3	5,9	3,5	3,7	4,1	0,3	
Railway	55,7	9,1	26,9	5,9	2,0	0,1	

Source: own calculations

Between 2003 and 2012 the highest dynamics was still typical for railway brownfields but residential and military brownfields also experienced high dynamic changes. Advanced vegetation succession between 2003 and 2012 was confirmed by the highest proportion of transition to herb vegetation (in agricultural, industrial, residential and railway brownfields and brownfields with civic amenities; in military and other brownfields transition to bare surfaces dominated) and second highest transition to woody vegetation, occurring in all brownfield types (Table 3).

Table 3: Land cover change processes (%) in brownfields between 2003 and 2012; 1 – stable plots, 2 – transition to woody vegetation, 3 – transition to herb vegetation, 4 – transition to bare surfaces, 5 – transition to sealed surfaces, 6 – transition to buildings, 7 – transition to mixed surfaces

1996–2003 (%)	1	2	3	4	5	6	7
Agricultural	68,8	8,0	13,4	6,7	2,3	0,8	
Industrial	74,5	7,0	9,0	5,6	3,1	0,6	0,1
Civic amenities	83,0	3,1	10,4	2,5	0,4	0,5	0,2
Residential	61,7	7,0	22,8		0,6		
Military	63,5	15,8	3,5	16,1	1,0	0,3	
Other	77,2	5,9	4,3	9,3	1,5	1,7	
Railway	56,5	15,3	20,9	4,2	1,9	0,8	0,0

Source: own calculations

4.5 Incorporating brownfields into green infrastructure of Brno

Out of 124 brownfields, 42 expect to have some part of their area converted to green spaces. Half of these sites belongs to industrial brownfields, while in the rest of brownfield types only around 10 % of each type have some part planned to be converted to a green space. Moreover, nearly half of all brownfields expect to have more than 25% of their area converted to green spaces (Table 4).

Table 4: Brownfields with part of their area planned as green spaces (1), brownfields where planned green spaces cover >25% (2), brownfields with planned green spaces and present woody vegetation (3), brownfields with planned green spaces and current woody vegetation >25 % (4), brownfields with >25 % of planned green spaces and >25 % of present woody vegetation (5)

1996–2003 (%)	1	2	3	4	5
Agricultural	5	1	5	1	0
Industrial	22	9	22	9	6
Civic amenities	4	2	4	1	1
Residential	0	0	0	0	0
Military	4	2	4	2	1
Other	3	2	3	1	0
Railway	4	3	3	1	0

Source: own calculations

If we look at presence of woody vegetation in brownfields where green spaces are planned, with one exception all of them have some of their area at least partly covered by woody vegetation. However, when considering the 25 % rule (i.e. more than 25 % of brownfield sites are planned to be converted to green spaces), the number of brownfields with woody vegetation slightly decreases (out of 19 sites 15 fulfil this condition) and if we consider that the woody vegetation in these sites should cover at least 25 % of the total area, we have even greater decrease – only eight sites are eligible (Table 4).

In some cases brownfields should be completely converted to green spaces according to territorial plan, yet their present proportion of woody vegetation is even less than 25 %. In other cases woody vegetation covers more than 50 % of the brownfields but their area planned for green spaces is less than 25 %.

5. DISCUSSION AND CONCLUSION

Assessment of dynamics of land cover changes as well as stability of land cover classes revealed some expected as well as surprising results. As expected, majority of brownfields experienced increase in bare surfaces in 2003 and increase in herb as well as woody vegetation in 2012. Also quite high proportion of stable buildings was not surprising. On the other hand quite large proportion of stable surfaces with woody vegetation in majority of brownfields was a bit startling. However, this might be due to high proportion of this land cover class already in 1996 – in this period, woody vegetation was represented mainly by intentionally planned trees and shrubs and in some cases, where it was represented by self-seeded trees, the use of the sites was already stopped. Another somewhat surprising result was quite high dynamics of land cover changes in railway brownfields. The probable causes were a) massive abandonment of garden colonies along railway which was probably caused by political decision to stop rent these areas for gardening purposes and also by change of lifestyle in the 1990s and early 2000s when gardening stopped being a favourable type of leisure activities, and b) abandonment of sites by its previous owners or rather lack of financial means for potential future use. On the contrary, high dynamics in agricultural brownfields was not surprising due to the fact that these sites were part of agricultural cooperative farms that in the 1990s underwent transformation and restitution processes which with the loss of markets and opening market to foreign competition contributed to cessation of their use and subsequent abandonment.

Here presented results clearly show several stages of abandonment which can be indirectly expressed in the terms of vegetation succession. Immediately after a use was ceased (in 1996), a site remained more or less the same or there were slight changes manifested by beginnings of spreading of bare and herb surfaces. This process became more pronounced after seven years when collapse or demolition of buildings resulted in spread of bare surfaces which were promptly colonized by herb vegetation. It was subsequently followed by spreading of woody vegetation and was in full force after another nine years. The major woody species that colonized surfaces were *Sambucus nigra*, *Robinia pseudoacacia* and *Populus tremula*. This corresponds with findings of Prach et al. (2001) or Prach et al. (2014). These stages were present in all types of brownfields with the exception of military and residential brownfields which experienced decrease in surfaces with woody vegetation and the increase in bare surfaces and surfaces with herb vegetation that occurred in the last period. This was probably because majority of sites in both types of brownfields were still used to some extent at the time.

Identification of brownfields sites with larger extent of surfaces with woody vegetation could help in selecting sites for their incorporation in a green network of the city, especially when combining with territorial plan which determines which areas should be converted to green spaces. We are aware of the fact that present woody vegetation is usually represented by self-seeding trees or remnants of formerly planted trees and therefore can form so called new wilderness which is not very aesthetically pleasing. However, these areas might serve as a source of biodiversity or as an initial state for their further transformation into green spaces as was seen e.g. in Poland (Krzysztofik et al., 2012).

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THE COMPARISON OF TEMPERATURE AND MOISTURE CHARACTERISTICS OF NATURAL AND ARTIFICIAL SURFACES

Lucie Almášiová[1] and Karel Dejmal[1]

[1] Department of Military Geography and Meteorology, Faculty of Military Technology,
University of Defence, Kounicova 65, 612 00 Brno, Czech Republic,
e-mails: lucie.almasiova@unob.cz, karel.dejmal@unob.cz

ABSTRACT

Forecasts of ice and earth surface quality have been studied at Department of Military geography and meteorology of University of Defence. A meteorological station was acquired for this purpose. The meteorological station measures, except standard meteorological features, temperature and moisture characteristics below ground. Temperature and moisture features are obtained from two surface types. One of them is a natural grass surface and the second is an artificial concrete surface of a parking place. The aim of our work is a comparison of mentioned characteristics and their links to actual meteorological conditions. The results will be implemented in study of the weather impact to cross country movement.

Key Words: *forecast, temperature, moisture, characteristics*

1. INTRODUCTION

The Department of military geography and meteorology is concerned with the forecast of ice and earth surface quality. A meteorological station with a lots of sensors and devices was acquired for improving on the forecast of ice. This meteorological station has lots of other usages. It is used for learning observation meteorology students of present master's and bachelor's programmes.

The main usage is study of meteorological elements. The sensors and devices measure basic meteorological elements as air temperature, air moisture, direction and speed of wind, solar flux, precipitation totals and atmospheric pressure, but also temperature and moisture of natural and artificial surfaces.

The temperature of a natural grass surface is measured in depth of 1.5 centimetres [cm], is also called temperature of surface, then in depth 5 cm, 10 cm, 20 cm and 50 cm. The temperature of an artificial concrete surface of a parking place is measured in depth of 1.5 cm, also called temperature of surface, 5 cm and 10 cm. The moisture is measured in depth of 10 cm for both of surfaces.

The temperature and moisture characteristics will be implemented in study of the weather impact to cross country movement, which is very important for research at the department of military geography and meteorology.

2. METEOROLOGICAL STATION AND ITS SENSORS

The meteorological station was installed in area of the department of military geography and meteorology in the end of November 2014. The main parts are measured station METEOS 6, meteorological sensors, radiation shield for temperature and moisture sensors, special poles for sensors and programs equipment for personal computer WinMeteo.

The measured system MetUni has this sensors: Sensor for measuring temperature and moisture HMP 155 from company Vaisala, pressure sensor PTB110 from company Vaisala, albedo meter CMA11, radiometer CNR 4 – company Kipp and Zonen, rain gauges MR3H-FC – company Meteoservis, temperature and moisture sensors measuring below ground and on surface, moisture sensor Virrib in depth of 10 cm of natural grass surface and artificial concrete surface and wind sensors for direction and speed WAA151 and WAV151 – company Vaisala. The measurement of all meteorological features is recorded every ten minutes. The sensor for chosen characteristics of temperature and moisture are based on principles of electric resistant and electric conductivity.

3. THE COMPARISON OF CHARAKTERISTICS

The comparison of the temperature and moisture characteristics of natural and artificial surface are make on data from December 2014 to May 2015. The data outages are under 4 percent of all data amount. The data are processed in mathematic environment of Matlab or Scilab.

The compared data are temperature and moisture of natural grass and artificial concrete surface.

3.1 Temperature

The temperature is very changeable meteorological element. It has some typical characteristics. One of them is daily course. The daily maximum is around afternoon and minimum is around sunrise. It depends mostly on season period, because of solar radiation influence.

The average daily course of temperature of an artificial concrete surface is different in every month and also in different depth. The average daily course of temperature of an artificial concrete surface has temperature of surface lower than temperature of air, but temperature in depth of 5 cm and 10 cm is higher and stable than temperature of surface in winter month, for example on Figure 1 for December 2014. The difference of amplitudes is till 2 Celsius degrees.

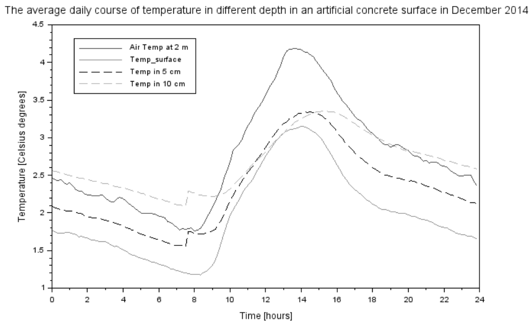

Figure 1: The average daily course of temperature in different depth in an artificial concrete surface in December 2014
Source: by Lucie Almasiova

Opposite, the average daily course of temperature of an artificial concrete surface has the highest temperature of surface in May 2015, demonstrated on Figure 2. The air temperature is the lowest. The position of the tops of amplitudes is different in every depth. The deepest is it measured temperature, the amplitudes move to the latest time. Also range of amplitudes of air temperature and temperature of surface is wide. It moves around 7 Celsius degrees.

For example the temperatures are similar in January and February, where the temperature in depth of 10 cm is lower, but difference of amplitudes is quite narrow. The situation of courses in March and April is approaching to situation from May.

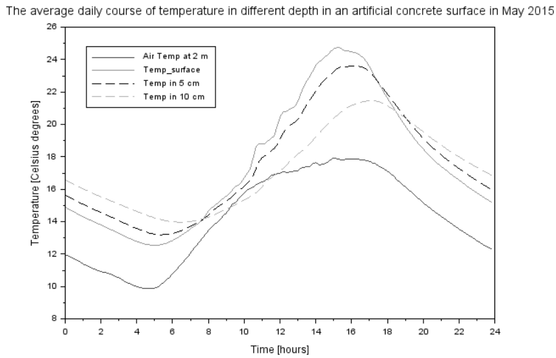

Figure 2: The average daily course of temperature in different depth in an artificial concrete surface in May 2015
Source: by Lucie Almasiova

Better view of daily course in each month in an artificial concrete surface gives Figure 3. The average daily course in winter months has lower amplitudes than daily course in spring months. It is displayed move of maximum. The warmer month has maximum later.

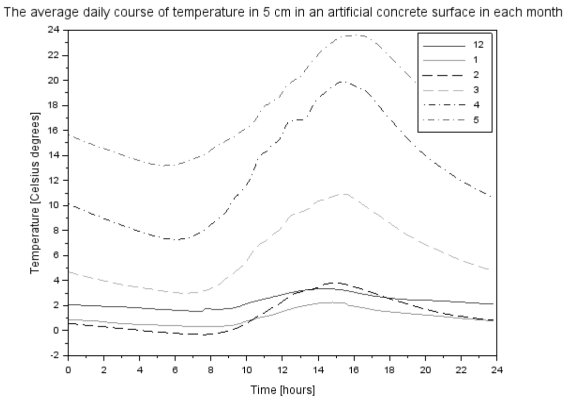

Figure 3: The average daily course of temperature in depth of 5 cm in an artificial concrete surface in each month
Source: by Lucie Almasiova

The average daily course of temperature of a natural grass surface has typical character in every season and also in different depth. Temperature of natural grass surface is measured in depth of 1.5 cm below ground, 5 cm, 10 cm, 20 cm and 50 cm. It shows better view for comparison average daily course in different depth in every month. During winter season temperature in depth of 50 cm is warmest and without marked daily course. The closer it is to surface, daily course is marked and temperature is lower. The surface temperature is the lowest and very similar with the air temperature. But difference of amplitudes is quite narrow, till 2 Celsius degrees. The interest is a difference of temperature in depth of 50 cm, where difference with other temperatures is above 2 Celsius degrees. The average daily courses in December 2014 are displayed on Figure 4.

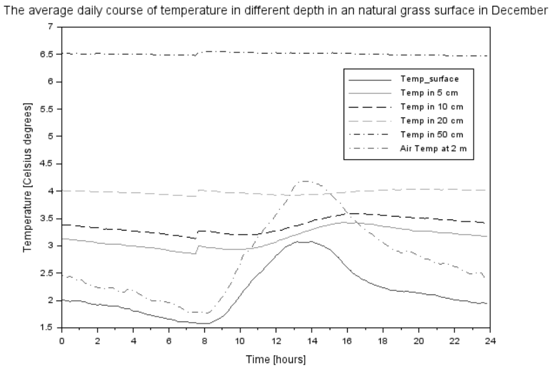

Figure 4: The average daily course of temperature in different depth in a natural grass surface in December 2014
Source: by Lucie Almasiova

The average daily courses in late spring, demonstrated on Figure 5 for May 2015, have wide amplitudes. The temperature in depth of 50 cm is the lowest temperature and very narrow or none amplitude. The surface temperature and air temperature have the highest and also the widest amplitudes. The surface temperature is a very similar with the air temperature. The maximum is a little bit later in case of the air temperature compared with surface temperature, but maximum in depth of 5 cm and 10 cm are later. The daily courses are insignificant with a bigger depth.

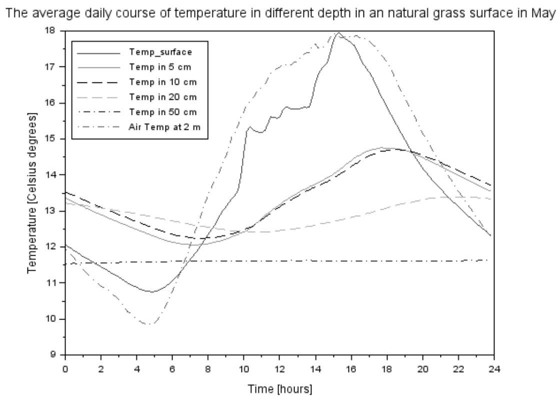

Figure 5: The average daily course of temperature in different depth in a natural grass surface in May 2015
Source: by Lucie Almasiova

The average daily courses are displayed for depth of 5 cm in a natural grass surface in each month on Figure 6. The temperatures have smaller amplitudes in spring months up to winter months and amplitudes become smaller and the maximums are later for bigger depths.

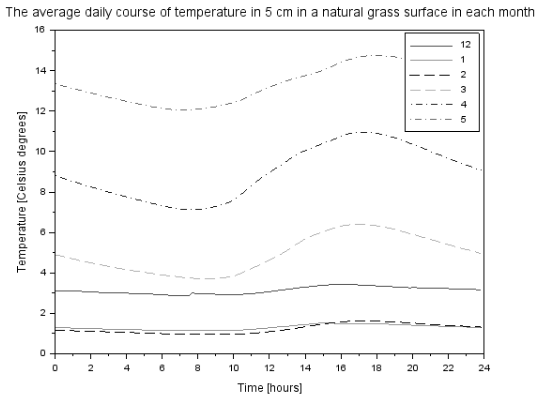

Figure 6: The average daily course of temperature in depth of 5 cm in a natural grass surface in each month
Source: by Lucie Almasiova

The comparison of temperatures both surfaces are shown on Figure 7. The amplitudes of temperature of an artificial concrete surface is higher than the amplitudes of temperature of air and also a nature grass surface. But the grass is more stable in night and generally has lower amplitudes. The year season is very important for influence for the size of amplitudes.

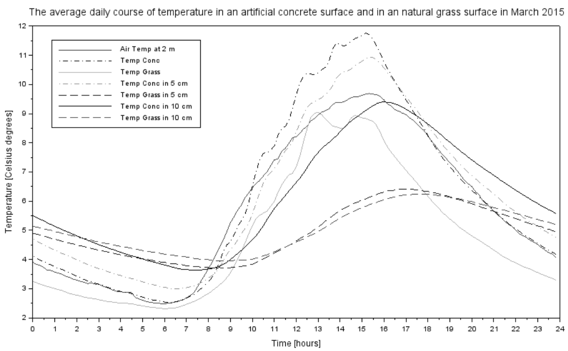

Figure 7: The average daily course of temperature in an artificial surface and in the natural grass surface in March 2015
Source: by Lucie Almasiova

3.2 Moisture

The second meteorological feature is the moisture. The moisture is not so very changeable like temperature. The amplitudes are negligible. The average moisture of natural grass surface is around 30% and the average moisture of artificial concrete surface has only about 10%. The similarity is not so close with temperature. The average daily course of moisture in a natural grass surface has maximum amplitude in morning for spring months. The winter months has amplitudes at the afternoon. It is displayed on Figure 8.

The average daily course of moisture in the natural grass surface is shown for each month on Figure 9. There are small amplitudes only at afternoon. A quite bigger difference is in May, where the size of moisture is lower.

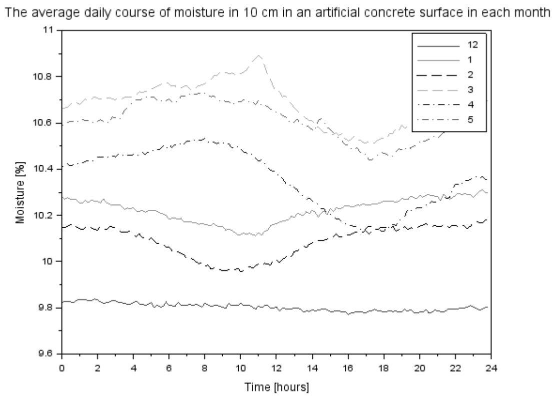

Figure 8: The average daily course of moisture in depth of 10 cm in an artificial concrete surface in each month
Source: by Lucie Almasiova

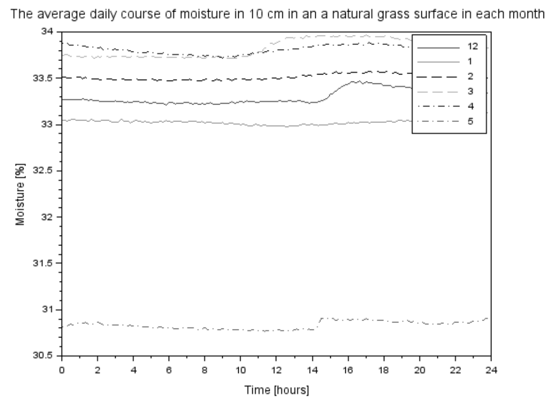

Figure 9: The average daily course of moisture in depth of 10 cm in an artificial concrete surface in each month
Source: by Lucie Almasiova

4. CHOOSEN LINKS TO ACTUAL METEOROLOGICAL CONDITIONS

A dependence of daily amplitude of studied temperatures on weather quantities is depicted in this section. Short wave radiation (S-rad), long wave radiation (L-rad), amount of daily precipitation (Prec), mean amount of cloudiness (Cld), snow cover (Snow), mean wind speed (Wind) and radiation balance – sum of long wave and short wave radiation (B). Correlation coefficient was used as a first estimate of relation and they are showed in Table 1.

Most important from selected quantities is short wave radiation. The dependence decreases with soil depth and is better for concrete surface. A little less dependence is on long wave radiation (sign – means that the surface is losing energy). The variability of long wave radiation does not vary so much in comparison with short wave radiation and annual course is similar to temperature course. This can explain why the link between long wave radiation and deeper soil temperature is higher in comparison with short wave radiation. Total radiation offers worse dependence than short wave radiation. The dependence of amplitude of concrete surface temperature on short wave and long wave radiation is in Figure 10.

Table 1: Correlation between temperatures and selected meteorological quantities

Level [cm]	Typ	S-rad	L-rad	Prec	Cld	Snow	Wind	B
200	A	0.82	-0.75	-0.13	-0.69	-0.18	-0.15	0.64
1.5	C	0.94	-0.74	-0.08	-0.65	-0.31	-0.12	0.81
1.5	G	0.88	-0.66	-0.09	-0.58	-0.36	-0.07	0.78
5	C	0.94	-0.74	-0.07	-0.65	-0.32	-0.11	0.82
5	G	0.82	-0.63	-0.12	-0.56	-0.40	-0.12	0.72
10	C	0.94	-0.74	-0.08	-0.65	-0.33	-0.10	0.81
10	G	0.23	-0.27	-0.06	-0.27	-0.13	-0.01	0.14
20	G	0.13	-0.17	-0.04	-0.19	-0.07	-0.03	0.07
50	G	0.02	0.08	0.06	0.12	0.00	0.14	0.07

The link with other quantities is lower but expendable – daily amplitude decrease precipitation, snow cover and wind. The dependence also decrease with depth. The deeper values of temperature mirrors forcing for longer period and time shift must occur there but this was not considered.

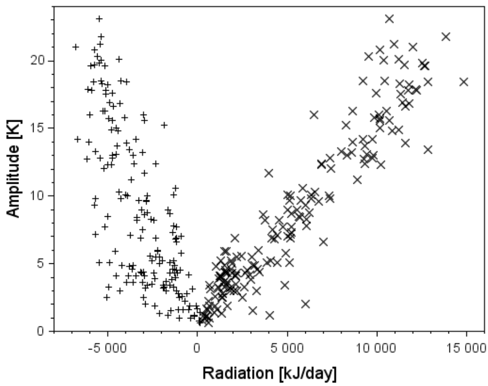

Figure 10: Amplitude concrete surface temperature on long wave radiation (+) and short wave radiation (x)

5. DISCUSSION AND CONCLUSION

The temperature acts like a presumption. The daily course of natural grass surface has smaller amplitudes and later maximums than daily course of artificial concrete surface especially due to heat capacity. The concrete has bigger heat capacity than grass, so in case of big amount of short wave radiation concrete has bigger amplitudes than air and also grass. The maximums are later due to accumulation of heat.

The long wave radiation causes that temperatures are stable and warmer in winter months than air and surface temperature especially for grass surface.

The moisture has not very distinct characteristics. The concrete is very stable material. There are not so many impacts, which affected the average daily course. The grass is a little bit more suggestible, especially with precipitation and short wave radiation, but there are not any strong expressions in depth of 10 cm on Figure 7.

The chosen characteristics are very important for prediction of ice. They are one of input data for METRo forecast for ice. It is necessary to know the behaviour of these characteristics for the next applications. The model METRo is studied for forecast of ice on various surfaces at the University of Defence at the Department of Military Geography and Meteorology. The moisture and temperature are also very important for research and evaluation the cross country movement, mentioned in [3] and [4]. These will be used in various situations by emergency services or in military operations.

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MODELLING OF GEOGRAPHIC AND METEOROLOGICAL EFFECTS ON VEHICLE MOVEMENT IN THE OPEN TERRAIN

Martin Hubáček[1], Vladimír Kovařík[1], Václav Talhofer[1], Marian Rybanský[1], Alois Hofmann[1], Marie Břeňová[1] and Lucie Čeplová[1]

[1] Department of Military Geography and Meteorology, Faculty of Military Technology, University of Defence in Brno, Kounicova 65, 662 10 Brno, Czech Republic,
e-mails: martin.hubacek@unob.cz, vladimir.kovarik@unob.cz

ABSTRACT

Manoeuvre is one of fundamental tactical activities. It is therefore essential to provide reliable geospatial information for a quality decision-making of commanders. Today, it is possible to offer much more within geospatial support. Geographic information systems allow modelling of an influence of the individual terrain components on movement of military vehicles depending on their technical and tactical characteristics. The Department of Military Geography and Meteorology at the University of Defence in Brno is focusing its research to this domain. Outcomes of this research are represented not only by verification of data quality and its suitability for modelling the tasks related to the vehicle movement but also by methodology of assessing the individual components of the terrain and procedures of cost-map production. The cost-maps can be used for planning of movement of vehicles through the open terrain based on different requirements both for military vehicles and rescue teams in crisis situations.

***Key words**: Geography, Meteorology, GIS (Geographic Information System), CCM (Cross Country Movement), M&S (Modelling and Simulation)*

1. INTRODUCTION

A motion is one of fundamental requisites of the mankind. Starting from ancient times the whole nations put into motion and that set up many routes and corridors between the major settlements that were preserved until today at least in their names. As the examples we can name the Salt Route serving for transporting of salt into central Europe, or the Amber Trail connecting the south and the north of the continent (NAVARRO 1925). The course of these routes was formed especially by geographic effects, so the routes run through the most easily passable terrain. Even today, significant European motorways and main roads copy a portion of the Amber Trail as the terrain configuration is advantageous for transportation. That means that even today it is not possible to cross the landscape anywhere but at places of the so called least resistance. Although the landscape changes and transforms over time due to the human activity, to some extent the basic characteristics of the landscape remain the same as thousands years before, i.e. the mountains remain the mountains, rivers do not change their watercourse dramatically and all these features remain in the same places. When planning the construction of infrastructure or when planning the motion itself, it is necessary to respect these natural barriers and if possible to avoid them or to learn how to overcome them.

Together with the development of civilization, colonization of other areas, trade, the emergence of new industries and the growth of the industry, the importance of passenger, raw material and supply transportation significantly increased. Nowadays, continents are crisscrossed with railways, roads, and motorways and all is interconnected with sea and air routes. However, the density of the transport network differs greatly, it is sparse or none at all at many places. Unlike other places in the world, Europe possess very dense road network. Nevertheless, there are situations when movement on roads is not possible. For example, these are the situations of moving military vehicles during operations or moving the emergency service vehicles during natural disasters. Movement of vehicles in the open terrain is however affected by numerous geographic and meteorological factors.

2. INFLUENCE OF TERRAIN AND WEATHER CONDITIONS ON THE VEHICLE MOVEMENT

Driving characteristics of every vehicle are defined by a variety of technical parameters. The fundamental parameters are the following:

- vehicle dimensions;
- performance characteristics of the engine;
- type of chassis (tracks, wheels);
- number and type of tires;
- rate of climb, trench crossing, approach angle, inclination and side inclination etc.

Many of these technical parameters are closely tied to the terrain configuration and properties of its individual features (RYBANSKY and VALA 2009). In most cases, their influence differs according to the weather conditions (DEJMAL et. al. 2011). For example, the river is a major obstacle for movement of majority of vehicles but when covered with a thick ice due to severe frost, that river can become easily passable. On the contrary, even relatively weak precipitation can cause occurrence of a muddy terrain and therefore inaccessibility of particular areas.

Interaction and combination of all the terrain features and phenomena forms a specific characteristic of a landscape (COLLINS 1998). Many elements of the terrain are interlinked and their influence on the vehicle movement must be addressed in a comprehensive view of the terrain. Basically, when considering the influence of vegetation on the mobility of vehicles, it is necessary to take into account also the influence of a terrain, soils, and other elements affecting composition of vegetation. Such comprehensive view is very complex, therefore for the purposes of simulation, it is useful to divide the influence of the environment on the vehicle movement to the individual components and to create the individual models using synthesis of given data.

According to Rybansky (2009), the influence of a landscape entering creation of the model of a vehicle movement can be expressed using the following coefficients:

Influence of terrain relief C_1

- slope gradient factor C_{11}
- small relief forms (microrelief) C_{12}

Influence of vegetation cover C_2

- spacing between stems C_{21}
- stem diameter C_{22}
- tree height C_{23}
- type of tree (tree stem flexibility) C_{24}
- nature of root system C_{25}

Influence of soils C_3

- kind of soil, soil type C_{31}
- ground cover (kind of plants) C_{32}
- surface roughness C_{33}

Influence of weather and climate C_4

- dry season C_{41}
- moist season C_{42}
- wet season C_{43}
- temperature above freezing C_{44}
- temperature bellow freezing C_{45}

Influence of hydrology C_5

- kind of water C_{51}
- depth C_{52}
- width C_{53}
- flow speed C_{54}
- characteristics of bottom C_{55}

- characteristics of bank (bank slope) C_{56}

Influence of settlements C_6

- block built-up area C_{61}
- uptown C_{62}
- cottage built-up area C_{63}

Influence of communications C_7

- highways C_{71}
- 1st category road C_{72}
- 2nd category road C_{73}
- 3rd category road C_{74}
- hardened ways, forest and cart ways C_{75}

Influence of other factors C_8

- technical factors (kind of vehicle, vehicle condition) C_{81}
- personnel factors (driver's skill) C_{82}
- environmental factors C_{83}
- characteristics of activity (peacetime, wartime, etc.) C_{84}

The individual deceleration coefficients C_1-C_8 are computed as the products of particular coefficients within each group. The overall coefficient C is a product of these coefficients (see Equation 1) while it ranges from 0 to 100 %. It can be therefore stated, that resulting velocity of the vehicle movement is a function of all the decelaration coefficients:

$$v = f(v_{\max}, C_1, C_2 ... C_8) \quad (1)$$

3. DATA FOR MODELLING PASSABILITY

A maneuver, i.e. a movement of troops through the terrain, is one of the prerequisites of successful conducting of battle. It is the reason why commanders study the terrain both before and during military operations. Apart from the terrain reconnaissance and assessing the terrain "in situ", it is possible to study it using geographic sources. For centuries, these were maps and verbal description of locations supplemented with sketches and drawings. After invention of photography, the photographs served as a valuable information source before they were replaced with imagery that was acquired from the air. Starting from 1960's the satellite imagery and other remote sensing data can be used to study the terrain characteristics.

Nowadays, there is a plentitude of data sources providing materials for studying terrain and therefore modelling the cross-country mobility. Development of digital technologies is also reflected in the domain of geographic data that are commonly available in a form of digital geospatial databases. Exploiting digital data and GIS technology enables more efficient study of terrain and its influence on various human activities.

For the purposes of modelling the possibility of vehicle movement the geodatabases depicting relief in a detail, i.e. the digital elevation models, combined with detailed landscape models are of the greatest use. Such databases within the Army of the Czech Republic are produced and distributed by the Military Geographic and Hydrometeorological Office. The basic landscape models are represented by the DMU 25 and the DMU 100 databases. They contain data covering the territory of the Czech Republic and its vicinity with a detail and location precision of the topographic maps at scale of 1:25,000 and 1:100,000 respectively. For coding geographic features, the DFDD (DIGWG Feature Data Dictionary) is used, together with certain national modifications. The DMU 100 database is used as a primary data source for creating the VMap1 products. Due to a better detail and attribute richness, the DMU 25 database is more suitable for modelling. Even though the DMU 25 contains layers with elevation data (e.g. contours, spot heights, microrelief features), it is appropriate to support it using another elevation model. The territory of the Czech Republic is covered with several digital elevation models. They differ from each other mainly by the time of creating, technology of data collection, and therefore by their precision. Currently the creation of elevation models based on airborne laser scanning approaches the final phases (BRAZDIL et al. 2009). The first of them, the DMR 4, is already finished and contains the elevation points in a regular grid of 5×5 m. The DMR 5 is finished on one third of the territory and is represented by the TIN (Triangulated Irregular Network) elevation model. It is expected that the full coverage will be achieved during 2015.

Other thematic databases can serve as the additional data sources. These can be databases of soils, climate data, and so on. Relatively detailed and reliable data sources are available for the Czech Republic. These can be exploited for the purposes of movement modelling in case of activities related to national security or emergency system units. However, the Czech troops, in connection to NATO commitments, have to fulfill the tasks also outside their own territory, such as in the Balkans, Iraq, Afghanistan, and most recently in Mali. But these areas are not covered by quality geospatial data at the same level as in the Czech territory. Topographic maps and aerial imagery are not the data ideally enabling modeling the cross-country movement like digital geodatabases. The easiest way how to get access to such data is using the Alliance resources or an involvement in the international cooperation at creating digital geodatabases. The best and most accessible resources that can be used are therefore the following:

- the MGCP (Multinational Geospatial Co-production Program) data;
- the DTED 2 (Digital Terrain Elevation Data), resp. the SRTM (Shuttle Radar Topography Mission);
- local geodatabases;
- satellite imagery (multispectral).

4. SIMULATING CROSS COUNTRY MOBILITY

The methodology for determining the optimal (i.e. the least-cost) route of a vehicle depends on the individual geographical factors. Each of these factors contributes to the deceleration of vehicle speed relatively to the maximum speed that a vehicle can reach on the road. The resulting speed of a vehicle in the terrain can be determined by the individual decelerating (cost) factors, as part of the particular set of the above-mentioned geographical features.

Four types of possible ways can be determined as a result of the Cross-Country Mobility (CCM) analysis that can represent the base for a commander´s optimal decision-making:

- the shortest path
- the fastest path
- the cheapest path
- the safest path

The warfare recognises three basic degrees of CCM:

- passable terrain (GO) – real speed is approaching the maximum speed;
- terrain passable with restrictions (SLOW GO) – real speed is lower or significantly lower than maximum speed, obstacles can be overcome;
- impassable terrain (NO GO) – obstacles cannot be overcome.

It is possible to determine the basic degrees of CCM for each transport or combat vehicle because of their technical parameters (chassis type, power of engine, transmission system, etc.), or to consider the CCM of the weakest vehicle in the unit.

Specific degree of CCM determination on a given part of the terrain can be expressed as a complex function in which all impacts of individual geographic factors are evaluated as the coefficients of deceleration ‘Ci’ and expressed as a number from the interval of 0 to 1. The individual coefficient of deceleration shows the real (or simulated) speed of vehicle v in the landscape in the confrontation with the maximum speed of given vehicle vmax. The impact of all the 7 basic geographic factors can be expressed by the formula (1).

If there is the assumption that the route of vehicle movement, including direct segment, consists of various sub-sections, in which values of geographical factors are unchanged, the final degree of CCM can be determined as a cost of a given segment.

For a given vehicle (i.e. its technical properties), the values of deceleration coefficients are calculated from ascertained properties of geographic objects stored in the spatial geo-database. Using formulas (1) it is possible to create a cost map in which the value of each pixel is the final (modeled) speed. The cost map can be used as a source for calculation of the shortest, fastest, cheapest or safest paths. It is possible to consider the quality and certainty of digital data describing the geographic features. Crisp sets or fuzzy logic is also applicable for cost map evaluation.

The final speed of given vehicle was evaluated according to formulas (1). Particular obstacles were compared with the given vehicle properties in a pixel of 1 by 1 meter. Total of 27 raster layers were created for each particular coefficient C_{ij} where the value of a given pixel was the “cost” of the pixel – that is the reclassified value of coefficient to the range of 0 to1.

The final cost map was created using map algebra from a combination of all particular layers. This cost map enables to find the cheapest way from a start point to a destination.

Precision, uncertainty, vagueness and similar properties were not taken into account in the calculations of cost map because of applying of crisp set analysis. The final result is easily understandable but the great disadvantage of such analysis is that the user has no information about the properties of features entering calculations. While determination of feature borders can be different (e.g. the footprint of building can be defined in resolution of several centimeters, the border between two types of soil is defined in resolution of approximately 100 meters), therefore it is necessary to include other parameters in the calculation. One possible approach is application of a fuzzy logic.

Certain processes that differ only in the input conditions are repeated with all coefficients. These are selection processes as well as conversional ones, etc. For solution of vagueness, the Fuzzy Membership and Fuzzy Overlay processes are used. While the use of Fuzzy Membership varies, Fuzzy Overlay is the same for all coefficients. Conditions for Fuzzy Membership are dependent on geometric accuracy that shows the types of geographic objects in the database. There is only the example of the coefficient C_1 – Terrain relief calculation in the following text.

Coefficient C_1 is very complex, it includes the influence of slope gradient as well as the influence of microrelief. The slope gradient is one of the input layers and it can be prepared from the current factor calculation. The calculation is divided into several branches.

In one branch, fuzzification is calculated directly from the values of gradient (expressed in degrees). The limiting value for the chosen vehicle (36°) was taken for the calculation. The conditions for fuzzification are as follows:

$$\mu_S(x) = \begin{cases} 0, & x = 0 \\ \dfrac{36 - x}{36}, \ldots & 0 < x < 36 \\ 1, & x \geq 36 \end{cases} \qquad (2)$$

Other branches of calculation concern microrelief. The input layers are point, line, or areal height obstacles. For each of them, Euclidean distance is calculated, and from that Fuzzy Membership as well.

The Fuzzy Membership for Euclidean distance of 20 m is calculated for the point objects with the following conditions:

$$\mu_{MP}(x) = \begin{cases} 1, & x = 0 \\ \dfrac{20 - x}{20}, \ldots & 0 < x < 20 \\ 0, & x \geq 20 \end{cases} \qquad (3)$$

Depth and height of an object are the observed parameters. Fuzzification for both parameters is given with these conditions:

$$\mu_{MPH}(x)=\begin{cases}0, & x=0\\ \dfrac{0.1-x}{0.1}, & ...0<x<0.1\\ 1, & x\geq 0.1\end{cases} \tag{4}$$

In case of line objects, Fuzzy Membership is calculated for depth and height and the width of an object is considered as well. Considering the Euclidean distance of 10 m, conditions for fuzzification are the following:

$$\mu_{HL}(x)=\begin{cases}1, & x=0\\ \dfrac{10-x}{10}, & ...0<x<10\\ 0, & x\geq 10\end{cases} \tag{5}$$

Fuzzy Membership for height, depth and width:

$$\mu_{HLH}(x)=\begin{cases}0, & x=0\\ \dfrac{0.1-x}{0.1}, & ...0<x<0.1\\ 1, & x\geq 0.1\end{cases} \tag{6}$$

Polygon objects are defined by their ground plan; therefore height and depth were used in the calculation. Fuzzification was calculated for Euclidean distance of 20m:

$$\mu_{HP}(x)=\begin{cases}1, & x=0\\ \dfrac{20-x}{20}, & ...0<x<20\\ 0, & x\geq 20\end{cases} \tag{7}$$

Fuzzy Membership for height and depth with conditions:

$$\mu_{HPH}(x)=\begin{cases}0, & x=0\\ \dfrac{0.1-x}{0.1}, & ...0<x<0.1\\ 1, & x\geq 0.1\end{cases} \tag{8}$$

All the remaining coefficients are calculated similarly with the exception of the coefficient C_4, which has not been calculated yet because the system is not connected to the on-line meteorological data.

The final deceleration coefficient is calculated from the individual files with the help of the Fuzzy Ovelay tool. The first five coefficients enter the calculation with the help of relation max{C_1, C_2, C_3, C_5, C_6}. The resulting value is multiplied by a raster of coefficient C_7 by reason of assigning meaning of the individual communications according to traffic importance (highways, 1st class roads, forest roads, etc.). The result is the cost map that can be an input for searching of an optimal route in a decision-making process in CCM (Fig. 1).

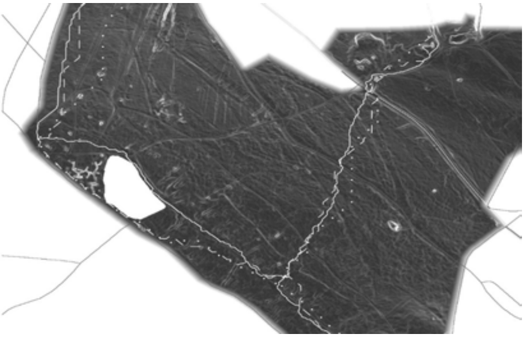

Figure 1: Vizualization of the vehicle routes over the cost map (white NO GO, black GO)

5. VERIFICATION OF DATA QUALITY AND SIMULATION RESULTS

Despite the fact that there are basic technical parameters characterizing possibilities of moving that are set for all vehicles being used in the army, these parameters cannot be met for all types of terrain and at any time. The parameters are defined for ideal conditions (see Table 1). In most cases the possibility of mobility will be affected by majority of the effects described in the chapter 2. It is possible to determine this influence by several ways:

- testing of vehicles in various types of terrain;
- testing of vehicles in various meteorological conditions;
- computing of the individual terrain layers for particular vehicles;
- statistical survey among vehicle drivers.

Table 1: Selected driving parameter of vehicles

		T 810	UAZ 469	PANDUR II	BMP 2	T72M4 CZ
Trench Crossing [m]		0.9	0.4	2.2	2.5	2.7
Vertical Obstacle [m]		0.6	0.4	0.6	0.7	0.8
Angle of [°]	Approach	37	48	43	29	46
	Departure	37	37	41	25	23
Maximum Gradient [°]		30	30	30	35	30
Maximum Side Slope [°]		20	25	20	30	25

Source: Autors

Testing of vehicles proves to be the most reliable way. The Department of Military Geography and Meteorology already conducts such tests in selected locations both in the Czech Republic and Slovakia for several years in order to refine computational methods. The following effects of the terrain properties are being verified during the tests:

- height segmentation and influence of slope;
- ability to overcome the micro-relief features;
- influence of soil conditions;
- influence of individual vegetation features and ability to overcome them;
- influence of meteorological conditions.

Testing takes place mainly in military training areas using vehicles being currently operated in the Czech Army. Tests focus on verification of driving characteristics of the following vehicles:

- the medium tank T-72;
- the armoured fighting vehicle BMP 2;
- the armoured personnel carrier PANDUR II;
- the heavy lorry TATRA 815;
- the medium lorry TATRA 810;
- the cross country vehicles UAZ 469 and Land Rover.

During testing, that is focused on monitoring the driving characteristics and the ability to overcome selected sections of the terrain and terrain obstacles, the following activities are performed in the test locations:

- taking soil samples and their subsequent analysis;
- penetrometry measurements of the soil bearing capacity;
- dynamometric measurements of vehicle characteristics;
- measurements of tree characteristics;
- detailed mapping of routes in order to determine precise profiles, relief slopes, obstacle shapes, and tree spacing;
- measurement of meteorological phenomena (precipitations, temperature, etc.).

Using the results of these tests it is possible to determine that sandy soils have a significant impact on the ability to overcome slopes (see Table 2). As seen in the table, the ability to overcome slopes is reduced to one half (HUBACEK and RYBANSKY 2013). Similarly, it is possible to determine the influence of sandy soils on the vehicle ability to overcome the grown tree by overturning (see Table 3). This issue is however complex therefore it is not possible to determine final results. Testing will continue and already received results will be further verified.

Table 2: Theoretical and real values of slope for tested vehicles

Vehicle	LR	T 810	BMP 2	T – 72
maximum gradient declared by the manufactured [°]	40	30	35	30
maximum measured gradient in sandy terrain [°]	20	17	20	17

Source: Autors

In addition to verifying driving off-road, which is placed only in selected areas, other activities take place in the terrain as well. They are focused mainly on verifying the accuracy and reliability of digital geographic databases. They are as follows:

- verification of accuracy and quality of elevation models;
- verification of accuracy and classification of roads of lower classes in vegetation (in forests);
- verification of correctness of attributes of vegetation in spatial databases;
- mapping of soil types and penetrometric measuring of soil bearing capacity.

Apart from the teachers of the department, the students of bachelor, master, and doctoral studies take part in this work either as a part of the practical exercises or as a part of preparation of their thesis. The results of testing are regularly published and they serve as a feedback to the digital database producers.

Results of mapping of soil types and penetrometric measurements are used for verification of a soil database and for a production of the cross-country mobility map in various climatic seasons (dry, moist, wet) for particular vehicle types.

Table 3: Maximum thickness of the tree trunks that (the) vehicle is able to overcome

vehicle	trunk thickness	
	loam soils	sandy soils
UAZ 469 / LR 110	6–8 cm	12–15 cm
T 815	23–26 cm	25–32 cm
BMP 2	22–25 cm	28–34 cm
T – 72	39–45 cm	40–45 cm

Source: Autors

Figure 2: PANDUR II vehicle during the tests

Even though the research is primarily focused on the Czech territory and on data available from this territory, the results can be applied after partial modifications also to foreign territory. There are some partial limitations that will affect the quality and accuracy of the outputs, but they can still be used as a basis for decisions of commanders in the performance of combat and other tasks related to movement in space.

These limitations are due to the following:

- different coding of geographic reality in digital geodatabases;
- lower horizontal accuracy of geographic data;
- lower attribute completness and diversity of information in data from the foreign territory;
- necessity of modification of algorithms for new landscape types.

To verify the use of the data, it was created in colaboration with the Military Geographic and Hydrometeorological Office in Dobruska, several datasets covering the military training area Dedice and corresponding by its content, accuracy, and production technology, with the data being used in majority of areas of operation of the Czech troops. The data were used for the CCM analysis and the results were tested usinf the real vehicles in the terrain (Fig. 2). Despite of partial differences between the ideal paths resulting from the data covering the Czech territory and data being created using technology employed at foreign territory, all these paths were passable by all tested vehicles. There were cases when the time needed for passing a particular section was longer than calculated but there was no situation where the calculated path would be impassable.

6. PARTIAL RESULTS AND DISCUSSION

Passability of terrain and ability to manoeuvre are fundamental prerequisites of success. Today's modern geoinformation technologies in collaboration with high-quality databases allow to create the cost maps facilitating decision-making of commanders of military and emergency units. Research conducted by the Department of Military Geography and Meteorology confirms this fact and proposes methods of making these maps.

The possibilities of their use are quite extensive starting from combat activities and defence of national border to fighting the forest fires, provision of supplies and evacuation during floods and other crisis situations. Given the need to change dynamically the input data for the calculations, it seems that the ideal option would be to create outputs in online mode with a connection to the input source data, such as existing geodatabases and current information from meteorological models. It would be suitable to link the outputs from the models to the command and control systems at staffs of units, in mobile terminals of commanders in the field, in the control centers of emergency services, or to use that in simulation tools.

Even though it may seem in this point that the complete realization is very far, many prerequisites for successful verification are currently being implemented. These are:

- existing data sources with verified reliability of geometry and attributes;
- methods of extending and updating of geodatabases so that the calculation outputs would be more reliable and accurate;
- methodology of cost-map production based on various data sources;
- database of vehicles and their capabilities to overcome various objects in the terrain;
- verification of vehicle movement capabilities in various terrain types and in various meteorological conditions.

There is a partial problem that have to be solved in the future, especially in cases of the requirement of providing calculations and results online, that is relatively high demands on computing power of workstations and the time for data processing. The latter id dependent on the following factors (TALHOFER et. al. 2014):

- size of a pixel selected for computations;
- use of the fuzzy logic principles;
- quality of the input data.

Since the pixel size should not be changed due to the output quality requirements (i.e. 1 m is considered as an optimum), it is necessary to perform some optimization of calculation based on the other two factors. It turns out that the use of fuzzy logic is unnecessary in some locations (e.g. built-up areas) and it does not bring better results. Also it is possible to adapt partially the computation with respect to the quality of input data, such as reliability, geometric accuracy, attribute completeness, etc.

The research results are not yet final and in the future it will be necessary to do further investigation of other components of the terrain, that have a lower priority at the moment – also due to their less occurrence. It will be necessary to verify capabilities of newly introduced vehicles using existed methodology. Finally, it will be necessary to convince potential users about the reliability of generated results and their suitability for their decisions. This will be perhaps the most difficult tasks in the future.

ACKNOWLEDGEMENT

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LANDSCAPE: A FRIEND OR FOE?

Martin Hubáček[1] and Vladimír Kovařík[1]

[1] Department of Military Geography and Meteorology, Faculty of Military Technology, University of Defence in Brno, Kounicova 65, Brno 662 10, Czech Republic,
e-mails: martin.hubacek@unob.cz, vladimir.kovarik@unob.cz

ABSTRACT

A landscape, in a military language rather a terrain, is one of decisive factors that must be taken in account when planning any operation. And it does not matter whether it is for defence of a territory, patrol planning in a foreign mission, or a movement of engineer troops during the construction of a temporary bridge after devastating floods. Since a long time ago, military staffs use various geographic products such as plans of forts and fortification, sketches and simple maps. Today, in digital era, it is a number of sophisticated tools based on the GIS technology and GNSS. Yet the map products and ability of orienting in the terrain plays the crucial role. Therefore it is necessary for any operation to have the specialists able to prepare the technology, to populate it with data, and to guarantee its operation and service. The Geographic Service provides that in the Army of the Czech Republic. Its members acquire their knowledge during their studies of the military geography and meteorology at the University of Defence in Brno. Apart from theoretical knowledge the students acquire their knowledge also during practical work both in the field and in the laboratory. These exercises are spread through the entire studies and they comprise of basics of surveying, mapping, reconnaissance flights, production of analogue and digital map products, or hydrological measurements, to complex analysis of geographic area of interest and other tasks. The students will encounter these tasks in practice in a territory of the Czech Republic or abroad. Their knowledge of meteorology and the influence of weather on a landscape and the troops activities are of the unquestionable importance.

***Key words**: Landscape, Education, Geography, Hydrology, Meteorology*

1. INTRODUCTION

A landscape, in a military terminology rather a terrain, is one of decisive factors that must be taken into consideration when planning any military activity or operation. Assessing the terrain effect is a part of assessing the influence of the environment to the activities of both the friendly forces and the enemy forces. And it does not matter if the task is relating to the territory defence, compound guarding, patrolling within the peacekeeping operation, supporting of military vehicle transports, or assisting the integrated rescue system during crisis situations.

Environment affecting the operations is composed of numerous partial elements. Basic factors of each operation are the following [1]:

- goal,
- enemy,
- friendly forces,
- basic components of environment (terrain and weather),
- time,
- civilian influence.

Answering the question, whether the landscape will be a friend or foe for friendly forces depends to a large extent on the ability of military geographers, on their knowledge and skills, and on the depth of knowledge of the landscape as a whole and its effects on human activities. From the perspective of the geographer and his or her contribution to the decision-making process, the interest lies not only on a landscape or terrain but also (at least partially) on weather. He or she must be able to assess from the climate perspective on the particular operation when the weather forecaster is not present. The paper aims at describing the system of education of military geographers at the University of Defence of the Czech Republic and at showing the ways for knowing the landscape and its importance for military activities.

2. EFFECT OF LANDSCAPE ON THE COURSE OF HISTORY

Both the terrain and weather may significantly affect the progress of any operation. In history it is possible to find many examples where the knowledge of terrain and weather affected, positively or negatively (it is usually a matter of perspective), the ultimate outcome of clash of two opposing groups. These examples can be found in most textbooks of military geography and in a number of books devoted to tactics and famous battles in a history [2] [6] [15].

To find such examples, however, it does not need to be an expert of the history, nor to devote deep study of geography and the impact of individual components of the landscape on a human activity. From the beginning of the human race, the landscape had a direct impact on human development. Fertile and climatic favourable areas allowed formation of ancient civilizations. Sudden changes then put into motion whole nations who moved to a more suitable environment or who used military invasions to expand their empires and spheres of influence. In addition to numerical and technological superiority, primarily terrain often played a key role in decisive engagements. Despite the effort of numerous historians, the information concerning most of ancient battles is unreliable. The tactics of ancient and medieval military leaders usually assumed fighting in the open terrain. Nevertheless, there are number of examples where commanders were able to take advantage of the terrain and to force their opponents to fight in places that where convenient for one side of a conflict. One of the best known examples is the Battle of Thermopylae (480 BC), where an alliance of Greek city-states was able to resist the Persian army despite their considerable numerical superiority. Another example is the Battle of the Teutoburg Forest (AD 9), in which the smaller and less experienced alliance of Germanic tribes lured the Roman legions in the area which was not convenient for them. Dense forest and soaked land did not enable to exploit the tactical superiority of the legions and that led to their defeat. The example from our region is the legendary Battle of Sudoměř (1420), in which Jan Žižka used terrain features to build a defence at a location that was favourable for him. In the Battle of Austerlitz (1805), in addition to his great tactical thinking Napoleon used the terrain and favourable weather, when the morning mist masked the movements of some of his troops.

Exploiting of the key characteristics of the terrain for gaining advantage over the opponent in these examples usually occurred thanks to brilliant brains of the military leaders. A fundamental change in military tactics and understanding the role of the terrain and the possibility of its exploitation in favour of friendly forces came in the 18th and 19th century. This change consists in technological development related to the industrial revolution, modernizations of guns, and creating of large recruiting armies. At his time, the first military institutions dealing with geography, mapping and the influence of the terrain on military actions started to be formed. These institutions were for example the *Militär-Geographisches Institut* in Vienna established in 1839 (his predecessor the *Topographishe Anstalt* was established already in 1806), the *Ordnance Survey* established in England in 1791, the *Service Géographique de l'Armée* established in France in 1887, the *Instituto geografico militare* established in Italy in 1818 or the *Instituto Geográfico y Estadístico* established in Spain in 1870 [4]. Similar institutions can be found also in other countries. In the same time, the first detailed cartographic works started to be formed. At the Czech territory, these were the maps of the first, second, and third military mapping. These maps and the maps derived were used as a source of geographic information even after establishing of the independent Czechoslovak state in 1918.

3. HISTORY OF EDUCATION OF MILITARY GEOGRAPHERS

Since establishing of the *Military Geographic Institute* in Prague in 1918, personnel education and training had been realizing mainly in a form of tuition using the institute capacity, employing the civilian surveyors, or supporting studies of personnel at universities in parallel with their job [7]. Nowadays, the University of Defence has been providing the education of military geographers for more than 60 years. At the time of the university's foundation in 1951, the *Department of Topography and Geodesy* was a part of the former *Military Technical Academy* [20]. Together with professional development in the field of geographic support of the armed forces, the weapon systems have been modernized, but in relation to the transformation of the army and political changes both the department and school were subjects of transformation over the years. In the period of 1953-1958, there were two departments – *Department of Geodesy and Photogrammetry* and *Department of Cartography and Topography*. Then, the department was functioning for almost four decades under the name of *Department of Geodesy and Cartography*. At the turn of the millennium, the department was bearing the name of *Department of Military Land Information*. The main task – educating of the new university graduates for the then Topographic Service (now the Geographic Service) – has been preserved.

The last major change occurred in 2005, when there was a fusion of the former Department of military land information with the Group of weather services from the Department of aviation and the joint *Department of Military Geography and Meteorology* was formed [5]. At the same time, the new study program Military geography and meteorology was created and accredited for both the bachelor and the master studies. Later, the study program was accredited also for doctoral studies. This step was a logical consequence of the two new arrangements: first, the new arrangements of both the Geographic service and Meteorological service of the Army of the Czech Republic (ACR); second, transformation of the *Military Topographic Institute* in Dobruska and the *Weather Centre* in Prague into the *Military Geographic and Hydrometeorological Office*. This arrangement is based especially on a new concept of the ACR, but also on a similar arrangement in the armed forces of the NATO member states. The wide range of tasks performed by both services is also reflected in the study subjects and practical training of students.

4. WAYS TO KNOW LANDSCAPE

Knowing the landscape; its development; the influence of its individual elements on human life and on the landscape itself; and recording, measuring and mapping of the landscape are the key elements of the education of geographers and many other disciplines dealing with Earth. This is the same also for students of the study program of the Military Geography and Meteorology. In addition to theoretical knowledge, the students go through a number of practical exercises throughout the study. These exercises allow a deeper absorption of information, verification of theoretical knowledge in practice and, last but not least, obtaining the more personal relationship to the branch, landscape, environment, and the planet Earth, as such. Practical exercises can be divided into several groups:

- surveying in the field
- working with cartographic and geographic data in labs or in the field
- analysing climate and meteorological data
- complex exercises,
- practical training at specialized army units,
- participating in students' research.

Surveying in the field

The first practical exercises in the field, through which student go, are related to the subject of Field Surveying. They familiarize themselves with the optical and electronic instruments and learn all fundamental surveying methods for measuring of bearings, angles, distances, heights and height differences. Simple exercises are followed by more complex tasks such as to determine point coordinates and heights in various geodetic systems, to lay-out, to find the unknown point, or to create a local network. Students use both terrestrial and satellite methods, or their combination.

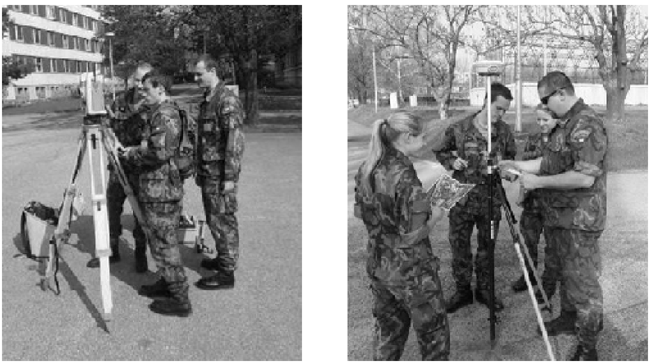

Figure 1: Field surveying of students with help of specialists from the VGHMUr Dobruska
Source: authors

Students have the opportunity to perform selected tasks under the guidance of specialists of the Department of Geodetic Support of the VGHMUr in Dobruška. The aim of these exercises is to introduce the students into exploitation of the latest surveying instruments that is introduced in the ACR and into current surveying methods. Students appreciate these joint exercises very positively and participate actively in surveying and discussions with specialists having a long experience both in the Czech territory and in foreign operations in the Balkans and in Afghanistan. All surveying work is carried out using the same procedures that are used in geodetic support of the ACR in the Czech territory or in the operations.

Apart from the subjects Geodesy and Mapping, where students use mainly geodetic and photogrammetric methods of data collection, students have further practical exercises in the subjects Hydrology and Meteorological instruments and methods of observation. During exercises in Hydrology students perform measuring of the velocity of the water flow in the individual river profiles using different methods, measuring of river bed profiles, mapping of the stream and its banks, and other tasks. The raw data coming from the individual measurements are partially processed on site for the case that some of the measurements would have to be repeated. Students will be able to use the acquired skills in the future for watercourse mapping, predicting the water level, creating topographic and special maps, or for preparation and assessment of the terrain for the purposes of building bridges and other provisional and permanent constructions.

Figure 2: Hydrologic measurement in the Oslava river
Source: authors

Given the scope of the field of study and specialization in geography and meteorology, students perform measurements and observations of the atmosphere and weather. To do this, students have a school weather station equipped with the basic instruments for measuring of meteorological variables where they learn all activities of meteorologist observer. During their practical training at specialized army units the students have the opportunity to perform measurements at the Air Force meteorological stations, where they develop their skills in observation and evaluation of weather.

Terrain instead of lab

Apart from working in the field, students can work in special laboratories of photogrammetry, global navigation satellite systems, geographic information systems, and meteorology. They can use a number of special instruments and computers with specialized software. They can use not only complete datasets of the VGHMUr in Dobruška, but also the samples of data covering foreign territories in standard formats of DTED, SRTM, VMap, MGCP, and many others including aerial photographs and satellite imagery. During exercises, students use existing spatial databases and they learn how to create their own databases and their specialized extensions.

From the perspective of the military geographer, the most important part of his work is the evaluation of the area of interest and performing of terrain analysis according to the needs of troops. Optimal results of his work are those in which he can support his conclusions with terrain reconnaissance and possible measurements in the field. The question is how to evaluate the unknown area when only geographic data are available, i.e. maps, geodatabases, aerial and satellite imagery, statistical information, guides, etc. That case assumes the experience in terrain evaluation, extensive knowledge of geography, knowledge of the influence of the terrain and weather on equipment and personnel, and sufficient amount of source data. Students cannot process such a task without the possibility of verifying of their own results and conclusions of the analysis.

Therefore, they perform the evaluation of a landscape not only in the classroom but also in the field. They can verify results of their work in the subjects Geography and Climatology on a number of geographically interesting sites. They learn how to evaluate terrain, landforms, and the nature of exogenous and endogenous processes in shaping the landscape, the human impact on nature and landscape elements. They distinguish vegetation composition in the lowlands and in rugged mountain terrain; they compare the acquired values with those in the maps and geodatabases and have the opportunity to know the reliability and quality of data. They investigate the soil resistance of rocks using penetrometric measurements and they evaluate soil carrying capacity. All of these activities aim to a single goal, which is bringing information to the commander whether the landscape in the particular area is a suitable place for planned activities.

Complex exercises

With increasing knowledge, students are introduced to more complex themes during practical work where it is not enough just to know a theory of a particular subject but it is necessary to apply knowledge and experience from other subjects. These complex themes form a major part of practical exercises in the subject Geospatial and meteorological support. Students work on the tasks that are very similar to those that they will meet soon after graduating and joining the system of supporting the ACR troops, coalition troops in multinational contingents, or in the frame of supporting the integrated rescue system at the territory of the Czech Republic.

The exercises are arranged into the two major components. The first component is the provision of quality data about the landscape (i.e. geographic reality of a particular area). Students perform a complex or partial geographic data collection for the purposes of a fictitious operation. They receive only a set of varied analogue documents (usually maps of various editions, age, themes, and projections; but also statistical and other data) and current aerial or satellite imagery. Students have to build a complex project of creating of geographic data and they have to:

- define map projection of the output materials (usually the UTM),
- select the appropriate method of data collection (i.e. technology, sources, etc.),
- perform collection of collateral data,
- perform the field inspection (if possible),
- create graphical outputs (i.e. scale, symbol sets, etc.),
- create additional outputs (i.e. graphs, schemas, 3D visualizations, etc.),
- present the results of their work.

The second component is processing of geographic data, their evaluation and studying selected areas of interest. Students use both the standard geographic products of the Geographic Service of ACR and the results of their surveying and observations to evaluate the landscape and to perform various analysis. They evaluate selected areas in terms of the following purposes:

- possibility of vehicle and personnel movement,
- possibility of observation, conducting fire, and other activities,
- possibility of supply from local sources,
- influence of population on the planned activity,
- sources of potential non-military threats (i.e. chemical and other plants, storage of hazardous substances, etc.),
- possibility of operations of the integrated rescue system units and the army during natural disasters.

Complex exercises integrate in this way the knowledge of most subjects and their main goal is to prepare students for the real tasks of their future practice.

Cooperation in solving of scientific tasks

Scientific tasks at the Department of Military Geography and Meteorology are focused primarily on the area of applied research in the domains linking geoscience disciplines with tactics, defence and protection of the territory and its inhabitants. They are based on the unique position of the department among other educational establishments of similar orientation. According to [10], this area is neglected by geographers in recent decades. However, long-term effort and results of work of the department teachers and students are in contradiction to this statement. It can be concluded from this, that even within a relatively small geographic community in the Czech Republic it is not sufficiently known what the individual departments pursue.

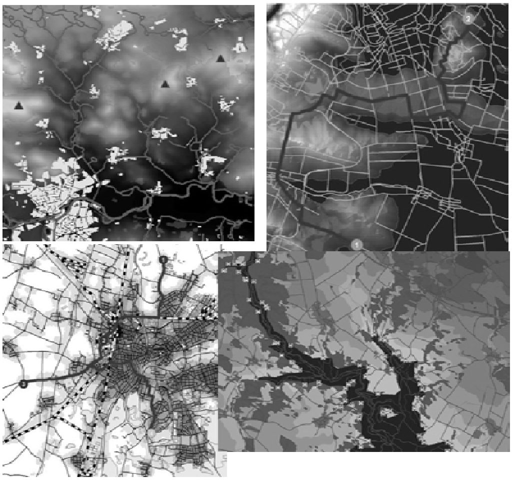

Figure 3: Examples of the analytical work of students
Source: authors

All the PhD theses successfully defended at the department in recent years can serve as examples of work in this area. These theses were focused on a problem of using geographic data in simulation systems and command and control systems ([3] [9]), analysis of geographic space for the needs of troops and the integrated rescue system units ([8] [12] [14] [16] [19]) or updating of geospatial data and geospatial support of the ACR ([11] [13]). All these works deal with an issue of geography and military. Research projects conducted at the department are also directed to this domain. This research is closely linked to the activities of the armed forces and their current needs. The results of this research, which also involve the students' participation, are published in journals and conference proceedings. The two unique monographs examining the effect of the terrain on the movement of vehicles can serve as an example of remarkable outputs of this research [17] [18]. In the early history of the department, the research was focused in particular to the tasks related to creation of the new map series and its updating (i.e. topographic maps, special maps, military geographic atlas), building of geodetic networks, network adjustment, or establishing of international datums at the Czech territory (S-42, S42/83, WGS84). Later, it was automation of cartographic production or creation of geographic databases and their exploitation for defence needs. Currently, members of the department work on the following problems:

- geospatial support of the armed forces on the Czech territory and abroad,
- assessing the quality of geographic data and reliability of analysis results,
- influence of the landscape on vehicle mobility,
- influence of weather on human activity,
- visualization of analysis results,
- production of terrain passability maps.

Students of doctoral studies or master studies participate in most of the projects. Their participation involves mainly surveying in the field, evaluating and processing data, and generating selected outputs.

Participation on the project allows the students to identify current problems of geographic and meteorological practice in the armed forces already during their studies. They have the opportunity to cooperate with teachers as well as with specialists of the Geographic Service and Hydrometeorological Service. Students of master studies can present the results of their contribution during national or international student conferences, or to integrate the problem into their thesis.

5. APPLICATION OF KNOWLEDGE IN PRACTISE

Military graduates, unlike their peers from other universities, have one indisputable advantage. There are work positions in one of the services assigned for them and they do not have to look for a job. The graduates usually start their service at basic technical posts within the Military Geographic and Hydrometeorological Office in Dobruška, at the Air Force meteorological stations, or as geographers at brigades. Given the wide range of tasks within the armed forces, the graduates have the opportunity soon after starting their careers to begin to specialize in particular specific areas or to try to work in various positions.

Apart from the practical experience in providing support of the ACR in the Czech Republic, graduates often have the opportunity soon after graduating to be assigned to various professional posts within the missions and operations abroad. They can gain experience from working in the international teams, at geographically different environments, and on varied tasks. These experiences and knowledge are then presented back to the services and also to the students currently studying in the department. This is an opportunity for comparing the theoretical knowledge with the practical experience of specialists coming back from the operations in the Balkans, Iraq, Afghanistan, but also from the specialists coming back from the command structures of NATO and EU.

6. CONCLUSION

For students, the landscape becomes an open classroom and laboratory, which offers them sometimes benign and sometimes harsh face. Whether the landscape will be a friend or foe for friendly forces depends on the degree of knowledge that was reached by students already during their studies. Landscape influences the course of history, so it is important to understand it and learn it, both in its elements and as a whole, including its effects on human activities. And military geographers are expected to know that. The department therefore seeks to provide students the ways for gaining this knowledge, from providing theoretical knowledge to training of practical skills. This effort is led, among others, by practical experience what military geographers need in the practice at the own territory as well as abroad.

ACKNOWLEDGEMENT

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ANALYSIS AND ASSESSMENT OF LANDSCAPE STRUCTURE USING COEFFICIENTS OF ECOLOGICAL STABILITY

Jana Vojteková[1] and Matej Vojtek[1]

[1] 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,
e-mails: jvojtekova@ukf.sk, mvojtek@ukf.sk

ABSTRACT

The paper deals with the analysis and assessment of landscape structure in the Horná Nitra Region using the coefficients of ecological stability. Based on specific natural and socio-economic factors affecting the formation of landscape and its changes, we chose the town of Handlová and municipalities of Cigeľ and Ráztočno as the study area which is located in the Horná Nitra Region. To define the level of ecological stability of a certain territory, several methods were created most of which are based on the calculation of the coefficient of ecological stability (C_{es}). It is a numeric value based on which the landscape is placed into a certain degree of ecological stability. For the calculation of ecological stability, three formulas were used: C_{es} according to Míchal (1985), C_{es} according to Miklós (1986), and C_{es} according to Löw et al. (1987) which are designed especially for the calculation of ecological stability in the agricultural landscape. As long as the study area is also used for agricultural purposes, we verified their suitability. We found out that in the study area all of these coefficients had the lowest values in the period of 1783-1785 while the highest values were in 2003 and 2011. Since 1987, the coefficients classify the study area to a significantly stable landscape which is mainly due to large size of the group of elements of forest and non-forest woody vegetation. Before 1987, the study area was more agriculturally utilized which was also proved by all of the calculated C_{es}. The most suitable C_{es} was the one by Löw et al. (1987) since it provides more accurate assessment of landscape ecological stability using all landscape elements and classifying them according to the degree of ecological stability.

Key words: *coefficient of ecological stability, landscape structure, Handlová, Cigeľ, Ráztočno*

1. INTRODUCTION

By continuous influence of natural processes, several types of landscapes were created which are referred also to as geo-ecological types or types of natural landscape. These types were, and still are, more or less affected also by anthropogenic processes. People concentrate their activities in specific landscape environment of these types where the results of their activities are overlapped with natural conditions and ongoing processes in them (Boltižiar, Olah, 2009).

Natural or anthropogenic processes cause changes in the landscape which, from the ecological point of view, directly influence also its stability and thus the ability of an ecosystem to return to dynamic balance or to its “normal” developmental direction using internal mechanisms. To define the level of ecological stability of a certain territory, several methodological tools were created most of which are based on the calculation of the coefficient of ecological stability (C_{es}) (Reháčková, Pauditšová, 2007).

The aim of this paper is the comparison of three coefficients of ecological stability (C_{es} according to Míchal (1985), C_{es} according to Miklós (1986), and C_{es} according to Löw et al. (1987)) in selected municipalities of the Horná Nitra Region in different time horizons. In order to calculate coefficients of ecological stability, the basic task was to analyze the landscape structure (LS) of the study area for which we used historical and topographic maps, orthophotos as well as field survey.

2. STUDY AREA

Based on specific natural and socio-economic factors, affecting the formation of landscape and its changes, we chose the Handlová Town and municipalities of Cigeľ and Ráztočno as the study area which is located in the Prievidza District and Trenčín Region. The town of Handlová is, according to the size of the cadastral area (8,555 ha), the largest town in the Prievidza District. The municipality of Cigeľ has an area of 1,735 ha and the municipality of Ráztočno has 1,759 ha (Fig. 1).

Natural factors influencing the changes in the landscape structure include particularly landslides. Socio-economic changes are represented mainly by surface and underground mining activities. In all three municipalities, the mining industry is located. In the town of Handlová and municipality of Cigeľ, it is focused on mining of brown coal and lignite while in the municipality of Ráztočno, it focuses on the surface quarrying of dolomite and in the municipality of Cigeľ on the surface quarrying of andesite.

The study area is classified into four geomorphological units: Kremnické vrchy (mountain), Žiar (mountain), Hornonitrianska kotlina (basin), and Vtáčnik (mountain).

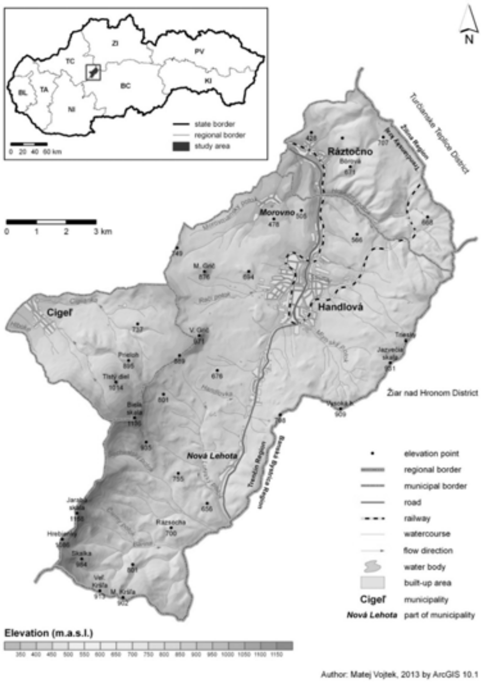

Figure 1: Study area

3. METHODS

For the calculation of coefficients of ecological stability of the study area, the basis was represented by the analysis of LS and its changes for which we used the maps from the years 1783/1785 (map of the 1st Military Survey at a scale of 1 : 28 800), 1845 (map of the 2nd Military Survey at a scale of 1 : 28 800), 1936 (reambulated map of the 3rd Military Survey at a scale of 1 : 25 000), 1956 (topographic map at a scale of 1 : 25 000), 1987 (topographic map at a scale of 1 : 25 000), and orthophotos from 2003 (scale 1 : 2 000) and 2009 (scale 1 : 2 000) which were updated by a field survey which was carried out in 2011.

After creating the maps of LS for the whole period (1783-2011), a unique and time extensive database (228 years) about the study area was created. Based on these maps and data obtained by their processing, each period was analyzed in terms of ecological stability.

To determine the ecological stability, we used the following formulas: C_{es} according to Míchal (1985), C_{es} according to Miklós (1986), and C_{es} according to Löw et al. (1987).

C_{es} according to Míchal (1985), determines the share of stable and unstable patches of landscape elements in the study area:

$$C_{es} = \frac{FL + WA + Pa + We + Or + Vi}{AL + AA + HG} = \frac{\text{Stable ecosystems}}{\text{Unstable ecosystems}}$$

FL – forest land, WA – water area, Pa – pastures, We – wetlands, Or – orchards, Vi – vineyards, AL – arable land, AA – anthropogenic areas, HG – hop-gardens

This formula was slightly modified so that stable areas included all patches from the group of elements of permanent grasslands and unstable areas included the group of technical elements.

Assessment of C_{es} according to Míchal (1985) was as follows:

- $0.0 \leq C_{es} < 0.1$ – landscape with maximum disruption of natural structures,
- $0.1 < C_{es} < 0.3$ – landscape used more than average with a clear disruption of natural structures,
- $0.3 < C_{es} < 1.0$ – landscape used intensively mainly through agriculture,
- $1.0 < C_{es} < 3.0$ – overall balanced landscape in which technical objects are already relatively consistent with the preserved natural structures,
- $3.0 \leq C_{es}$ – stable landscape with a predominance of natural and nature-close structures.

C_{es} according to Miklós (1986), differentiates stable and unstable patches according to their ecological significance by introducing numerical coefficients:

$$C_{es} = \frac{p_n * k_{pn}}{p}$$

p_n – size of individual landscape elements, k_{pn} – coefficient of ecological significance of landscape elements, p – overall size of the study area

Coefficients of ecological significance of landscape elements according to land use have the following values: agricultural land (0.14), meadow vegetation (0.62), pastures (0.68), gardens (0.5), orchards (0.3), forest land and water areas (1), other (0.1).

Assessment of C_{es} according to Miklós (1986) was as follows:

- $C_{es} < 0.2$ – significantly unstable landscape,
- C_{es} 0.2 – 0.4 – unstable landscape,
- C_{es} 0.4 – 0.6 – partially stabilized landscape,
- C_{es} 0.6 – 0.8 – stabilized landscape,
- C_{es} 0.8 – 1.00 – significantly stabilized landscape.

C_{es} according to Löw et al. (1987), divides the individual landscape elements into groups based on the degree of ecological stability (DES):

$$C_{es} = \frac{1.5\,A + B + 0.5\,C}{0.2\,D + 0.8\,E}$$

A – percentage representation of the size of landscape element included into the 5th degree of DES

B – percentage representation of the size of landscape element included into the 4th degree of DES

C – percentage representation of the size of landscape element included into the 3rd degree of DES

D – percentage representation of the size of landscape element included into the 2nd degree of DES

E – percentage representation of the size of landscape element included into the 1st degree of DES

Assessment of C_{es} according to Löw et al. (1987) was as follows:

- $C_{es} \leq 0.1$ – devastated landscape,
- $0.1 < C_{es} < 1.0$ – disrupted landscape capable of autoregulation,
- $C_{es} \approx 1.0$ – balanced landscape,
- $1.0 < C_{es} < 10.0$ – landscape with a predominant natural component,
- $10.0 \leq C_{es}$ – natural or nature-close landscape.

4. RESULTS

C_{es} calculated according to Míchal (1985) assesses the municipality of Cigeľ in each time horizon, municipality of Ráztočno since 1936, and the town of Handlová since 1956 as the stable landscape with a predominance of natural and nature-close structures. The municipality of Ráztočno in 1936 and the town of Handlová until 1956 lie within the interval of 1.0-3.0 which means that the landscape was generally balanced and technical objects are already relatively consistent with the preserved natural structures.

The calculated coefficients of ecological stability, according to Miklós (1986), classify the study area into three intervals: 0.4 to 0.6 – partially stabilized landscape (Handlová Town until 1936), 0.6 to 0.8 – stabilized landscape (Handlová Town between 1936 and 1956, municipality of Cigeľ in 1783-1785, 1845, and municipality of Ráztočno until 2003) and 0.8 to 1 – significantly stabilized landscape (Handlová Town since 1987, municipality of Cigeľ since 1936, and municipality of Ráztočno since 2003).

According to C_{es} by Löw et al. (1987), the study area was assessed as follows: municipality of Cigeľ until 1936, municipality of Ráztočno, and the town of Handlová until 1987 were within the interval from 1 to 10 which means that the area is rated as the landscape with the predominant natural component. Since 1936 (Cigeľ) and 1987 (Handlová, Ráztočno), the study area is rated as the natural or nature-close landscape.

Based on the calculated coefficients of ecological stability, we found out that all three C_{es} in the study area had the lowest values in the period of 1783-1785 while the highest values were in 2003 and 2011 (Fig. 2).

Since 1987, all calculated coefficients (Tab. 1) classify the study area to significantly stabilized landscape which is mainly due to large size of the group of elements of forest and non-forest woody vegetation, which is considered the most stable ecosystem in the landscape. Prior to 1987, the study area was more used for agricultural purposes as shown by the assessment of C_{es} according to the used formulas.

The results of landscape structure assessment using different methods for the expression of coefficients of ecological stability justify the diversity of the study area in terms of its utilization and stability (Kilianová et al., 2009).

After verification of the C_{es} used, we found out that C_{es} according to Míchal (1985) seems to be inappropriate because it does not include all landscape elements and thus it does not reflect the historically distinct ecological quality and structure of patches within the same group of landscape elements (Lipský, 2000).

C_{es} according to Miklós (1986) proved to be more accurate than C_{es} by Míchal (1985). However, its disadvantages are: general classification of patches into the formula (e.g. forest land cannot include clearings, etc.) and according to Kopp (2004), ecological stability of the landscape is not determined only by the quality of its ecosystems, but also by its functional arrangement.

The most suitable C_{es} in our case was the one by Löw et al. (1987) since it provides more accurate assessment of ecological stability of the landscape because the formula includes all landscape elements and classifies them according to the degree of ecological stability.

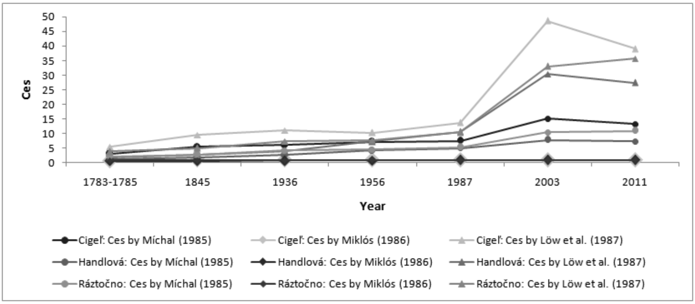

Figure 2: Development of the coefficients of ecological stability during the period of 1783-2011

Table 1: Coefficients of ecological stability during the period of 1783-2011

C_{es} by Míchal (1985)							
Year/municipality	**1783-1785**	**1845**	**1936**	**1956**	**1987**	**2003**	**2011**
Cigeľ	3.06	5.33	5.93	7.02	7.45	15.09	13.16
Handlová	1.01	1.57	2.49	4.05	4.87	7.79	7.30
Ráztočno	2.06	2.65	4.20	4.47	5.25	10.44	10.89
C_{es} by Miklós (1986)							
Cigeľ	0.74	0.79	0.80	0.82	0.83	0.88	0.87
Handlová	0.54	0.57	0.62	0.70	0.80	0.84	0.84
Ráztočno	0.69	0.71	0.76	0.77	0.79	0.84	0.84
C_{es} by Löw et al. (1987)							
Cigeľ	5.43	9.43	11.01	10.21	13.62	48.62	39.01
Handlová	1.63	2.60	4.04	7.18	10.51	30.35	27.38
Ráztočno	3.74	4.94	7.29	7.56	10.31	32.96	35.71

Source: own calculations

5. CONCLUSION

For the calculation of ecological stability, we used three formulas: C_{es} according to Míchal (1985), C_{es} according to Miklós (1986), and C_{es} according to Löw et al. (1987) which were applied also in the works such as Buček, Míchal (1990), Malenová (2008), Reháčková, Pauditšová (2007), Žigrai (2001), etc. There are also other formulas to calculate C_{es}, for example, C_{es} according to Streďanský, Šimonides (1995). Most of these authors used C_{es} in the agricultural landscape and thus confirming the significance of these coefficients. On the other hand, C_{es} was used also by the authors who focus on alpine landscape, such as Boltižiar (2007) who confirms the significance of the landscape structure analysis by using C_{es} as well.

According to the calculated coefficients of ecological stability, we found out that in the study area all of them had the lowest values in the period of 1783-1785 while the highest values were in 2003 and 2011. Since 1987, all calculated coefficients classify the study area to a significantly stable landscape which is mainly due to large size of the group of elements of forest and non-forest woody vegetation. Before 1987, the study area was more agriculturally utilized which was also proved by the assessments using the mentioned formulas of the C_{es}. The most suitable C_{es} in our case appears to be the one by Löw et al. (1987) since it provides more accurate assessment of landscape ecological stability because it includes all landscape elements and classifies them according to the degree of ecological stability.

C_{es} is usually a key element for the design of actions for the landscape creation resulting from the proposals of the local territorial systems of ecological stability (MÚSES) processed for the landscaping projects. Based on the methodology of the uniformly set ecological stability of the landscape, there will be a natural opportunity to compare territories and connect smaller territorial units into larger units (Reháčková, Pauditšová, 2007).

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FUNCTIONAL MINING REGION: JÁCHYMOV STUDY AREA

Hana Svatoňová[1]

[1] Department of Geography, Faculty of Education, Masaryk University, Poříčí 7, 603 00 Brno, Czech Republic, e-mail: svatonova@ped.muni.cz

ABSTRACT

The region of Jáchymov became the place of world exclusivity – it was the only place where the Soviet Union could obtain uranium immediately after the 2nd World War. This situation has brought massive changes to the landscape of Jáchymov associated with the development of mining industries and the need of labour force. This paper presents the whole complex of mining system passing through several phases. The functional mining region is defined as well as model of mining system containing the main objects and their relationships.

Key words*: functional mining region, mining system, post-industrial landscape, uranium mining, Jáchymov, prison camps*

1. INTRODUCTION

There were only two places in the world after the Second World War where uranium ore was mined: in Jáchymov in Czechoslovakia and in Belgian Congo. After the firths nuclear bombs were used and showed the power of military usage of uranium, the Soviet Union started to have eminent interest in developing its own nuclear weapons. As soon as in 1945- short time after the surrender of Germany and Japan- Soviet government and Czechoslovak government signed a treaty on uranium mining and it‘s sale to the USSR (Pluskal,1998). With the liberation of Czechoslovakia, the USSR gained control of uranium mines in Jáchymov, from where it could immediately start to transport the uranium to it‘s territory for nuclear research. Interest of the-global power was quickly reflected in fast development of uranium mining in – Czechoslovakia: new mines were being opened, settlements were being built, new labour force was being taken on, prison camps were being built. After communistic coup d‘etat in 1948, thousands of opponents of the new regime were used as slave labour force in the mines. In Jáchymov, the mining system was quickly built, the landscape was dramatically changed during short time, a lot of new inhabitants came to this area to find a job and new life- there. On relatively small area we can study the building of the whole complex of mining system, existence functional mining region in his phases as well as landscape changes and relicts of uranium mining.

2. JÁCHYMOV STUDY AREA

Jáchymov is a small town (2800 inhabitants, 2013) in the Ore Mountains on the west of the Czech Republic on the border with Germany (see Fig. 1 and 2). Underhill landscape of Jáchymov was hit by two distinct processes immediately after the Second World War: expulsion of the German population and the rapid development of uranium mining. Uranium deposits in Jáchymov were-among the two most important places of the world uranium mining after the Second World War.

Mineral resources of Jáchymov‘s landscape are a consequence of the complex mineralization. Hydrothermal ore solutions filled crack mica schist, and created veins containing silver, bismuth, nickel, cobalt and uranium. The veins of uranium ore are found in mica schist rocks from the surface to contact with masses of granite at depths of about 800 meters. Ore was concentrated in lens of different thickness (from 1 mm up to max 40 cm). 970 ore veins were tested in Jáchymov district, 370 of which have been mined for uranium mineralization. Note: In 1898 Marie Curie-Sklodowská discovered two new radioactive elements, radium and pollonium in Jáchymov pitchblende (uranium oxide containing 46 to 88 % uranium). Very rare and expensive radium started to be isolated from the uranium ore for laboratory usage. In 1927 processing of 35 tons of pitchblende received only about 3 grams (!) of pure radium (Vacula, 2016).

Figure 1: Location of Jáchymov in Europe.
Source: World – ESRI data

Figure 2: Jáchymov – small town in Krušné hory (Ore Mountains).
Source: Hana Svatoňová, 2011

3. METHODS

Geographical research of the Jáchymov area carried out in different stages. Region selection of post-industrial landscape of Jáchymov study area is based on studies Kolejka et al. (2012), Svatoňová & Plšek (2012) and Svatoňová & Lněnička (2013), Hofmann et al. (2014). Military maps (1 : 25 000) and old aerial photographs taken in 1952 were used in the preparatory phase of the research. The materials of remote sensing – current and old aerial photographs – were used for the identification and location of the now defunct objects. Resolution of old aerial photographs available online (National INSPIRE Geoportal) was crucial for detailed identification of objects. Projection of old buildings to the current orthophotos was made with tools for the transparency of layers (aerial photographs). Exactly drawing objects, images and maps were necessary for quality field work and research. Fieldwork continued the preparatory phase. The objects were documented and mapped in aerial photographs and redrawn to map. Documentation – 400 photographs of current state of landscape was made in 2011 and 2012. Working in archives was a specific of this geographical research. Many documents, contemporary statistics, government contracts, special maps and drawings are stored in the ARCHIVE DIAMO. Geodatabase of Jáchymov study area is needed to continually update Talhofer et al. (2012). Camps localisation was made according to terrain fieldwork.

4. MINING SYSTEM AND FUNCTIONAL MINING REGION

For use in geographical research of industrial and post-industrial landscape the functional mining region was defined as well as model of mining system containing the main objects and relationships.

Mining system consists of mining and processing objects, heaps, labour and housing and services. Structure, elements, sub-elements and relations of system are presented by model of mining system on fig. 3.

Many authors (Hall, Hay, 1980; Van Den Berg et all., 1982; Bezák, 2000; Hudec, 2011; Posová a Sýkora, 2011) define and use the term functional urban region. For the purposes of geographical research of post-industrial landscape was defined **functional mining region** as a **contiguous territory with a functioning mining system** (Fig. 3 a 4).

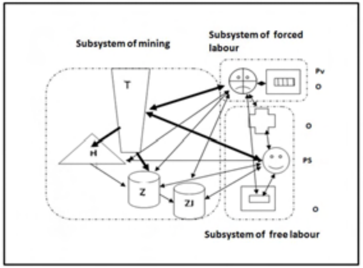

Figure 3: Model of the mining system of Jáchymov using forced labor, T – mining objects, H-heaps, Z – processing plants directly related to mining, ZJ – other processing plants, Ps – free labor , Pv – forced labor – prisoners and captives, O – housing and services.
Source: own processing.

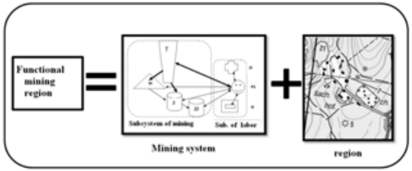

Figure 4: Functional mining region.
Source: own processing

5. MINING SYSTEM ACCORDING TO PREFORMANCE – MATURITY

It was observed during the geographical research that mining systems pass through several stages of maturity, from young systems to dead systems with abandoned mining.

Mining systems according to performance were classified to four classes:

- **young** (dynamic with newly constructed buildings and forming the relationships, increasing output performance),
- **mature** (created objects are functionally active, the system gives a maximum and stable output),
- **old** (objects cease to exist, a number of relationships disappear or dysfunctional, passive, output decreases),

- **dead** (the objects were largely abolished, network of relationships are disintegrated, the system lose its functionality, new functionality and new applications are searched. stem is inefficient).

Development of the system by functionality could be represented graphically – x-axis represents the time axis, y-axis the value axis – the system performance (production volume, number of employees). Mining system of Jáchymov's pass through stages of maturity is presented on Fig. 5.

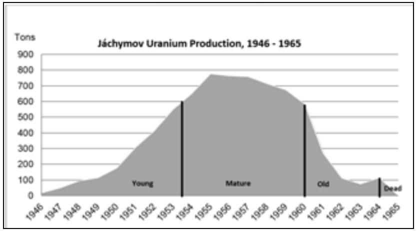

Figure 5: Mining system of Jáchymov according to performance – maturity.
Data sources: Archive Diamo. Development of the Uranium Industry in Czechoslovakia 1945–1965.

6. CONSLUSION

Landscape of Jáchymov is known for uranium mining in the 20th century and for the sad fact of existence of prison camps. It represents the example of disappearing traces of some human activities as well as the example of transformation of the mining area.

The article presents a landscape of Jáchymov as an appropriate area for defining and modelling the mining system and defining a functional mining region. Development of the area after the 2nd World War is characterized by exceptional dynamic processes: interest of the Soviet Union – the victorious power – to buy uranium, the removal of the German population, the advent of new labour force, involuntary stay of thousands of prisoners of war and political prisoners, building of settlements and prison camps, open shafts, detailed geological research, building processing plants, creating heaps and many others. Uranium mining in Jáchymov was completed in 1964. The whole system worked for nearly 20 years. Therefore, it is suitable for the study of some processes, including its own dynamics and performance. For the purposes of geographical research, a model of mining system of Jáchymov was compiled. The employment of forced labour force is a specific feature of the system. The functional mining region is defined as a mining system located in the area. It is an area where individual objects and relations of mining system are physically located. The core of functional mining region is represented by Jáchymov. The region consists of cadastral municipalities affected by mining system. The functional mining region covers an area of approximately 300 km^2. The region has a border with the Federal Republic of Germany. The subject of further geographical research will be the reconstruction of functioning of processes and objects in the region Jáchymov including time trends and specifics related to the existence of prison camps.

ACKNOWLEDGEMENT

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THE GIS SUPPORT TO MEASURES ON THE GROUND IN CASE OF LEAKAGE OF LIQUID POLLUTANT ON THE ROAD

Jaromír Kolejka[1], Petr Rapant[2] and Jana Zapletalová[3]

[1] Masaryk University, Faculty of Education, Department of Geography, Poříčí 7, 603 000 Brno, Czech Republic, e-mail: kolejka@ped.muni.cz

[2] IT4Innovations – National Supercomputing Center and Institute of Geoinformatics, VSB-Technical University of Ostrava, 17. listopadu 15, 708 33 Ostrava-Poruba, Czech Republic, e-mail: petr.rapant@vsb.cz

[3] Institute of Geonics, Czech Academy of Science, Ostrava, Department of Environmental geography, Drobného 28, 602 00 Brno, Czech Republic, e-mail: zapletalova@geonika.cz

ABSTRACT

Accidents on roads associated with the leakage of hazardous substances are one of the major challenges encountered by disaster management. Because of the impossibility of predicting the place and time of the event, then it is necessary in the event of such an accident to proceed in quick succession of steps. They are designed primarily to protect human life and health, and then to minimize to property and environment damage. The paper describes the response to this event using GIS tools and generally available geodata. The simulated accident on the D1 highway near Ostrava is applied as a demonstration example.

***Key words:** GIS, decision support, geographic data and knowledge*

1. INTRODUCTION

Modern geoinformatics is used, among other for the following groups of purposes:

a) it captures, stores, manages, evaluates and transmits information in a localized area,

b) it provides practical application in various decision-making processes in a wide range of human activities. With the emergence of new social applications of geoinformatics the requirements to meet these demands also grow. Qualitative and quantitative breakthrough in the practical application of geoinformatics marked the advent of desktop computers in almost all fields of human activity in the 1990s.

The needs of practical disciplines backward stimulated, inspired and accelerated the development of geoinformatics, especially (i) the development of hardware and software, (ii) increasing the capacity of data storage, (iii) intermediate products and results processing, (iv) development of communication technologies, (v) mobile geoinformation facilities, (vi) increase in the general level of education, and (vii) computer literacy. These all advantages of geoinformatics support a wide range of useful applications in the disaster management. The procedure of its usage in the decision making after a toxic accident on the road presented in the paper serves as an example.

2. DISASTER MANAGEMENT

Disaster management ranks among the so-called everyday applications of geoinformatics. Modern disaster management – (hereafter DM) – is a set of activities focused on preparatory, operational and corrective phase dealing with the processes in the landscape endangering human lives and material goods. DM relies on powerful computers and information technology in accordance with technological development. With a growing number of population as well as tangible and intangible property the volume of damages caused by natural disasters or diverse accidents conditioned by man activities increases. Also, the moral impact of such events on the population escalates, whether the current growth is actually attributed to the growing number of events, or simply by their better recording, documentation and information about them. All these phenomena take place in the geographical environment and they involve in various ways natural, economic and human components of the landscape. Disaster management as a comprehensive management system of the competent authorities is focused on analysis and evaluation of safety risks, planning, organizing, implementing and controlling activities undertaken in connection with the disaster situation generally (Law no. 240/200 Coll. about Disaster Management). Originally a military term is being used since the late 20th century for designating of the processes associated with managing disaster situations of natural, anthropogenic, social, economic origin or in business administration (Antušák, Kopecky, 2003). Its wide (i.e. civilian) understood (as "Emergency Management" – Glossary of disaster management and defence, 2009) includes all attitudes, opinions, experiences, recommendations, methods, measures and constraints applied in a hierarchical and functionally interconnected system by the appropriate authorities public administration, legal entities and individuals with the aim of:

1) to minimise (prevent) the possibility of a disaster origin (in the form of prevention and correction of disaster situations in connection with effective anti-disaster intervention) and/or (in the event that the disaster has already occurred) disaster consequences,

2) to reduce the extent of damages, to minimise the duration time of the disaster, to eliminate the effects of negative factors of disaster situations and to restore the system to its normal state (Dvořáčková, 2008).

The system emergency planning of the Czech Republic consists of three relatively independent fields: (i) defence planning, (ii) civil emergency planning, and (iii) emergency planning (Antušák, Kopecky, 2003). A wide application of physical geographic data and knowledge is offered in all three fields, but so far it happens quite rarely. So called Integrated Rescue System (IRS) was created for disaster management in the Czech Republic. It coordinates the joint procedure of its essential bodies (Fire Rescue Brigade, Emergency Medical Service, Police) and, if possible, bodies of civil protection, segregated armed forces, etc.) in preparing for emergencies and in conducting safety and liquidation works (Rektořík, et al., 2004). Physical geographic data and knowledge can be applied at various stages of Disaster Management situation to solve extraordinary events (Fig. 2). At rapid intervention (which is primarily for saving lives and health), it is appropriate to use the data of the digital terrain model (DTM) to create a 3D image of a intervention area for operational decisions of the relevant sections of the IRS there. Similarly instantaneous meteorological data can be effectively applied. At short-term decision making (stopping the loss of human lives, spreading of damage to property and into the environment), it is already useful to use of information about all components of the landscape, because at this stage it starts to use the technical resources of the IRS at the place of the event. For selection of techniques and the place of deployment the interpreted analytical data about the behaviour of hazard are required: flood, fire, spreading of toxic substances, etc. Here, in addition to the original geodata, the geographic knowledge of interpreted documents can be applied.

In the medium term horizon it will deal with the liquidation of the impact of the event and as a long term horizon of the education and prevention (and on an integrated risk evaluation of individual cases of possible events). Here the efficient operation of disaster management cannot be already imagined without the use of physical geographic data and knowledge.

The effectiveness of disaster management is measured by the speed and accuracy of steps that have been chosen and deployed to solve specific event.

It is therefore necessary to develop, formulate and formalize relevant procedures for implementation into computer-assisted decision in DM, leading to the development of such products (instructions, solutions) and visualizations that will support users at different levels of DM, starting with the management and ending with the individual citizen. Tasks can be realized only on the basis of interdisciplinary data integration and knowledge of the natural, economic and social aspect of environment

Different geodata and expert knowledge characterize group of activities and functioning of DM in the stage:

1. Preventive measures (risk assessment – identification of localities with the highest probability of occurrence of specific adverse events, if possible). Risk assessment is a standard example of decision support, as it focus in the right direction attention of DDMM and informed citizen at critical points. The degree of risk then it may reduce the incidence of processes that could start their own harmful event.
2. Interventions planning (modelling adverse effect on its various alternatives – classification of methods and locations of intervention). When it deals with immediate intervention (which is primarily about saving lives and health), it is appropriate to use the data of the digital terrain

model (DTM) to create a 3D image of a rescue space for operational decisions of the relevant sections of the IRS in it.

3. operational decision-making (implementation of intervention: place, time and manner, presentation of tasks for management and citizens). There is also optimally apply the 3D visualization of the situation (land use) and sensitive objects (tertiary structure), but also information about the risks that could negatively affect the development of emergency.
4. subsequent short- and medium-term corrective measures (technically substantiated selection, location, extent and intensity of activities). When short-term decision making (stopping the spread of damage to people, property and the environment), it can already make good use of information about all components of the landscape, because at this stage is to use the technical resources of the IRS in the place the event. In the medium horizon it will be the liquidation of the consequences of the event.
5. long-term mitigation of consequences of emergency (like a professionally well-founded choice, location, extent and intensity of activities). There purposefully interpreted geodata of various structures of the landscape can be advantageously used, both in terms of strengthening recovery (and those resist) functions of buildings and areas, and in terms of education and prevention.

Geodata and expertise have always played an important role in decision-making processes in the area, both in terms of more efficient use and protection of resources and space for various purposes, and in terms of limiting the negative impacts of human activities on the landscape and back to human activity. Moreover, in addition, currently, computer equipment (ICT), GIS, remote sensing, computer cartography, etc. in the hands of professionals, as powerful tools along with expert systems can facilitate much faster, more reliable and more efficient management of DM. So far, this is done mostly on the basis of administrative and technical approach that gradually opens the expert knowledge and structured data on the landscape (by type structures), which offers an unprecedented chance for DM already in the nearest future.

3. CURRENT STATE-OF-ART

The issue of transport of hazardous materials is a part of the investigation disciplines for decades. Possibilities for safe transport has been evolving (i) depending on the technological development of transport means and shipping containers (marginally Verma and Verter, 2007), (ii) the development of transport infrastructure (in terms of a wider range of better transport routes) (iii) the development of legislation etc. The transport of hazardous materials covers a range of different modes of transport. In the Czech Republic it regards in particular road and rail transport, to a lesser extent by river transport. Road and rail transport in terms of risks of transporting hazardous materials are often compared (Purdy, 1993).

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One of the most cited books dealing with this topic is the “Guidelines for quantitative risk assessment” Purple book) written by De Haag and Ale (1999) which is concerned in its second part with the transport evaluation of hazardous materials. Nicolet-Monnier and Gheorghe (1996), are giving close consideration to transport based on the experience examples of the USA and Great Britain. Here, the orientation towards knowledge creation practices of so-called *risk management* can be found. In the European context the study by Høj and Kroger (2002) is instructive. There the risks of transport (in general, not just hazardous substances) by road and rail are analysed. Among others, they remind that the risk assessment was mostly devoted to special locations such as tunnels (e.g. Diamantidis, Zuccarelli, Westhäuser 2000) or bridges. The purpose of these evaluation was to create a knowledge base not only for the decision-making processes, but also for risk communication – its smooth functioning (incl. Terminology apparatus) in case of accidents appears necessary to eliminate damages. As Goerlandt and Montewka (2015) note, a number of applications that are used for risk management take no account to theoretical issues related to disaster management, which includes just a set of definitions and terminology or perspectives of risks. This can cause a number of problems. In this context Høj and Kröger (2002) note that an important aspect of risk assessment is the human factor (reliability), which to a large extent could impact on the degree of transport risk (Swain and Guttmann, 1983). Among many other authors it is possible also appoint articles of authors Fabiano, et al. (2002, 2005), Bubbico, Di Cave, Mazzarotta, (2004), Bubbico, et al. (2006), Van Raemdonck, Macharis, Mairesse (2013); from the Czech authors for example Soušek´s surveys (2005,2008, 2010). Visualization of such a risk could be another means evaluating the level of risk transport of hazardous materials. Van Raemdonck, et al. (2013) show it at the example of Flanders. Their work focuses on two components: (i) assessing the likelihood of an accident, and (if it occurs) (ii) to evaluation the consequences of the accident, which is similar to the process used (Verter and Verma, 2007).

Transport of hazardous and toxic materials is regulated by international regulations, which are based on the EU's Model Regulations (RID, ADR, ICAO, ADN, IMDG Code).

General conditions for the transport of dangerous goods by road specified in Decree ADR (European Agreement Concerning the International Carriage of Dangerous Goods) whose amended version came into force in the EU on 1 January 2015. The follow-up methodologies and procedures dealing with the risks of possible consequences of accidents involving dangerous materials are then based on that directive.

A number of different methodologies and work indicates that the shipment of hazardous substances question is very topical. As shown by some statistics, 39% of all toxic accidents occurs during transport and a further 8% during their loading and unloading (Bernatík, 2006).

For example Krejčí and Bambušek (2012) calculated the risk of accidents during transport of hazardous materials in the Czech Republic. They based on information from National traffic census and statistical data. They state, that in the Czech Republic has been transported 1,669 mill tonne-kilometers of dangerous goods on the roads in the year 2010. In the same year 101 traffic accidents of vehicles carrying hazardous materials happened. Fabiano, Curro, Reverberi and Pastorino (2005) performed a calculation of the risk of accidents involving dangerous substances for Italy.

The risk modelling associated with toxic accidents is solved by a number of programs modelling the consequences of accidents, such as PHAST, RMP COMP, ALOHA, DAMAGE, CHARM, EFFECTS, ROZEX etc.

Considerable progress is characterized by modelling atmospheric dispersion of pollutants. Currently operational e.g. ALOHA model (Areal Locations of Hazardous Atmospheres – http://www.epa.gov/ceppo/cameo/aloha.htm) is used for scattering of dangerous substances from both stationary and mobile sources. The program CAMEO and the subsequent mapping software MARPLOT (Mapping Application for Response, Planning and Local Operational Tasks), developed by the United States Environmental Protection Agency (EPA) and the National Oceanic and Atmospheric Administration (NOAA) is another program that focuses on modelling the dispersion of hazardous substances. The program works with physical and chemical characteristics of toxic substances and allows modelling of scenarios scattering of dangerous substances (http://www2.epa.gov/cameo/cameo-software). In the Czech Republic the software ROZEX alarm (http://www.tlp-emergency.com/rozex.html) has been developed. It allows the modelling the release of hazardous chemicals, forecasting emergency manifestations and quickly generate information needed for intervening IRS components. In addition to the characteristics of toxic substances the program also works with GIS and allows the display of dangerous zones on maps.

Generally, the risk assessment of transport of dangerous substances is predominantly a probability calculus. Less attention has been paid to support decisions when such a situation already arises. The cause is probably the fact, that it is impossible to prepare data sources in advance, especially thematic maps, for endless possible locations.

4. DECISION MAKING PROCEDURE DURING TOXIC EVENT ON THE ROAD

Decision-making in the field is based on the utilization of the relevant geographic data (Table 1) and on knowledge in the evaluation of the affected area for possible spreading of liquid pollutants.

Table 1: Data sources applied in the process responding to a toxic disaster on the road

No.	Area of Knowledge	Name of Geodata	Administrator	Description
1	Land transport – roads	Road map	Roads and Motorways Directorate	Digital map contains roads in layers
2	Topography	ZABAGED – all layers, grid	ČÚZK (State Administration of Land Surveying and Cadastre)	Geodatabase ZABAGED in raster format represents a basic topographic maps of the Czech Republic 1:10 000
3	orientation	Colour ortophotomap	CENIA	Continuously updated colour aerial ortophotomap shows the current status of the territory; map can be downloaded from a map server and enables resolution of about 1 m
4	Administrative division	Czech Statistical office	ČSU – Czech Statistical Office	layer municipalities border of the Czech Republic Source: database Fire and Rescue Service
5	land use	ZABAGED – Forests, meadows, built-up area, communication and other infrastructure	ČÚZK	Individual forms of land use are stored in the geodatabase ZABAGED in separate layers The resolution corresponds to a map scale of 1:10 000
6	geomorphology	Digital terrain model of 4th generation	ČÚZK	Digital terrain model was acquired by lidar technologies for the whole territory of the Czech Republic. It has a high resolution moving in the order of the first meters.
7	geology	Geological map of the CR 50	ČGS (Czech Geological Survey)	The map is accessible in the resolution corresponding to a measure 1:50,000
8	soil science	Water retention capacity of the soil and hydrological soil groups CR 50	VÚMOP (Research Institute for Soil and Water Conservation)	Soil maps distinguish soil areas of each class values. Assembled seamless maps are available at a resolution corresponding to a scale of 1:50,000.
9	hydrometeorology	Saturation indicator	Czech Hydrometeorological Institute	Saturation indicator represents estimation of the current water saturation of territory. It is derived using a simple model of the balance of rainfall, runoff and evapotranspiration.
10	hydrology	Water resources map of CR	VÚV (T. G. Masaryk Water Research Institute	Map shows the drainage network, water objects and watersheds in the resolution 1:50,000

The gradual using of knowledge with the support of GIS technology can be formulated into a standardized procedure. An adequate explanation of the procedure is crucial to understand the necessity of individual steps and their sequence in the selection, deployment and locating the necessary measures to mitigate the consequences of an accident involving leakage of hazardous materials into the environment.

The procedure starts with locating the accident site. Optimally, this is done by the road map thanks to the kilometreage which can be red also by eye witnesses directly on the road (on the highways – in other cases the first orientation points are for example distances from intersections, village edges, notches and embankments, etc.). According to these preliminary information the accident site is marked into the road map as accurately as possible (Fig. 1). At first, according to information from witnesses and later on (naturally as soon as possible) according to GPS coordinates (e.g. using by GPS devices embedded in “smart phones”).

Figure 1: Segment of road and motorway network map of the Czech Republic showing the accident site. Communication kilometreage provides a more exact localization of events
Source: http://geoportal.jsdi.cz/flexviewers/Silnicni_a_dalnicni_sit_CR/

Location of the accident site on the road with the leakage of toxic substances in the road map RMD in terms of pre-locating the crash site is sufficient. Later on a map from the geodatabase ZABAGED ZM CR 10 or 25 DMÚ mentioning all highways and roads, including unpaved is more convenient.

The segment of this map for the vicinity of the accident marks usable road network for access to the crash site for ground equipment. Thus, it is possible to read the initial topological characteristics of the site, including terrain.

The visualisation of the accident site on topographic map ZM CR 10 – ZABAGED – involves differentiating relevant forms of land cover and defining the operational zones around the crash site. Circles with a radius of 100, 500 and 1000 m indicate: the danger zone (with designated regime changes), the outer zone (with priority measures to protect the population) and the threat zone (such as areas of possible spread of toxic substances). Size is determined flexibly based on the judgment of a qualified commander of the action, taking into account the minimum criteria and the nature of the leaking substance.

In terms of handling of the situation (to prevent the spread of pollutants and consequences) is primary task a qualified estimation of possible routes of movement of the liquid pollutant on the earth's surface by a digital terrain model of the 4^{th} generation. This model is so detailed that due to captured surface detail enables accurate modelling of potential drainage routes, with regard to the small surface shapes both natural and anthropogenic origin (Fig. 2).

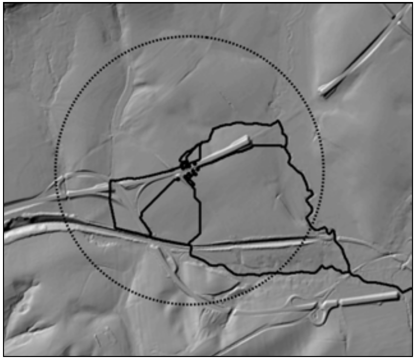


Figure 2: Sample of operational search of possible routes outflow of liquid pollutants from the crash site over the earth's surface within a radius of 1000 m around the crash site
Source: ČÚZK

In this step it is necessary tentatively identify several “starting points” of initial runoff pollutants, to allow in case of fast moving substances direct surgical technique to place at risk the inlet harmful substances into the water receptor (Fig. 2). The commander of the intervention in the field then communicates to the Disaster Staff, by which routes actually pollutant flows.

The display of colour ortophotomap of the crash site significantly helps in spatial orientation around the crash site. It is used to gain a realistic view of the area of the accident and for future intervention. This material has a much larger volume of information in an acceptable presentation to the human eye compared to the topographic map. Georeferenced colour aerial ortophotomap also gives information on the crash site and its surroundings with an expression of sufficient detail about the configuration of land use. Marking the accident site to ortophotomap is sufficient to assess the spatial relationships of the accident.

The joint visualization of road network, the main forms of land use affecting the character of runoff and pollutant and predicted route of its movement to surface water recipients gives a basic idea of the space for future deployment of intervention (Fig. 3). From this material the access routes of intervention techniques to the spreading pollutants with respect to possible obstacles resulting from land use can be tentatively identified. Preliminarily it can also guess where it is possible to stop pollutant before entering the receiving water.

After finding possible routes of the surface flow of the liquid pollutant with respect to terrain and land use, it is necessary to activate the previously prepared data layer on the effect of soil and geological environment. Like that it will be possible to assess whether a substance is flowing predominantly to soak or surface run off, or a balanced combination of these processes. The procedure is based on the Geological map of the Czech Republic 1:50 000, the content of which was purposefully interpreted (and reclassified in GIS) in terms of the relationship of geological environment to run off the liquid pollutant. Similarly, the evaluation of the impact of the soil environment on the liquid pollutant runoff is carried out according to the map of the Water retention capacity of soils in the scale of 1:50 00 and map of the Hydrological soil groups of the CR 50.

Figure 3: Visualization of the main forms of land use in the context of the road network and projected paths of movement of pollutant
Source: ČÚZK

Integration of partial evaluation of geological and soil environment into a summary of the expected behaviour of liquid pollutants in the study area was compiled by partial overlay maps in the GIS. The procedure is performed in two alternatives: dry and wet, according to the nature of prior area saturation with water. This information is provided by the Czech Hydrometeorological Institute on its website in the cartographic form for the whole territory of the Czech Republic.

When searching for the place of for intervention unit deployment, it is important to find the critical points in the route runoff liquid pollutant. (Fig. 4). It is the lowest site for the application of measures in the terrain before pollutant is entering into different environments, including areas which are inaccessible. In practice, it is an indication of the intersections of "pollutant runoff lines" with borders of "areas" of different pollutant flow nature and inaccessible land use for the technical equipment. It also relates to marking the intersection of the line marking pollutant flow with the line "potential water recipient", i.e. water streams or water reservoirs. This will give a route of a pollutant in different types of the environment and points of extreme points by adequate measures application.

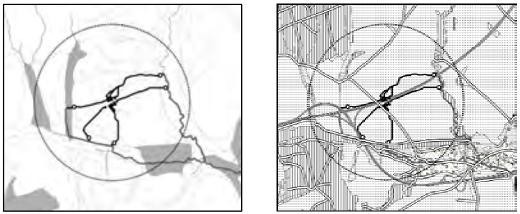


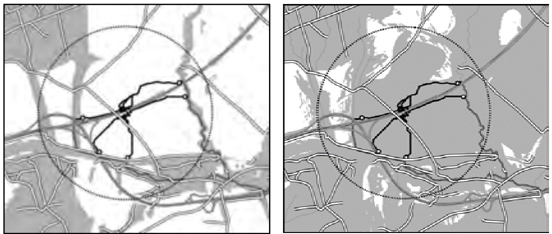
Figure 4 Black encircled hite points indicate the points on lines of possible movement of pollutants, wherein flowing substance change the type of environment and the nature of its motion (left) and / or passes into the environment (land use) impervious by technique, respectively directly flows into the water recipient (right)
Source: CGS, VÚMOP, ČÚZK

The main practical task is to find the access path to critical points for the intervention technique. According to the estimated velocity of the pollutant flow (due to its quantity and viscosity) it is necessary to proceed from the bottom up, i.e. from the topographically lowest elevations on the projected routes of the pollutant flow to higher sites primarily due to prevent greater damage close to water recipients. In a quick of pollutant flow it is necessary to reach as soon as possible the intersection of the line of flow down and receiving water recipient. In the case of slow of pollutant flow it is better to get to the other ('safer') points upstream proposed pollutant flow. Searching for optimal passable routes for intervention technique on the way to critical points is realized by the reclassification of relevant GIS data layers into the layers of individual “barriers” for the intervention technique, than by combining them into an integrated layer of barriers. Among the barriers for the intervention technique the important role play also the high slope gradient. The map of commonly used inclination categories (0-3° – plane; 3-7° – flat slope, 7-15° – moderate slope; 15-25° – steep slope and over 25° – cliff) may be derived from a digital terrain model. Although there is no uniform standard for reliable patency of different terrain types for intervention technique and success usually depends on the skills of the driver and the current state of the vehicles, it can be at least generally indicated the areas which should be avoided by intervention technique. These may be in the case when the slope is represented by the high slope gradient (above 15° at dry conditions and 7° at wet conditions), different natural area conditions for surface liquid pollutant run-off (separately for dry conditions and wet conditions) and by water objects, woods/forests, buildings, walls and the like (Fig. 5). Areas of such barriers can be obtained from a simple data layers using the reclassification as referred above.

Figure 5 Territorial distribution of barriers for the intervention techniques access in terms of the obstacles arising from excessive repose terrain and drainage networks (natural and technical slopes – left), impenetrable natural environment (desktop surface barks liquid pollutants, incl. railway – the middle), streams, technical infrastructure and areas of land use (forests, buildings, walls, fenced gardens, and – right) (Note. All the examples refer to the dry situation)

Source: ČÚZK, CGS, VÚMOP

The integration of data layers representing individual barriers can leads to the combined barrier data



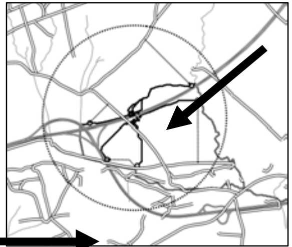
layers separately for the dry and wet situations in the antecedent soil saturation by the water (Fig. 6).

Figure 6 Distribution of barriers (barriers) to move emergency equipment in the area of interest in the vicinity of the accident on a road connected with leakage of liquid pollutant under dry conditions (left) and wet conditions (right)
Source: ČÚZK, CGS, VÚMOP

It is evident that under wet conditions it is necessary to apply measures anywhere before the junction of pollutant runoff routes into the water recipient, even without the use of intervention technique (see fig. 6 – right). Wet conditions would be risky and could end by the immobilization of technique before reaching the critical point.

Data layers of barriers need to be prepared in advance for each area of interest (cadastre, district, region, state) at a maximum resolution according to the available data using the above mentioned standardized procedure. If such layers are stored in the disaster management database they can be activated operatively in a very short time and able to derive more (see below) data for operational decisions in the terrain for specific events.

The real retrieval of optimal access routes for the intervention technique to key points are solved with the standard GIS tools (e.g. Cost Distance and Cost Path in the Spatial Analyst extension of ArcGIS). The input data layers for this procedure are represented by the layers of barriers (under dry or wet conditions) converted into binary form (mask), the layer of the road network (where the intervention technique can as closely as possible approach to the critical points from) and the layer of critical points as the locations of the latest possibility of adequate action for preventing liquid pollutant to reach a water recipient (Fig. 7).



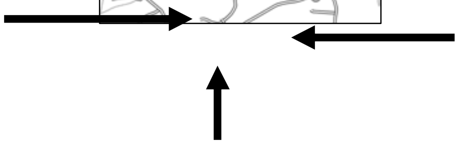


Figure 7 Example of searching access routes (green) of intervention techniques to all identified critical points on the lines anticipated surface movement of liquid pollutants using procedures Cost Distance and Cost Path accessible in ArcGIS Spatial Analyst by ESRI
Source: ČÚZK, CGS, VÚMOP

5. CONCLUSION

The demonstrated procedure is based on the assumption that the specific disaster management staff has all the necessary data layer (not the original thematic data, but their purpose-derived mapping derivatives taking into account the necessary expert knowledge) in its own operational database. Obtaining the required output – the derivation of routes arrival of emergency techniques to critical points in the event alternatives for dry and wet – is thus a matter of minutes from the first delivery location of the event. Due to the fact that a key success factor is also the time, the gained time savings can extremely improve efficiency of operation in the area and accelerate successful liquidation of the accident and its consequences.

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DISPERSAL FUNCTION OF RECENTLY PLANTED BIOCORRIDORS

Martin Večeřa[1], Martin Culek[2] and Tomáš Slach[3]

[1] Department of Botany and Zoology, Faculty of Science, Masaryk University, Kotlářská 2, 611 37 Brno, Czech Republic, e-mail: veceramartin@mail.muni.cz

[2] Institute of Geography, Faculty of Science, Masaryk University, Kotlářská 2, 611 37 Brno, Czech Republic, e-mail: culek@sci.muni.cz

[3] Department of Forest Botany, Dendrology and Geobiocoenology, Mendel University in Brno, Zemědělská 3, 613 00 Brno, Czech Republic, e-mail: tomas.slach@mendelu.cz

ABSTRACT

We have studied two 42 years old windbreaks functioning as biocorridors and one TSES biocorridor composed of a woody strip planted 18 years ago. These biocorridors are connected to semi-natural forests which are expected to be source areas of forest species for dispersal or migration via these landscape structures. Thorough field research, including vegetation and mollusc sampling, and subsequent data processing using regression analyses brought interesting results. The current distribution pattern of forest species in the biocorridors reflects their recent spread from source forests related to relatively low age of corridors. Diversity of forest plant species grows up and some of them evidently do migrate through the biocorridors. Similar, though not so obvious, is the pattern of molluscs.

Key Words: *Ecological network, TSES, biocorridor, dispersal corridor, biota migration, South Moravia.*

1. INTRODUCTION

Proper protection of biodiversity needs both the protection of species and their sites. Sufficient opportunities for migration and spreading for majority of species should be provided too. That was why first biocentres (core areas) and biocorridors were proposed in the Zoning Plan of a cadastral area of the town Drnholec in the South Moravian Region, the Czech Republic, as early as in 1978 (Lőw, Zimová 1978). Later on, Methodology of so called Territorial System of Ecological Stability was elaborated in the beginning of the 1980s (Lőw et al. 1986, 1995). Almost at the same time, an Ecological Network in the Netherlands was proposed (Bennett 1991). Goals and approaches of both networks are similar (Buček, Lacina 1996, Jongmann, Pungetti 2004). Territorial systems of ecological stability are for 23 years incorporated in the Czech Act No. 114/92 Sb. on the Nature and Landscape protection. In the last 20 years, about 500 biocorridors and biocentres were realised (planted in fields). But their monitoring by investors (mostly the Ministry of the Environment) is not in progress. Research work is done rather by initiatives of several enthusiastic scientists. That is why students from the Institute of Geography of the Masaryk University in Brno were also involved in this research; with a supervision of the corresponding author of this paper.

2. AIMS

The main aim of the study was to ascertain the evolution of recently planted biocorridors with regard to their ecological functionality. More precisely: If realised biocorridors enable spread of selected forest species. If yes, to which extent and what are the differences according to biocorridor age.

3. RESEARCH IN BIOCORRIDOR FUNCTIONALITY

3.1. Research in foreign countries

In the 1980s, there was a general lack of proper scientific information on biocorridor functionality for any target organism. This was also the main argument against a broad community of scientists and conservationists who were intuitively advocating the biocorridor theory (e.g. Simberloff, Cox 1987). Shortly afterwards, the questions related to biocorridor functionality for different organisms in various environmental conditions became a very popular among researchers. These studies were reviewed with the objective of summing up partial findings. Later, reviewers also tried to draw some general conclusions about biocorridor functioning. Most authors agreed that the usability of biocorridors as movement routes for organisms is considerably affected by some key parameters – e.g. biocorridor width, continuity and vegetation composition or stability of the environment in space and time (McEuen 1993; Deckers et al. 2005).

A meta-analytical review of 35 studies, which was done by Gilbert-Norton et al. (2010), showed that biocorridors increase movement rates of target organisms between fragmented habitats (regarding animals and some plant species) for approximately 50% regardless of the spatial scale, particular species and ecosystem type, compared to movement rates between isolated patches. On the contrary, significantly lower movement rates in biocorridors were recorded for birds and insects. The use of biocorridors by various organisms has been properly addressed for the last 15 years and it is also our research objective presented in this paper.

Only a few studies on biocorridor functionality regarding molluscs have been done worldwide so far. The reason why is that most scientists consider mollusc species as very static animals only. Their long-distance movements and dispersal are realised in a passive way (via birds, mammals, humans etc.) therefore they are sometimes compared to hitchhikers (Horsák 2012). Studies done by Baur and Baur (1990, 1992) are a rare example of research in mollusc movements in woody strips. They documented slow active movement of *Arianta arbustorum* preferring interior parts of woody strips.

3.2. Research in biocorridors regarding plants and selected fauna species in the Czech Republic

Research in biocorridors concerning movements and dispersal of animals and plants in cultivated landscapes started in the former Czechoslovakia in the 1980s.

First studies were aimed at movements of rodents (Pelikán 1986) and carabid beetles (Šustek 1992, 1998) through windbreaks. The latter study found windbreaks composed of native woody species may enable movement of 10 times more forest and eurytopic carabids occurring in the neighbouring forests compared to those composed of non-native species.

From 1992 to 1996, the state authorities financially supported a comprehensive survey of five TSES biocorridors composed of woody strips which were planted on former arable land in the early 1990s. A progress of succession of plants, invertebrates, lepidopterans, mammals, and birds was monitored during that time (Bínová et al. 1993). Results of this study described the decline in heliophilous plant species related to progress of a canopy closure. Some parts of the research were carried on from 1999 to 2001 (Zimová et al. 2001). Thereafter the financial support from the state ceased. Only monitoring of woody plants growth and succession at the localities has continued until recent time (Úradníček, Jelínek 2012). Tree species composition, woody plants growth and marginally herb layer of selected windbreaks of various age and type were evaluated in the South Moravian Region (Kolibáčová 2000). Beside others, Kolibáčová studied two windbreaks near the Kuželov village (Hodonín district) whose biocorridor functionality we examined in our study. Several theses of Mendel University students investigated Kuní hora – Travičná TSES biocorridor. Šťastová (2012) recorded 53% of forest plants in the herb layer and proved the forest plant dispersal via this windbreak. Other findings regarding biocorridor functionality were provided by variously aimed theses of Masaryk University students (Foltánek 2011; Slach 2014; Večeřa 2012, 2014; Vodová 2012 and others). Research of the oldest TSES biocorridor of local importance in the Czech Republic, planted near the Vracov village (South Moravian Region) between 1990 and 1991, shows that first forest plant species (e.g. *Dryopteris carthusiana*) have appeared there. Some results have already been published (Culek 2012, Culek, Večeřa and Slach 2012).

Some recent studies on molluscs occurring at embankments along motorways and railways were done in the Czech Republic (Juřičková, Kučera 2006; Pechová 2010). Their objective was to examine if these structures facilitate invasive mollusc species dispersal compared to surroundings. However, no pattern suggesting biocorridor functionality of embankments was detected.

4. RESEARCH IN BIOCORRIDOR FUNCTIONALITY FOR FOREST PLANTS AND MOLLUSCS

4.1. Study area

We selected three different woody strips in the South Moravian Region (Czech Republic), each of them planted on arable land and connected to forest. Two of them have originated as windbreaks and the third one has been planted as a TSES biocorridor. Two study sites are situated near the Kuželov village in the Bílé Karpaty Mountains (White Carpathians) and the third one is situated near the city of Brno, close to the Podolí village (Fig.1).

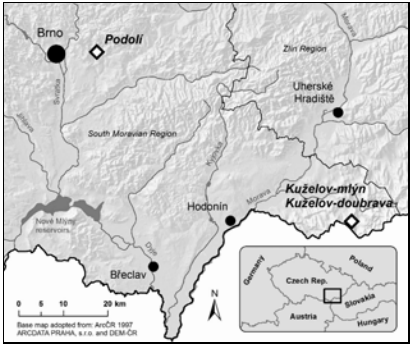

Figure 1: Location of study sites Podolí, Kuželov-mlýn and Kuželov-doubrava

The White Carpathians belongs to the Bělokarpatský bioregion (Culek 2013, Culek et al. 2013) which is known for its exceptionally high diversity of plant species. Orchid meadows, near-natural forests and relatively low degree of ruderalization of agricultural landscape are typical for this bioregion.

Study sites in the White Carpathians are called Kuželov-doubrava and Kuželov-mlýn. They are situated in the south-western part of the mountain range near Kuželov at altitudes of 360–402 m (Fig. 2). Woody strips were planted here in the 1970s as windbreaks. Their age is about 42 years.

The windbreak called Kuželov-doubrava has an average width of 58 m. It was studied in its full length of 940 m. This windbreak connects two forests called Ochoza and Doubrava. These forests are composed mainly of Carpathian oak-hornbeam forests of association *Carici pilosae-Carpinetum betuli* (Neuhäuselová et al. 1998). Carpathian oak-hornbeam forests also represent potential natural vegetation in the area of windbreaks. The windbreaks are not entirely continuous. Kuželov-doubrava is interrupted by two gaps. The first one is made by a stream (15 m gap), the second one by a road (10 m gap).The windbreak called Kuželov-mlýn parallels with Kuželov-doubrava and is situated 1.4 km northwest. The windbreak was studied in the length of 1180 m in the section between the road and the Ochoza forest, its average width is 50 m. The windbreak is interrupted once by the stream with path alongside (50 m gap).

There is an arable land around the windbreaks. Each of them is lengthwise divided into three parts. There is a core formed by conifers surrounded by strips of deciduous trees on both sides. *Tilia cordata*, *Quercus robur* and *Quercus rubra* (alien) dominate the deciduous parts. Coniferous parts consist mainly of *Pinus sylvestris* and also of *Larix decidua* in the Kuželov-doubrava windbreak. Along the edges of windbreaks grows shrubs *Caragana arborescens* (alien), *Rhamnus cathartica*, *Cornus sanguinea, Viburnum opulus* and *Crataegus* sp.

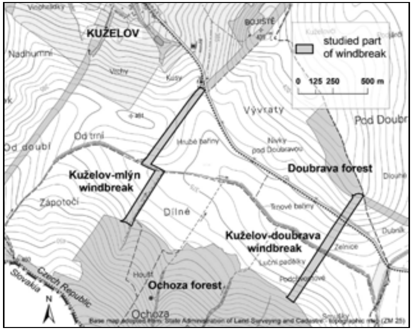

Figure 2: Study sites near the Kuželov village
(Base map adopted from ČÚZK – topographic map 1:25 000)

The study site called Podolí is situated near the same-named village, in eastern hinterland of the Brno city (Fig. 3). Biocorridor is situated in the very border of the Lechovický bioregion which is an area of long-term intensive land cultivation. The Horákov forest is a part of the Drahanský bioregion comprising a neighbouring upland area with a large proportion of preserved near-natural forests (Culek 2013, Culek et al. 2013).

This strip was planted in 1997 (age of 18 years) as a part of future TSES supra-regional biocorridor. Length of this strip is 1000 m and the average width 11 m. Altitude of the woody strip varies between 260–314 m.

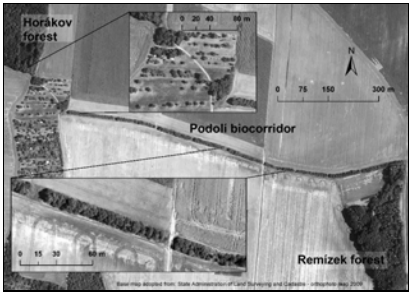

Figure 3: Study site Podolí
Source: Aerial snap from 2009 adopted from ČÚZK.

The Podolí biocorridor is surrounded by arable land. It connects small floodplain forest called Remízek in the east (55 years old, growing on former wet meadows) and orchard adjacent to a large complex of the Horákov forest in the west. Some parts of the Horákov forest are composed of

Hercynian oak-hornbeam forests of association *Galio sylvatici-Carpinetum betuli* which represent potential natural vegetation in the Podolí biocorridor, too. Bedrock is formed of the Culm greywackes and slates. These sediments are covered with loess in the whole area except for the Horákov forest. Soil cover is dominantly composed of brown earth, partly of chernozem, and also of cambisol in the westernmost part. Core of the woody strip is formed by trees, side parts mainly by shrubs. The core trees are mainly *Tilia cordata* and *Fraxinus excelsior*, occasionally *Carpinus betulus*, and rarely *Acer pseudoplatanus* and *Quercus robur*. Shrubs growing on the sides are represented by *Viburnum opulus*, *Rhamnus cathartica*, *Euonymus europaea*, *Ligustrum vulgare*, *Frangula alnus* and others.

4.2. Material and Methods

Presence of a particular species in a woody strip, especially if occupying just one place or a very small area, may be completely random. However, biocorridor functionality for particular species can be proved by their distribution pattern at the locality (cf. Wehling, Diekmann 2009; Liira, Paal 2013). As the main indicator of biocorridor functionality we considered a decrease in proportion of forest species occupying the woody strip with increasing distance of the source forest edge. If there is a significant decrease in that measure and if it is caused by increasing distance, not by chance or by confounding environmental factors, e.g. soil pH gradient (cf. de Blois 2002; Deckers et al. 2004; Davies, Pullin 2007), we conclude that species progressively spread along the strip.

Woody strips and adjacent parts of connected forests were surveyed from June to September 2013 for species composition and frequency of vascular plants and molluscs at all the localities.

In total, we recorded 71 vegetation plots of an area of 100 m^2. At the Kuželov localities, these plots were situated in the interior parts of windbreaks (at least 3 m from the margin row of trees), with regular spacing of 50 m along the windbreak. Adjacent parts of connected forests were sampled preferentially in order to record a representative part of their species composition. In the Podolí biocorridor, vegetation plots were situated in centres of small segments and adjacent parts of connected forests were just surveyed to create a list of all vascular plants occurring there. The nomenclature of vascular plants follows Kubát [ed.] (2002). Recorded plant taxa were divided into groups of forest species and others according to their light demands (following Zlatník et al. 1970).

In addition to vegetation sampling, the distribution of selected forest plant species was mapped in more detail in Kuželov-doubrava. We selected species whose current state of spreading is clearly visible in the field. Their furthermost occurrences from the forest edge in direction to the windbreak were marked with GPS.

Samples of molluscs were collected totally from 44 plots (each 25 m^2) situated in the interior parts of woody strips, with spacing approx. 100 m. A preferential sampling was done in adjacent parts of the forests. The nomenclature of molluscs follows Horsák et al. (2013).

In order to investigate changes in environmental conditions along the forest-woody vegetation strip continuum, we measured, calculated or estimated relevant environmental and spatial factors at vegetation plots and sampling plots of molluscs. Subsequently we tested a potential effect of these factors on the proportion of forest species and species composition of molluscs in the woody strips using a multiple linear regression (MLR) and redundancy analysis (RDA).

Variables which were considered for vegetation plots (marked with ‘p’) and for sampling plots of molluscs (marked with ‘m’): altitude (p, m), slope (p, m), SSW aspect (p, m), xericity index (p), dominant species in tree layer (p), cover of woody layers (p), soil pH (p, m), activity of soil catalase (p), soil content of carbonates (p, m), soil sorption complex saturation (p), soil moisture (p, m), woody strip width (p, m), distance of plot from selected connected forest (p, m), distance of plot from the nearest connected forest (p, m).

The distance of a plot from selected connected forest was measured along the woody strip from the contact with the forest. We considered also the distance of plots from the forest at the northern end of the Kuželov-mlýn windbreak which was not covered by this study.

5. RESULTS

5.1. Distribution of plants

Totally 213 species of vascular plants were recorded at the localities, of which 195 species in herb layer. The highest number of species in the herb layer (134) was found in Kuželov-doubrava (woody strip and adjacent forests together), the lowest number was found in Podolí (71). If considered the woody strips themselves, the richest in species was the Kuželov-mlýn (115) and species poorest was Podolí (53). Woody strips are richer in plant species than the adjacent parts of connected forests.

The group of forest species contains 77 herb species and 12 woody species at the localities. In the Kuželov windbreaks, there was found on average 76% of forest species from the adjacent parts of connected forests, in Kuželov-doubrava it was 40 species, in Kuželov-mlýn 31 species. On average 29% of forest species from the adjacent forests was found in Podolí (only 4 species).

The detailed mapping of selected species distribution in the southern part of the Kuželov-doubrava windbreak comprised following species (with their mode of spreading): *Asarum europaeum* (myrmecochory), *Actaea spicata* (endozoochory), *Euphorbia amygdaloides* (clonal growth and myrmecochory), and *Mercurialis perennis* (clonal growth and myrmecochory). Their frequencies decrease from the forest in the direction of the windbreak (see Fig. 4).

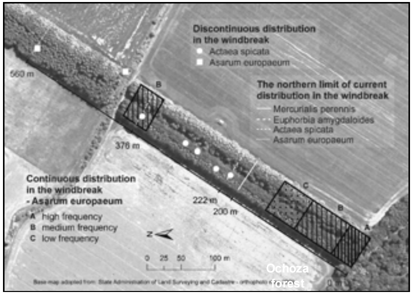

Figure 4: Distribution pattern and the farthermost limit of current distribution of selected species in the Kuželov-doubrava windbreak
Source: Aerial snap from 2009 adopted from ČÚZK.

In Kuželov-doubrava, there was found a significant decrease in proportion of forest species with increasing distance of plots from the Ochoza forest (MLR: $r^2 \sim 39.18\%$, $p < 0.01$). In Kuželov-mlýn, a similar pattern occurs. The distance of plot from the nearest forest was the best predictor there (17.61 %, $p < 0.05$). Other variables did not add a significant portion of explained variation to the models for neither locality. No significant effect on proportions of forest species of any variable was detected in Podolí (see Discussion).

5.2. Distribution of molluscs

Totally 15 mollusc species were recorded at the localities (see Fig. 5). The species were divided into three rough ecological groups according to their habitat preferences (following Dvořáková et al. 2011):

Forest species (5 species): *Cochlodina laminata, Discus perspectivus* (Vulnerable)*, Merdigera obscura, Monachoides incarnatus* and *Alinda biplicata.*

Open habitat species (5 species): *Cepaea vindobonensis*, *Cochlicopa lubricella, Euomphalia strigella, Vallonia pulchella* and *Vallonia excentrica.*

Indifferent-to-habitat species (5 species): *Aegopinella minor, Cepaea hortensis, Cochlicopa lubrica, Helix pomatia* and *Vitrina pellucida.*

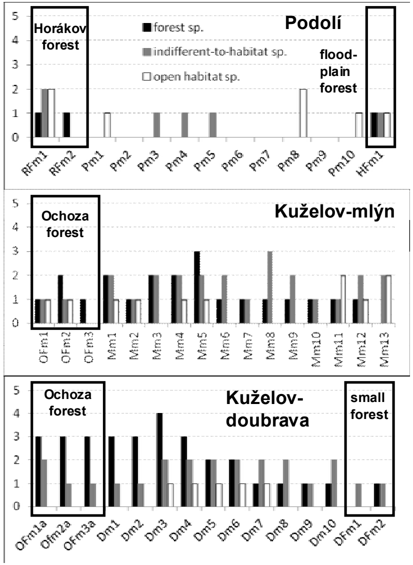

Figure 5: Number of mollusc species according to their habitat preferences recorded at sampling plots in studied woody strips

The Kuželov windbreaks are occupied by forest species, indifferent-to-habitat species and relatively few open habitat species. There are several molluscs that occur only in the adjacent forests and do not penetrate into the windbreaks (e.g. *Discus perspectivus* and *Alinda biplicata* in Kuželov-doubrava). Other forest species are slowly penetrating into the windbreaks (e.g. *Cochlodina laminata* in Kuželov-doubrava), and one species is occurring in most samples in both of the windbreaks (*Monachoides incarnatus*).

We did not record any forest mollusc species in the Podolí biocorridor. The only forest species at the locality was *Monachoides incarnatus* occurring in both of the adjacent forests. The community of molluscs is very species poor in Podolí, dominated by indifferent-to-habitat species (e.g. *Aegopinella minor*) and open habitat species (e.g. *Vallonia excentrica*).

The highest portions of variance in species composition of molluscs in Kuželov-doubrava were explained by distance of plot from the nearest connected forest (RDA: $R^2 \sim 33$ %, $p < 0.01$) and by SSW aspect (29 %, $p < 0.01$). In Kuželov-mlýn, distance from the nearest connected forest was also the best explanatory variable (17 %, $p < 0.05$). It was impossible to analyse species data on molluscs from the Podolí biocorridor in such a way because of very few individuals recorded there.

6. DISCUSSION

As the study sites differ in various aspects (Kuželov versus Podolí), we found considerable differences in biocorridor functionality among them. Both of the Kuželov windbreaks contained on average 76% (36 species) of all forest plant species observed in the adjacent parts of connected forests. This proportion is comparable to findings of forest plants in hedgerows from the state of New York, where they recorded 70% (Corbit et al. 1999), and from North-western Germany, 77% (Wehling, Diekmann 2009). In the Podolí biocorridor, on the contrary, there were recorded on average 29% (4 species) of forest species from the adjacent forests. Moreover, none of them was a mesophilous forest specialist. Regarding molluscs, we observed too few species at the localities to draw some clear conclusions, but the pattern seems to be more or less the same as the one of plants. The Kuželov windbreaks are wider and older than the Podolí biocorridor which are the most distinct parameters of these woody strips at first glance. It may be supposed that the interior parts of the woody strip in Podolí need more time for full development of forest-like environment. However, this may not be the only reason why there are currently almost no forest species spreading in Podolí. Other possible reasons include: i) an indirect connection to mesophilous forest there (via the orchard and thickets); ii) possibly higher agricultural pressure on the interior parts of the strip due to its smaller width and activities of man (higher nutrient input from fertilizers and fed animals, more intensive side light); and iii) different environmental conditions between the woody strip and the Horákov forest (e.g. pH, soil moisture and soil content of carbonates) which may impede the spread of forest species.

In the Kuželov windbreaks, we detected decreasing proportions of forest plant species with increasing distance from the source forest which indicates biocorridor functionality. Similar findings were published also in other studies (e.g. Corbit et al. 1999, Verheyen et al. 2003). Distance of a sampling plot from the source forest explained at most 39% of a variance in proportions of the forest species in Kuželov-doubrava. No other environmental factor appeared as a significant explanatory variable for none of the localities. However, in Kuželov-mlýn, a huge amount of variance (over 82%) still remains unexplained. It suggests there might be some other variables behind the current state that were not detected (e.g. amount of side light). But light conditions are probably not the main limiting factor for the dispersal of forest species as suggested by a penetration of some shade demanding plants (e.g. *Actaea spicata*) into the windbreaks.

Regarding mollusc species, the Kuželov windbreaks are still considered as transitional habitat. There is a certain degree of colonization by forest species but still much light demanding species occur even in interior parts. In the Podolí biocorridor, habitats of sufficient quality for forest molluscs have not yet developed, thus we recorded those species only in the adjacent forests. Species composition and frequencies are driven mainly by distance from the nearest forest in the Kuželov windbreaks (Kuželov-doubrava 33%, Kuželov-mlýn 17% of explained variation). The cause is forest species occur mainly close to the source forest, whereas open habitat and indifferent-to-habitat species occur mainly in distant parts of the windbreaks. It indicates that a succession of mollusc communities towards the forest-like environment is still in progress.

7. CONCLUSION

In our study we proved woody strips planted on former arable land 42 years ago facilitate dispersal of forest plant and mollusc species from adjacent forests across highly used agricultural landscapes. Thus these strips serve as biocorridors for those species. It seems that the connection between woody strip and a forest is a very important structural parameter enabling even the slow dispersal of some forest specialists. A proper development of interior forest-like environment in woody strips needs certainly a sufficient time. However, a relationship between time factor, structural parameters of biocorridors and overall landscape context needs to be further examined with more replications.

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TRANSFORMATION OF HISTORICAL CULTURAL LANDSCAPE EXEMPLIFIED BY SVÄTÝ JUR

Ján Lacika[1, 2]

[1] Institute of Geography of the Slovak Academy of Sciences, Štefánikova 49, 814 73 Bratislava, Slovak Republic, e-mail: geoglaci@savba.sk

[2] Constantine the Philosopher in Nitra, Faculty of Natural Sciences, Department of Geography and Regional Development, Trieda A. Hlinku 1, 949 74 Nitra, Slovak Republic, e-mail: jlacika@ukf.sk

ABSTRACT

The preserved segments of historical cultural landscape (HCL) are important parts of the present landscape, which enrich the living environment of the particular region, in our case the cadastre of the town Svätý Jur. A considerable part of HCL consists of cultural monuments conserved because they represent valuable achievements of the past human generations. The best way how to do it is to include the monuments into the functional part of landscape with a function which is in harmony with the principles of sustainable development. This paper presents the methodology applicable to landscape planning. It is focused on research of the HCL via identification of the relevant properties of cultural monuments in model territory. An effort has been made to produce a complete picture of the state of HCL by the analysis of geographical, cultural, artistic, aesthetic and technical/legal properties of monuments. This picture will make it possible to prepare a set of proposals for the revitalisation of landscape in model territory and optimal use of its cultural and historical potential.

Key words: *historical cultural landscape, sustainable development, cultural monument, Svätý Jur*

1. INTRODUCTION

Properties of natural landscape are not the only indicators of the state of the environment. Results of research focused on cultural landscape, in this calse historical cultural landscape are applicable in a similar way. Elements of this landscape are normally cultural monuments, legally protected historical structures preserved mostly thanks to the respect of people to the legacy left here by their ancestors. The current condition of these important landscape components betrays the cultural level of the society. Historical cultural landscape preserved in its compact form is considered a positive part of the current landscape and valuable living environment of its population and visitors. Hence, it is important to provide for their protection by inclusion of monuments into the functional part of the current landscape with an optimal function, which is in harmony with sustainability principles of the given region. This paper is focused on verification of the methodology proposed for the comprehensive assessment of the condition of historical cultural landscape on example of model territory, particularly, the cadastre of the town Svätý Jur (Fig. 1). It aspires to a more detailed approach to the theme than the one applied to the model territory of the Sub Little Carpathian Region (LACIKA, in press).

2. TERMINOLOGY

The basic notions used in this paper are *cultural landscape* and *historical cultural landscape*. The notion cultural landscape appeared for the first time in the mid-19th century. It was introduced by geographer Carl Ritter in its German equivalent *Kulturlandschaf.* In 1908, another German researcher Otto Schlüter presented a new scientific trend and called it *Landschaftskunde.* Anglophone literature uses the term *cultural landscape* introduced by the American geographer Carl SAUER (1925 and 1963). Research of cultural landscape in Slovakia developed under the strong influence of the traditional German "Landschaft" school. HROMÁDKA in his *Všeobecný zemepise Slovenska* (1943) (General Geography of Slovakia) used the terms *kultúrny kraj* and *prírodný kraj*, corresponding to terms cultural landscape and natural landscape.

Figure 1: Situation of model cadastral territory of Svätý Jur

The term *cultural landscape* now is "global", as its definitions exist in different national and international legal documents. It became one of the key terms of the UNESCO Programme aimed at the rescue of the world natural and cultural heritage (UNESCO 1977–2013). The continuously updated *Operational Guidelines for the Implementation of the World Heritage Convention*) define cultural landscape as the "combined works of nature and of man" demonstrating the development of human society as determined by natural features. It is one of four specific types of localities in the List of the World Heritage. Apart from cultural landscape the Guidelines also discern (Historic Towns and Town Centres, Heritage Canals and Heritage Routes.

The term **historical cultural landscape** is the key one for our purposes. It emerged as associated to the historical development of landscape where the objects of research are elements of cultural landscape produced in the past. Delimitation of the past though, is not always precise it can even involve the primeval times but also elements that appeared after the Second World War. HANUŠIN et al. (2013) points out that besides the attribute *historical* there are also other associated with cultural landscape in specialised literature. Belgian author ANTROP (1997, 2000 a 2005) elaborated the concept of *traditional landscape*; he defined it as landscape with a clear and distinguishable structure containing important natural, cultural and aesthetic values. He found out that the intensive transformation of traditional landscape began in the 18th century and the current process is that of negative evolution causing the loss of diversity, cohesion and identity of traditional landscape. The global manifestation of its degradation requires, as Antrop asserts, new conceptions of landscape management built on holistic and interdisciplinary approaches. MATLESSA (2008) uses the term *ancient landscape,* meanwhile the continuously updated documents of UNESCO (1977–2013) interpret a related category, that is, *relic* or *fossil landscape*. It is defined as landscape in the status of abrupt interruption of the development and its remnants are still visually identifiable in some material form. They are mostly historical structures, which lost their original function, abandoned and decaying with imminent vanishing. Their conservation requires restoration of function or creation of a new one with preservation of their historical value.

The term *historical landscape structure* also deserves attention in the context of research of historical cultural landscape. HUBA (1988) defined it as a specific, time-delimited and spatially diminishing subtype of landscape structure as a whole. For JANČURA (1998) it is one of landscape structure categories besides the present and secondary ones. Czech author GOJDA (2000) used the term *archetype* of the European cultural landscape and defined its four principal types for individual historical periods. ŠTEFUNKOVÁ et al. (2011) transformed this terminology into typology of cultural agrarian landscape in Slovakia. They identified landscape archetype of primeval farmers, archetype of agrarian landscape in Roman colonies, archetype of medieval agrarian landscape, and archetype of modern agrarian landscape. HREŠKO, KANÁSOVÁ a PETROVIČ (2009) also dealt with landscape archetypes. They explain them as the way of landscape adaptation to the impacts and changes caused by humans from the Upper Palaeolithic to modern times.

Historical cultural landscape is subject to transformation, changing social and economic situation: It is either replaced or gains a new quality. The process of transformation is either spontaneous or controlled. First of all the valuable elements of landscape are preserved and the State includes them into the pool of cultural monuments. Pursuant the Act of the Slovak Republic No. 49 of 2002 about protection of the monument pool, cultural monument is the movable or immovable object having a monument value. Monument value of a cultural monument is the set of important values in terms of history, society, landscape, urbanism, architecture, science, technology, arts or crafts and may become an object of individual or territorial protection.

Cultural monument for the author of this study is the key object of evaluation procedures. The term *cultural monument* is often used here without the attribute of *cultural* and *monument* is interpreted as an equivalent to the notion of *cultural monument*.

Cultural monuments or monuments are not strictly defined in terms of time The list of approved National Cultural Monuments contains Neolithic archaeological localities but also the monument of Slavín erected in 1960. Authors of the project HANUŠINA et al. (2013) use the term historical cultural landscape a part of cultural landscape. As already exposed, historical cultural landscape (HCL) is such part of cultural landscape whose function, structure and perception characteristics remained almost unchanged for about 60 years. In case of the Sub Little Carpathian Regions it is landscape, which originated before 1950; landscape that existed before the beginning of collectivisation and of what is refereed to as the socialist transformation of towns and villages. It must be added that there are also some much older areas among the elements of historical cultural landscape.

Cultural landscapes are perceived as important part of national cultural heritage and governments make great efforts for their protection and management. The American Alliance for Historic Landscape Protection (AHLP) engaging experts in history, geography, architecture, archaeology and landscape ecology was founded in 1978. Among its founders and prominent representative is the American landscape architect Robert Z. MELNICK. He presented a method for the analysis and evaluation of cultural landscape for the purposes of strategic projects of the American National Park Service in his key book from 1983. Melnick carried out his research in rural cultural landscape of American National Parks with their specific assets and abundant representation of natural landscape components. However, it is also applicable to other landscape types.

3. METHODOLOGY

The methodology for research of HCL normally concentrates on its mapping. Comparative procedures, mainly the overlay of historical maps from different time periods and modern maps are often used. Apart from cartographic materials, other historical sources such as paintings, old photographs and postcards, descriptions in documents, literature, etc. also used. The methods for HCL mapping has been further elaborated by ANTROP (1997). The first step concentrated on the study of natural regions (relief, natural resources and soils) as related to the cultural and historical landscape organisation. The second step is comparative. It compares graphical and cartographic sources. Evolutional scheme of landscape transformation is the third step and the fourth compares the status of the existing landscape with the elaborated schemes.

Specialised literature offers many inspiring examples of methodology using overlay of historical maps from different historical periods and their comparison with cartographic outputs recording the present landscape. HAASE et al. (2007) applied it in the analysis of historical landscape in German Saxony while apart from traditional research they also picked the GIS methods and technologies of landscapemetrics (LSM) and deterministic methods (ABIMO). BALEJ (2011) purposefully uses landscape metrics in identification of relevant properties of landscape elements which enter evaluation procedures in landscape planning. ZOMENI, TZANOPOULOS, and PANTIS (2008) used the analysis of vegetation maps compiled from aerial images from 1945, 1969 and 1995 for the identification of changes in rural cultural landscape in the north of Greece. The use of landscape metric methods made it possible to detect big changes in land use and accretion of abandoned areas. Specific use of digitised historical maps is described in article of MEINI M., ADDUCCHIO, CILIBERTI, and DI FELICE (2014). They identified historical rural landscape in Italian south and results have been applied in the management of the developing tourism along old migration routes of shepherds with their flocks. As far as methodology is concerned, contribution of Italian authors CULLOTTA a BARBERA (2011) is also interesting as it responds to the conspicuous shrinkage of the traditional cultural landscape around the Sicilian volcano Etna and presents the use of interdisciplinary methodological approach making use of analysis of different cartographic materials and land use databases.

Mapping of historical cultural landscape and work with historical graphic and cartographic sources were the research methods also applied to this study albeit as part of broadly interpreted methodology of a comprehensive and detailed research of cultural monuments in the model territory of the town Svätý Jur. A new method is applied, It tries to reach beyond the frame of traditional conservationist approach to the issue and to enrich the research by geographical aspects which track the monuments as landscape elements interacting with other landscape components. A more comprehensive knowledge of monuments makes it possible to see them not only as valuable historical cultural objects but also as elements of more or less transformed historical cultural landscape. Hence, the research effort eventually focuses on identification of compact segments of historical cultural landscape that must be, for the sake of sustainable development of the given region, as smoothly and gracefully as possible included into the existing functional cultural landscape.

The input data of evaluation procedures are sets of relevant properties of researched monuments gathers from available sources and databases and proper field research. Properties concentrated into the evaluation record are identified for each monument (Fig. 2). They are classified into three main groups:

- Geographical properties: position in landscape, relationships to other monments and other cultural landscape elements;
- Historical, cultural, artistic and aesthetic properties: styles, style homogeneity, presence of significant artistic works, special architectural and artistic features, presents of aesthetically inappropriate phenomena;
- Functional, technical, legal properties: classification of the original function, present functionality of the monument, technical condition of the monument, property/legal status of the monument.

Analysis of geographical properties superstructure, which is not normally included into an exclusively conservationist research. It is involved with the given monument in the context of modern landscape where it is situated as an element in linkage to other landscape elements. It concentrates on different attributes of geographical position of the monument identified by means of typology of modern landscape. It investigates what composition of types there is in the immediate environs (e.g. position in a settlement landscape, position in viticultural landscape, position in mountain forest landscape, and the like). Analysis are carried out in more detailed scales (maps in scale 1 : 10 000 and 1 : 25 000), which render a very exact specification of geographical position, for instance, position within a settlement (central, marginal, street, inside block, in courtyard , park, etc.). Apart from the geographical position of a given monument in linkage to typology of present landscape, properties of the position in relation to other monuments are also important for our research. The given monument is characterised by the fact whether it is a solitary element amidst the modern cultural landscape or on the contrary, it is a harmonious part of well-preserved historical cultural landscape (element of a set of cultural monuments).

Analysis of historical, artistic and aesthetic properties is based in processing of materials and sources produced for the given monument by specialist of different sciences. A set of such knowledge may disclose the cultural, historical, artistic and aesthetic value of the examined monument as an element t of historical cultural landscape. It contains data about the age and building history of the monument, application of styles, stylistic homogeneity or heterogeneity, presence of important architectural details, artistic and artisan works, certain specificities and rare details, connections with historical figures or prominent personalities and events, etc. Analysis of the phenomena with disturbing effects for the historical, cultural, artistic or aesthetic values of the given monument (inadmissible building interventions, inappropriate installations, disturbed statics, etc.).

Attention is also given to the aesthetic side, that is, perception properties of the given monument or landscape segment where it is places. Attempt is made to identify aesthetically attractive nooks (sceneries) with the top rate of historical authenticity but also segments of historical cultural landscape, which contains objects/structures disturbing their aesthetic quality (inadequate electric installations presence of disturbing technical elements like transformers, wiring unit chambers, gas taps, and the like, also uncultivated greenery, graffiti, etc.).

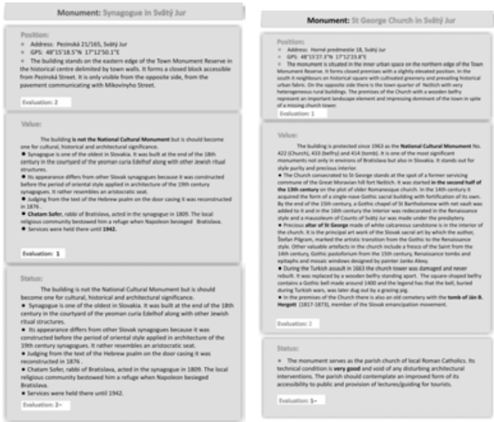

Figure 2: Evaluation records of monuments: a) St George Church and b) Synagogue

The third set of analysis is involved with **functional, technical and ownership properties** of the monument which area also significant indicator of the condition of historical cultural landscape in a given territory. They greatly help preparation of measures protecting and developing of historical cultural landscape which is part of our research as well. Forms of its original use and primal function determine function of the monument as it is not preserved in the majority of cases in changed social and economic conditions. Monuments as a rule acquire a different, new function or they lose it whatsoever. The basis of this study is the functional classification of monuments discerning: sacral monuments, archaeological monuments, mansion houses and forts, historical greenery (historical parks and gardens) profane monuments in urban landscape, profane monuments in rural settlements (folk architecture), monuments of material culture (industrial heritage) and other monuments (funeral or festive).

Example of the evaluating record of the St George Church in Svätý Jur (Fig. 2a) illustrates the input data used in evaluation procedures. Each of the three main groups of properties is evaluated separately. Geographical properties, cultural-artistic and aesthetic properties, functional, technical and ownership/legal properties are evaluated individually. The result is reflected in three figures: 1 to 3 in the first two cases, 1 to 4 in the third case. They are refined by means of a plus or minus signs. Minus sign is not imparted in case of the lowest value. For the sake of simplification and easy orientation, each of the three groups of properties was marked by a single-word expression POSITION, VALUE and STATUS. The result of evaluation is expressed as H: 1/1/1, while the figures in the record express the result o evaluation in order position/value/status.

Environment of the monument is important for the evaluation of geographical properties. It acquires value 1 is it is situated in a compact historical environment or it is a harmonious part of the compact historical cultural landscape or it is situated in a valuable natural environment. Value 2 is coferred to monuments situated in hybrid environment, in mixed historical and modern cultural landscape or if the monument neighbours on modern stgructures or it is situated in a partally impaired natural environment. Value 3 is given to a monument with the least favoured postion, it isolated amid modern cultural landscape or it is part of devastated natural environment.

Evaluation of cultural, artistic and aesthetic properties of examined monument greatly depends on quality of sources prepared by historians, archaeologists and other conservationist. It is important to gather as many sourced not only about the material but also about the spiritual cultural values of the monument (For instance linkages to personalities and events). A value 1 monument is significant not only in the national but also in a general context, while monument with value 2 is important on the regional level and value 3 is attributed to monuments of local significance.

The third group of evaluations pays attention to relevant, technical and ownership/legal properties of the monument. It is the only one with four-grade evaluation scale. The top value 1 is attributed to monuments, which have been refurbished and simultaneously fulfil the function that is not in conflict with its cultural and historical value. If it is accessible to public it is postive provided it is inharmont ywith its protegion and development. Value 2 manuments are functional but their technical conditions requires an extensive renovation while value 3 is conferred to unfunctional and decaying monuments albeit preserving their integrity. Value 4 monuments are in the worst condition, practically ruins facing an acute threat of complete disappearance.

Evaluation records of monuments existing in study territory are then used as source for identification of the preserved segments of compact historical cultural landscape. Their delimitation requires data from evaluation of geographical properties, other two groups of evaluated properties describe the quality and inner linkaged of monuments, which are in the identified compact historical cultural landcape.

4. STUDIED AREA

Cadastre of the town Svätý Jur neighbouring on the periphery of Bratislava have been chose for the model territory neighbsusediace s okrajovými mestskými časťami Bratislavy. On the opposite side the neighbour of Svätý Jur is the town of Pezinok with four-times the population of Svätý. Position of SR is a typical one on the foothills. It is situated on the line separating the lowland from the mountain landscape while the greater part of cadastre is in the Little Carpathians and the smaller is in the Danube Lowland. Almost the entire inner-urban area is in the lowland part. The seal level altitude of the cadastre oscillates between 130 and 594 m. Granitoids prevail in the mountainous part of cadastre while softer morphometric parameters are in the fringing slopes of the mountains rages. A more dynamic relief is in the values of the Little Carpathian streams. The lowland part of the cadastre is built of the Neogene gravel, sand and clay overlaid by the Quaternary fluvial sediments.

The mediaval town has been formed on an alluvial cone of the Starý potok Brook, which has detemined its quasi-triangular ground plan. The surface of the cone expands and slightly drops to an extensive swamp depression of Šúr, which is a valuable natural phenomenon now boasting the statute of the National Nature Reserve. The swamp was bigger in the past. It was reduced by melioration of a part of the territory via an artificial canal dug in 1896.

Size of cadastre of Svätý Jur is 3,987 ha and with population 5,442 (31. 12. 2013), the settlement density is 136.64 inhabitants per km^2. The character of land cover corresponds with the structuring of cadastre into the flat and mountainous parts. Pursuing the HANUŠIN et al. (2013) data, woods prevail in the mountainous areas covering 57.2 % of the total cadastre area. Arable land occupies 15.1 %, while the lower slopesof the Little Carpathians are coated by vineyards on the lower slopes of the Malé Karpaty Mts. (8.35 % of the cadastre area). Map of M. CEBECAUEROVÁ and M. MADAJOVÁ (in HANUŠIN et al. 2013) shows the sppatial composition and the rate of heterogeneity of land cover in Svätý Jur in 2003.

The monograph of Michal LUKNIŠ (1977) contains a deeper geographical knowledge of the territory in question. It became an example to follow by Slovak regional research on the level of settlements. It contains an integral summary of knowledge about natural and cultural cadastre of Svätý Jur (then Jur pri Bratislave) collected by minute field research. The author of the monograph demonstrated an extraordinary capacity to identify and interpret the linkages and relationships between individual landscape components. The most complete set of data and facts about the historical development of this territory is to be found in monograph compiled by Juraj TURCSÁNY (2009).

ŠTEFUNKOVÁ et al. (2011) devoted their publication to historical landscape structure of farming landscape. Its status in 1838 and 1949 has been identified from the map referred to as Francis' Ordnance Mapping and from historical aerial photographs which was confronted with the landscape structure in 2010. Results of the research involved with the historical agrarian structures presented in studies of ŠTEFUNKOVÁ et al. (2013) and KRNÁČOVÁ and ŠTEFUNKOVÁ (2011) have been a valuable source for our research. Monograph compiled by ONDRUŠ (2013) is dedicated to the historical mining landscape of the Little Carpathians. The main source of data about cultural monument of Svätý Jur has been the first volume of the General List of Monuments in Slovakia (GÜNTHEROVÁ, ed. 1967) and the Internet database of the Monuments Board of the Slovak Republic.

5. RESULTS

5.1 Development of historical cultural landscape

The cadastral territory of Svätý Jur has been long time developing as a part of the settlement-communication belt which formed on the dividing line of two contrasting natural landscape types. On the one side it is the mountain range of the Little Carpathians with dissected terrain and the edge of the Danube Lowland with the difficult to traverse swampy depression of Šúr on the other. Such position was optimal for the development of settlements in terms of their defence and socio-economic-development, so was that of towns of Modra and Pezinok, rural settlements of the region. Natural assets of the territory were also opportune for additional aspects of the development of historical cultural landscape. They were propitious for growing grape vine and the development of viticultural landscape since the Middle Ages.

The beginnings of cultural landscape in Svätý Jur date even to the Neolithic. In the earliest stages of settlements, the Neolithic people built their seats on the elevated spots of the marginal hills of the Little Carpathians (J. VAVÁK in TURCSÁNY, ed. 2009). Elements of historical cultural landscape from the ear of what is referred to as the protohistorical settlement (since the Neolithic until the arrival of Slavs) disappeared and cannot be found in the present landscape either. However, they are documentable by archaeological research. The oldest identifiable stage of the development of historical cultural landscape of Svätý Jur are the ramparts and ditches of the Great Moravian hill fort researched by archaeologist Ľ. KRASKOVSKÁ (1963). According to VAVÁK (in TURCSÁNY, ed. 2009) the forested hill on the fringe of the Little Carpathians was settled as early as in Bronze Age. Archaeologists also demonstrated presence of a Celtic settlement in the Upper Iron Age. Remnants of still preserved fortification belonged to Old Slavs who started it event before the Great Moravian era, by the end of the 8th century. Judging by the extent of the area (3.26 ha) surrounded by a system of ramparts and ditches it is obvious that it was one of the most important settlement in western Slovakia. After the disappearance of the Great Moravian Empire, the fort served as a refuge for locals and its area was partially used until the 14th century. It was too big for the Counts of Svätý Jur and Pezinok who became the local landlords in 1209. They built their manor on top of the hill on the opposite side of the valley in the 13th century. The monument has been described by PLAČEK and BÓNA (2007) based on many older sources.

Fragments of the medieval Castle of Biely Kameň represent an element of the following stage in the development of historical cultural landscape in Svätý Jur. After the first owners of the estate died, the stone Early Gothic castle, later adapted, was hired by the Old Hungarian noblemen in 1543. In 1604, the last tenant Štefan Illésházy built a manor house in the town and the inhabited castle fell in decay. Nowadays it is in a desolate state threatened with complete destruction.

An important compact preserved historical landscape of the territory is the inner town of Svätý Jur castellated by well preserved town walls. VAVÁK (in TURCSÁNY, ed. 2009) concludes that a serving settlement of the Great Moravian fort existed in this place in the Great Moravian period. The oldest reference to Svätý Jur recorded in the royal deed of donation from 1209 mentions a developed settlement with a Church, market and a central position in the donated estate (TURCSÁNY in TURCSÁNY ed. 2009). Presumably, it was already in the 13th century when the basic ground plan of the twon emerged although its cartographic version is only from the mid-17th century as part of the cadastre map. The ground plan of the town, its parcels and street network has not practically changed. Its situation and shape make use of the natural assets; covers the dry and smooth surface of the alluvial cone which forme in the mouth of the Little Carpathian brook in losland. Detailed research of the town's inner space (Fig. 3) shows a comparatively high level of conservation of the historical urban fabric albeit with high share of modern buildings. The original structures concentrate around the Horné Predmestie, Prostredná ulica Street which the main communication of the town. Some precious curias, burgher houses and old vine-grower houses are in side lanes.

The space of the historical town is comparatively well delineated by conserved belt of town wall which were built, in contrast to the majority of historical Slovak towns in early modern times. The town of

Svätý Jur was only allowed to build them after it was granted the privileges of a free royal borough in 1647. Situation in Pezinok and Modra was similar. The position of fortifications was more than desirable in restless times of Turkish wars. It was proved in 1663, when the Ottoman troops invaded the town through unfinished town walls and sacked it (DUCHOŇ in TURCSÁNY ed. 2009). Town walls along with five circular and nine polygonal bastions were built of the locally quarried stone. The entrance to the town was available through four big gates and two small gates opening to the vineyards. Historical etching of Samuel Mikovíni from 1736 depicts the north-eastern walls of Svätý Jur. Comparison with the present situation shows that this important element of historical cultural landscape in the town has not much changed. The principal gates were pulled down while the two small ones still exists like do the long stretches of walls on two of three sides of the triangle demarcating the historical town core. Four polygonal bastions and four circular bastions now without loop holes two escaped the urban renewal. Modern interventions also include opening of additional gates to gardens and a modern family house thoughtlessly built into the town wall.

The town expanded to the south-eastern direction in the 19th and 20th centuries. First of all it was the street connecting the town with the railway station built in 1844 for horse railway operating between Bratislava and Trnava. Sporadic construction also took place in the dissected terrain of vineyards, where several small hamlets sprang. In the second half of the 20th century, some of them changed into recreation cottages, now much sought out. Well-to-do newcomers refurbish them into luxurious residences. Originally an independent settlement of Neštich becam part of Svätý Jur, but its uncontrolled and impulsive transformation resulted in a hybrid formed by the original vine-grower houses and rather hideous modern buildings and outbuildings.

Historical viticultural landscape in cadastre of Svätý Jur is very old. Indirect indications (archaeological artefacts from fort in its environs), vine growing may have existed in western Slovakia as early as in time when it was inhabited by the Celts and the following Roman era of our history. Although the above mentioned document of 1204 does not mention vine growing, obviously activities connected with winemaking were important sources of income for the local landlords. The bond between vine growing and the town has been very firm and close since the time when the town was owned by the Count of čias Svätého Jura and Pezinok until today. It has long been the main breadwinning activity and the most popular employment of locals. The development of viticultural landscape was controlled by various factors, oscillation of climate as well as socio-economic changes. Proofs of changing scope of vineyeards have been found in the town cadastre. Among the principal ones are the stone ramparts fomed of gathered stones. They have been also seen in the woods above the belt of vineyards. It means that grape vine was grown in higher situated plots. Climate change and the alleged "little ice age" is believed one of the causes why the area of vineyards diminishes.

In the second half of the 19th century the historical viticultural landscape of Svätý Jur has underwent a great change caused by the powdery mildew, phylloxera epidemic and perenospora which in the whole of Europe. The problem has been solved by completely new vine plantations. Arrival of new agro-technical methods and new different way of working the vineyards changed the physiognomy of landscape. The data about harvests and amount of produced wine betray that the stage of transformation of historical viticultural landscape finished around 1911. But the positive trend was soon interrupted by the outbreak of the First World War (DUCHOŇ in TURCSÁNY ed. 2009). According to ŠTEFUNKOVÁ et al. (2013) the biggest intervention into local historical viticultural landscape has been the collectivisation of agriculture started in the 1950s. In the course of about two decades the traditional mosaic of farming landscape totally changed. Large terraced vineyards accessible to tractors and other mechanisms replaced vineyards fragmented into small plots. The study of ŠTEFUNKOVÁ et al. (2013) demonstrates this extreme transformation by means of a couple of aerial images from 1945 and 2003. A new stage of transformation came after 1990 and it still goes on. Even if it did not acquire such dimension as the collectivisation stage, landscape changes are obvious. TURCSÁNY (in TURCSÁNY, ed. 2009) asserts that in 20 years the area of vineyards in the cadastre of Svätý Jur markedly diminished while the abandonment is responsible for the loss of 21.82 ha, and the loss of 43.97 ha and 10.94 ha is attributable to building-up and forestation respectively. In 2010, only 214 ha of vineyards were exploited (LIESKOVSKÝ et al. 2013).

In spite of massive transformation, segments of historical viticultural landscape with traditionally worked vineyards on narrow strips of fields and traditional stone terraces (Fig. 3) still exist in the cadastre of Svätý Jur. They require adequate protection as the viticultural landscape is the most threatened type of historical cultural landscape. ŠVEDA (2011) identified increase of urbanised and technicised areas of the CORINE Land Cover database for the period of 1990–2006 and classified Svätý Jur into the suburban zone of Bratislava. This fact distinctly influences the current transformation of historical cultural landscape; historical urban fabric is being modernised and the town faces a considerable pressure of developers longing to build in the vineyards of Svätý Jur.

Figure 3: Segment of thraditionally cultivated vineyards with stone walls

5.2 The present state of historical cultural landscape of Svätý Jur

The database of the Monuments Board of the Slovak Republic recognises 38 structures as National Cultural Monuments (NCM) in the cadastre of Svätý Jur. Twenty structures of this database plus other two of high cultural and historical value that are not included in the database have been submitted to research. The analysed and evaluated monuments include: 1 hill fort, 1 castle ruins (7 structures of NCM), 1 Roman Catholic Church with wooden belfry, 1 Evangelical Church, 1 monastic compound, 1 synagogue, 1 chapel, 1 cemetery (with 5 tombstones, 1 memorial and 1 sepulchre), 1 manor house, 1 curia, 2 burger houses, 1 apartment building, 5 vine grower's houses, 1 Town Hall, 1 Commemorative House and 1 railway building and town walls. The complete NCM list also contains 1 statue on top of a post, 1 memorial and 2 commemorative plaques.

Historical core of Svätý Jur has been recognised as the Town Monument Reserve (TMR) in 1990. The Reserve includes part of the town delimited by what were once the town walls and the immediate environs of St George Church. A buffer zone protecting first of all the viticultural landscape in close neighbourhood of the inner town space that might prevent undesirable constructions in this valuable territory is missing. Seventeen evaluated monuments are within the TMR and other 5 monuments are situated outside.

The result of evaluation of 22 monuments according to the above-described methodology is presented in Table 1. Values of properties of situation displayed in the first column of the table are between 1 and 2 suggesting a comparatively scarce disturbance of historical cultural landscape especially in the historic core. Seventeen monuments included in the TMR are parts of prevailingly historical urban fabric with sporadic frequency of modern buildings. The drop of the position property value to 2 in some cases is due to inappropriate interventions into buildings or to dereliction. The position of five structures not included into the TMR poses no problem; in case of the hill fort and the castle it is a quasi natural forest landscape; the Commemorative House is situated on the edge of the inner town space neighbouring on vineyards; the former station of horse railway stands next to the rails and the environs of a wayside chapel are partly disturbed by a busy road.

Results in the second column of Table 1 are the most important ones in terms of the whole research because they indentify the range of historical, cultural, artistic and aesthetic qualities of monuments. Values 1 and 1– were attributed to five monuments. They are structures included among the most significant monuments in Slovakia and require a special protection and highly considerate approach to their use. St George Church with the wooden belfry and old cemetery is one of the most valuable sacral monuments in western Slovakia. It excels for purity of style and presence of several precious art works (for instance: stone Renaissance altar, medieval wall paintings).

Table 1: Results of evaluation of the Svätý Jur Monuments

Monument	Evaluation		
	Situation	Value	State
1 Hilt fort of Neštich	1	1–	2
2 Biely Kameň Castle	1–	2	1–
3 St George Church	1	1	1
4 Synagogue	2	1	3
5 Piarist Church and monastery	1	2	1–
6 Town walls	1–	2	2–
7 Evangelical Church	1	2–	1
8 Evangelical cemetery	2	3	2
9 Pálffy manor	1–	2	1–
10 Ambruster curia	1	2	1–
11 Town Hall	1	3	2
12 Burgher house I.	1	3	1–
13 Burgher house II.	1	3	2
14 Vine grower's house I	1	3	2
15 Vine grower's II	1	3	2–
16 Vine grower's house III.	2	3	1–
17 Vine grower's house IV.	1–	3	2
18 Vine grower's house V.	1–	3	2
19 Residential house	2	3	2–
20 Horse railway station	2	1–	2
21 Chapel of Ascension of the V. M.	2	3	1–
22 Commemorative house	1–	3	2

This monument is the only one attributed value 1 for all three parameters. It means ideal position, good technical condition and suitable use. Local synagogue is a remarkable object (Fig. 2b). It belongs to the oldest in Slovakia. At the beginning of the 19th century, an important figure of the world Jewry, Chatam Sofer, was active here. It is the reason why its cultural and historical quality was attributed number 1 in spite of the fact that this valuable historical structure has not been given the status of the National Cultural Monument. Its position is free from problems but the very bad technical condition of the building caused, apart from other, by disinterest of the private owner of the monument is a serious problem. It should be urgently included into the National Cultural Monuments database. Similar proposal also concerns the local Evangelical Church because it represents an example of transformation of a Renaissance burgher house into a sacral building. Evaluation 1– for cultural and historical value was also attributed to the building of the former horse railway station built in 1840. The railway operated between Bratislava and Svätý Jur and was later prolonged to Trnava and Sereď. It is a valuable monument accounting for the beginnings of railway transport in this country. Same evaluation was given to the Great Moravian hill fort of Neštich. Evaluation 2 in the value column was given to four monuments of Svätý Jur (monastic compound of Piarist Fathers, town walls, Pálffy manor and Ambruster curia).

Figure 4: Transformation of historical cultural landscape. Town Monument Reserve Svätý Jur
Note: 1 National Cultural Monuments (NCM) 2 valuable buildings not included into the NCM database, 3 historical urban fabric with low level of modernisation, 4 historical urban fabric with higher level of modernisation, 5 modern urban fabric built-up area, 6 urban greenery

Analysis of the state of monuments expressed in evaluation records served as a valuable source material for the assessment of integrityf historical cultural landscape in the cadastre of Svätý Jur. The cartographic version of the result yielded by research conducted in the inner space of the town is represented on the map (Fig. 4). If was found out that the historical urban fabric is compact and free from disturbing modern urban elements. The most valuable space in the town is the communication cutting the whole historical core in the longitudinal direction. It leads from the Parish Church over the Horne Predmestie, upper section of the Prostredná Street that widens into a longitudinal square next to the monastery. Eleven of 22 evaluated monuments concentrate in this most valuable part of the town. Four of evaluated monuments including the conserved town walls are situated in side lanes of the historical town's core. Urban fabric of side lanes is essentially original but the number of mismatching modern buildings is higher than in central zone. Major invasions into architecture of the original vine grower's houses represent the great problem of the periphery. There are several examples of profound refurbishment, which totally changed the historical character of buildings. In many cases only the original ground plan of the plot has been preserved although the modern buildings mostly respect the basic physiognomy of the street. Side streets in general are more neglected and display frequent aesthetic defects such as inappropriate engineering network installations, on-street parking, etc. The owner of the reconstructed vine grower's house (National Cultural Monument) on Bratislavská ulica Street has diligently conserved its original shape as represented on an old postcard from the 20th century (Fig. 5). The positive fact is that the two main stretches of the town walls neighbour immediately with vineyards. This feature must be preserved.

Figure 5: Transformation of historical cultural landscape. Example Bratislavská Street in Svätý Jur, a) on an old postcard from the beginning of the 20th century, b) present state

6. CONCLUSION

A detailed research into the transformation of historical cultural landscape was conducted in the model territory of the town Svätý Jur. The research overstepped the frame of the traditional conservationist approach to the given issue and obtained more comprehensive knowledge about the condition of the existing monuments not only in the temporal but also spatial context. Evaluation records of 22 monuments provide the real picture about their condition by evaluation of their a) geographical, b) historical, cultural and aesthetic, c) functional, technical and ownership/legal characteristics. It was found out that the location of these monuments is more or less void of problems (value in scale from 1 to 2). Four structures of above-regional cultural historical significance (value in scale 1 to 1-), six structures of regional cultural and historical significance (value in scale 2 to 2-) were identified in monuments of Svätý Jur. Historical and cultural significance of the 12 remaining structures is local. Unfortunately, neglected structures are comparatively abundantly represented. Four monuments are devastated to a degree of complete destruction (value 2- to 3) and they even include a structure (synagogue) of superregional cultural and historical significance which has not been yet recognised as the National Cultural Monument.

The second part of research concentrated on the setting of the evaluated monuments. The detailed field research of the inner urban space and selected parts of the outer space of the town Svätý Jur confirmed a comparatively low rate of transformation of historical cultural landscape. Historical urban fabric has kept the compact character with few disturbing modern interventions. However, the main problem is the unproportionate modernisation of buildings first of all in side streets and disregard for the aesthetic quality of interesting nooks of the town. Historical cultural landscape of Svätý Jur is more compact than those in Pezinok and Modra. These two towns with similar situation and cultural and historical development have undergone a far greater transformation of historical cultural landscape (LACIKA 2013 in press), hence Svätý Jur as the only settlement in the Sub Little Carpathian Regions has been rightly granted the status of the Town Monument Reserve.

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EVALUATION OF CROSS-BORDER CO-OPERATION OF SLOVAKIA AND HUNGARY: THE CASE STUDY OF THE NITRA SELF-GOVERNING REGION

Hilda Kramáreková[1], Alena Dubcová[1] and Ingrida Némethová[1]

[1] 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,
e-mails: hkramarekova@ukf.sk, adubcova@ukf.sk

ABSTRACT

The paper deals with basic knowledge about cross-border co-operation between Slovakia and Hungary based on legislative documents having regard to the operational cross-border co-operation programmes. The goal is to analyze drawing of financial resources from European regional development fund (ERDF) based on database of winning projetcs in every aspect within HU-SK cross-border co-operation programme in the Nitra Self-governing region (NSRG).

Results give us information about the amount of non-repayable grant from ERDF in NSRG and about the number of successfull projects by districts. As the examples of good praxis we presented a few realized projects in NSRG. At the end we mentioned information about future programme period 2014-2020.

Key Words: *Cross-border Co-operation, Operational Programme, Slovakia, Hungary, Projects*

1. INTRODUCTION

The concept of cross-border co-operation is seen as a direct co-operation between the authorities at lower levels like the government, which on both sides of the border helps promote peace, freedom, security, respect for the protection of human and ethnic rights, protection of minorities and leads to the development of cross-border regions (European Charter of border and cross-border regions, 1995, in Rajčáková, 2009). Transnational, cross-border and inter-regional co-operation on regional development for sustainable development of the region is also the aim of the Law No. 539/2008 of the Collection of Laws about the supporting of regional development.

The purpose of cross-border co-operation between local and regional authorities is to assist in the process of European integration and to create good neighborly relations for building social, economic and political contacts at local and regional level.

In the programming period 2007–2013 Slovakia drew resources from the EU from cross-border co-operation of the five programs for each border – with the Czech Republic, Austria, Poland, Hungary and Ukraine (http://www.euractiv.sk/?id=cezhranicna-a-uzemna-spolupraca, 2014). Outstanding position had the programme with Ukraine, which was implemented through the European Neighbourhood and Partnership Instrument (ENPI) and was the only multilateral – four-sided programme (besides Slovakia and Ukraine it also involved Romania and Hungary). Other programmes were Central Europe 2007–2013, Southeast Europe 2007–2013, INTERREG IV C and INTERACT II.

2. THEORETICAL-METODOLOGICAL ASPECTS

The issues of cross-border co-operation was broadly discused from various aspects in domestic and in foreign literature (e.g. Repaská, Vilinová, Svorad, Dubcová, 2015, Veselovský, Šolcová, Krogmann, 2014, Rajčáková, Švecová, 2013, Halás-Řehák, 2008, Halás, 2007, Kramáreková, Dubcová, Bagitová, 2006, Krogmann, 2006, Jeřábek, Dokoupil, Havlíček, eds., 2004, Hasprová-Nemčíková, 2004, Krogmann, 2002, Záhoráková-Oremusová, 2002, Némethová, 2002, Rajčáková, 2001, Krogmann, Pulpitlová-Trembošová, 2001, Pulpitlová-Trembošová, 2001, Rajčáková, 2002a, 2000b, Jeřábek, 2000, Drgoňa, 2000).

Financing of the regional development on the local level is traditionally in the focus of economists, but recently it has become interesting for geographers. Several authors, f.e. Martin and Minns (1995) emphasize that without understanding the regional structure of the public financial flows in the area is our knowledge of the conditions of the mechanisms and the regional development factors very limited. Martin (1999) states that for the understanding of regional development are the financial flows a research area of fundamental importance.

Analyses of the regional impacts of drawing structural funds are broadly discussed especially in the foreign literature, however not on the local level. In the Czech Republic deals with the impacts of economic and social cohesion on the regional development as well as with the issue of the various forms of drawing the financial funds Lněnička (2008a, 2008b, 2008c), experiences with drawing the structural funds in the Czech Republic on the example of rural microregions are mentioned by Ježek and Ježková (2007). Teoretical-metodological approaches to the study of regional dimension of the fiscal policy are analysed in depth by Macešková (2009, 2007) and the case study of regional analysis of the public capital expenditure at county and district level in the Czech Republic was introduced in the work of Blažek and Macešková (2010). In Slovak gographical literature is the issue of the spatial aspects of drawing structural funds in the NSGR discussed by Kramáreková (2010) and Cicoňová and Kramáreková (2013). Charvát (2010) analyzes the use of funds via the Rural Development Programme for the development of the villages of Trnava region in the period 2007-2010 and Buček (2010) focuses on the property of the Slovak capital Bratislava, during the global financial and economic crisis. In the recent contributions the cross-border co-operation Hungary-Slovak border area was explored in the study of Hakszer (2013).

This paper deals with analysis of the 358 final beneficiaries database published on http://www.husk-cbc.eu/sk, which in the period 2007-2013 drew funds within the Hungary-Slovakia Cross-border Co-operation Programme. From the list of projects a total of 68 projects were selected, in which the NSRG figured as the leading partner or co-operating partner. After the verification of data by the authority of the NSRG we have graphically visualized it and interpreted it.

Acquisition and processing of this information has allowed us to identify the receipt of the funds flows and subsequently to monitor their effects.

2.1 Hungary-Slovakia Cross-border Co-operation Programme 2007–2013 (HU-SK CBC Programme 2007–2013)

The Hungary-Slovakia border region includes large agglomerations, cities with national and regional importance and also a wide area of rural countryside. The border region is very heterogeneous from an economic, social and cultural point of view. The strategy of the programme focuses on the increase of the integration of the border region mainly in the fields of economic and human co-operation, as well as cross-border environment, nature protection and accessibility.

For the HU-SK CBC Porgramme 2007–2013 were defined three priority axes:

1. Priority axis 1 (PA 1) – ***Economy and society*** is aimed at actually promoting co-operation initiatives contributing to an integrated development of the economy and the society. For this PA were defined 7 areas of support (measures):

   1.1 Support of cross-border business co-operation

   1.2 Co-operation in the field of research and technology development (RTD) and innovation

   1.3 Joint tourism development

   1.4 Joint development and the coordinated use of healthcare facilities (it was not drawned in NSGR)

   1.5 Development of networking, partnership, programme and project planning and management capacities

   1.6 Joint use and development of human resources

   1.7 People to people actions

2. Priority axis 2 (PA 2) – **Environment, nature protection and accessibility** includes activities aiming at improving the physical conditions of the cross-border co-operation especially in the field of transport infrastructure and accessibility. The axis also aims at

encouraging joint actions in the field of protection of the natural environment. For PA 2 were defined 5 areas of support (measures):

2.1 Joint actions to encourage the protection of the natural environment

2.2 Joint nature conservation activities

2.3 Small road construction, bicycle paths, public transport

2.4 Facilitating better border-crossing across the border rivers

2.5 Improvement of cross-border communication channels

3. Priority axis 3 (PA 3) – **Technical Assistance** includes activities assisting in implementation of the programme

The supported projects were realized in eight NUTS III regions in Hungary and in five self-governing regions in Slovakia. The applicants or partners of each project were state authorities, cities, villages and self-governing regions and organizations established by them, private companies with public participation, organizations functioning in the form of a European grouping of territorial co-operation and non-governmental organizations (http://www.husk-cbc.eu/ sk, 2014).

2.2 Analysis of funds drawing by area of support of HU-SK CBC Programme 2007–2013 in the Nitra Self-governing region

For the support of projects within HU-SK CBC Programme 2007–2013 in total 207 642 916 EUR were allocated from all sources:

- for PA 1 it was 85 133 595 EUR – 41 % (EU sources 72 363 556 EUR, national public sources 12 770 039 EUR),
- for the PA 2 it was 110 050 746 EUR – 53 % (EU sources 93 543 134 EUR, national public sources 16 507 612 EUR) and
- for the PA 3 it was 12 458 575 EUR – 6,00 % (EU sources 10 589 789 EUR, national public sources 1 868 786 EUR).

The support from ERDF for both Slovak and Hungarian applicants could be up to 85% of total eligible project costs (http://www.husk-cbc.eu/sk, 2014). In the programming period 2007–2013 5 calls were announced, within which it was possible to submit applications for a financial contribution.

2.2.1 The 1st call for submission of financial contribution in 2008

In the 1st call of the programme published on 15 October 2008 there were a total of 123 successful projects. An amount in the funds determined for measures in the 1st call were 71 014 050 EUR in total, of which 63 538 887 EUR were sources from ERFD and the rest were the national funds.

In the 1st call 36.82% of financial contributions were drawn. For PA 1 it was intended 20 421 592 EUR and for the PA 2 it was 50 592 458 EUR. The level of funding for projects implemented in NSRG was 4 771 870 EUR (Table 1), of which 2 680 497.07 EUR were used for measures of the PA 1 and 2 091 373.15 EUR for the PA 2.

In the NSRG 20 projects were successful, of which 5 were in the area 1.5 Development of networking, partnership, programme and project planning and management capacities and 5 in the area 1.7 People to people actions. Most funds went to a project under measure 2.3 Small road construction, bicycle paths, public transport (Figure 1). The main applicant of this project was the city of Komarno, in co-operation with the Hungarian Komárom. The project of “Bicycle path Komárom – Váh – Komárom and its connection to the international route” won 1 574 633.82 EUR.

Table 1 Funds drawing according to area of support and a number of supported HU-SK CBC programe projects in the year 2008 in the NSGR

	1st call														
Area of support/ measure	Funding from ERDF		Number of projects	Funding from ERDF		Number of projects	Funding from ERDF		Number of projects	Funding from ERDF		Number of projects	Funding from ERDF		Number of projects
	in EUR	in %		in EUR	in %		in EUR	in %		in EUR	in %		in EUR	in %	
1.1	403973,00	8,47	2	2574945,31	33,08	4	629933,00	39,38	2	1579580,50	10,97	1	0,00	0,00	0
1.2	0,00	0,00	0	1033410,70	13,28	1	0,00	0,00	0	828731,81	5,76	1	0,00	0,00	0
1.3	1257873,00	26,36	3	1132589,10	14,55	1	0,00	0,00	0	2053944,37	14,27	2	0,00	0,00	0
1.4	0,00	0,00	0	0,00	0,00	0	0,00	0,00	0	0,00	0,00	0	0,00	0,00	0
1.5	612461,97	12,83	5	136900,00	1,76	1	0,00	0,00	0	707376,11	4,91	4	0,00	0,00	0
1.6	127199,37	2,67	1	0,00	0,00	0	0,00	0,00	0	574597,28	3,99	4	0,00	0,00	0
1.7	278989,51	5,85	5	371199,57	4,77	6	0,00	0,00	0	98043,41	0,68	1	0,00	0,00	0
2.1	354383,93	7,43	2	635440,99	8,16	3	722433,05	45,16	1	2540262,23	17,65	2	613940,6	8,64	1
2.2	162355,40	3,40	1	802027,63	10,30	2	0,00	0,00	0	2579844,51	17,92	4	0,00	0,00	0
2.3	1574633,82	33,00	1	0,00	0,00	0	0,00	0,00	0	2100169,01	14,59	1	2492671	35,08	1
2.4	0,00	0,00	0	672476,07	8,64	1	0,00	0,00	0	1330482,59	9,24	1	3999904	56,29	1
2.5	0,00	0,00	0	425548,25	5,47	1	247206,40	15,45	1	0,00	0,00	0	0,00	0,00	0
Total	4771870,00	100,00	20	7784537,62	100,00	20	1599572,45	100,00	4	14393031,82	100,00	21	7106515	100,00	3

Source: (http://www.husk-cbc.eu/sk/, 2014)

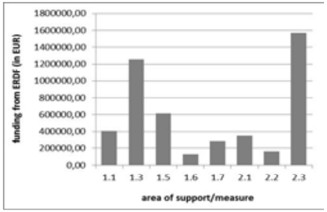

Figure 1: Funds drawing according to area of support in HU-SK CBC programme in the year 2008 in the NSGR (1st call)

The most successful district in the aspect of the number of projects has been the district of Nove Zamky (8 projects), it was followed by the districts of Komárno (6) and Levice (4). Nitra and Šaľa were successful with one project, Topoľčany and Zlaté Moravce did not win with any project.

2.2.2 The 2nd call for submission of financial contribution in 2009

The 2nd call was announced on 29 June 2009. The 107 of approved projects gained 49 820 390 EUR. In the 2nd call 25.83% of the funds intented for the programme were spend. 122 392 260 EUR were allocated for the PA 1 and 227 428 130 EUR for the PA 2. For the projects implementation the NSRG gained almost twice as much funding than in the 1st call – 7 784 537.62 EUR (Table 1), in the PA 1 it was 5 249 044 EUR and in the PA 2 it was 2 535 492.94 EUR.

Also in 2009 the NSRG received 20 projects. While the largest volume of the funds was obtained from the measure 1.1 Support of cross-border business co-operation (Figure 2), most projects (6) were implemented within the measure 1.7 People to people actions. Via this measure it was possible to raise funds to support activities of organizing joint events and programmes for co-operation in the field of culture, sport and nature conservation. The NSRG obtained for these projects from the ERDF 371 199.57 EUR.

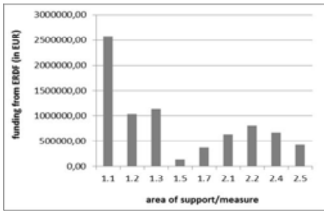

Figure 2: Funds drawing according to area of support in HU-SK CBC programme in the year 2009 in the NSGR (2nd call)

As an example let us mention the project entitled “Expanding interpersonal relationships between villages Tata and Svodín” when in every village four cultural events were realized. Another axample is the project of the city Želiezovce called “Linking the cultural traditions of the cities of Želiezovce and Iszaszeg”, which gained 72 621.11 EUR.

The most successful district was the Komárno district with the 7 projects, followed by districts of Levice and Nové Zámky (both 5 projcets) and Nitra district (3 projects). Districts of Šaľa, Topoľčany a Zlaté Moravce did not win with any project.

2.2.3 The 3rd call for submission of financial contribution in 2010

In the 3rd call announced on 1 December 20 projects were successful. Allocated amount of the funds was 10 365 801 EUR. Within this call 5.37% of the financial contributions were spent. In total 1 936 941 EUR were intended for the PA 1 and 8 428 860 EUR for the PA 2. The NSGR gained 599 581.95 EUR for 4 projects (Table 1). The PA 1 was supported by the amount of 629 933 EUR and the PA 2 by the amount of 969 649.45 EUR.

Within the measure 1.1 Support of cross-border business co-operation the NSRG gained for 2 projects 629 933 EUR (Figure 3). These were used to create business partnerships and networks and improving the flow of business information. As an example we can mention the project "Creation of cross-border hunting, and forestry cluster" that was focused on almost the whole geographical area of the project.

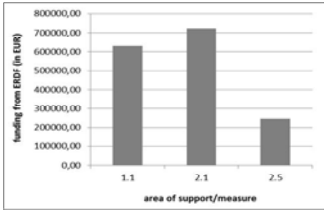

Figure 3: Funds drawing according to area of support in HU-SK CBC programme in the year 2010 in the NSGR (3rd call)

In the measure 2.1 Joint actions to encourage the protection of the natural environment (focusing on management tasks related to flooding) the NSRG won for the project "Surface water draining in the villages Ipolydamásd – Chľaba" 722 433.05 EUR.

For the measure 2.5 Improvement of cross-border communication channels (village Svodín in the district of Nové Zámky in co-operation with Pons Danubii EGTC) the NSRG gained 247 206.40 EUR. From the aspect of the number of projects the district of Nové Zámky gained two projects and districts of Komárno and Levice 1 project.

2.2.4 The 4th call for submission of financial contribution in 2011

In the 4th call announced on 23 June 2011 99 projects were financially supported. In total 27 357 498 EUR were intended for the PA 1 and 22 498 084 EUR for the PA 2. The determined amount of 49 855 582 EUR represented 25.84% of whole funding program. The NSGR gained 14 393 031.82 EUR for 21 projects (Table 1). The PA 1 was supported by the amount of 5 842 273.48 EUR and the PA 2 by the amount of 8 550 758.34 EUR.

In this call the NSRG gained the highest non-repayable financial contributions in the whole program period 2007–2013.Within the measure 1.1 Support of cross-border business co-operation the NSRG received 1 579 580,50 EUR for the project, of which the lead partner was a non-profit organization Incubator Komarno – Center for promotion of business activities. The main objective of the project was to improve the conditions of the business environment, in order to support local small and medium-sized businesses and to reduce unemployment in the region. Significant volume of financial contributions were received in the amount of 2 053 944.37 EUR within the measure 1.3 Joint tourism development as well.

The largest number of projects (4), was successful in the measures 1.5, 1.6 and 2.2. Most funds, however, were received in the measure 2.2 Joint nature conservation activities and 2.1 Joint actions to encourage the protection of the natural environment (Figure 4).

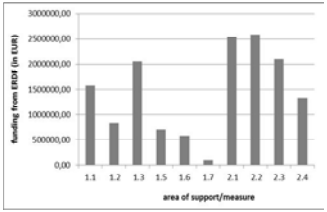

Figure 4: Funds drawing according to area of support in HU-SK CBC programme in the year 2011 in the NSGR (4th call)

The highest number of successful projects were in the district of Komárno (7), followed by the districts of Nové Zámky (7), Levice (4) and Nitra (3). Other districts (Šaľa, Topoľčany, Zlaté Moravce) have not been successful.

2.2.5 The 5th call for submission of financial contribution in 2013

The 5th call for submisson of projects was announced on 3 April 2013. In the year 2012 no call was announced, as it was expected that by the year 2011 all financial resources for the programmig period 2007 – 2013 will be exhausted. However, it was found out that in Slovakia the amounts must include VAT but in Hungary not. Therefore, the Slovak side of the program reverted VAT back, which represented a significant amount of funds and the 5th call for applications for non-repayable funding could be announced.

The fund limit for the 5th call was 11 816 023.06 EUR for 9 successful projects. Within last call 6.12% of the whole ERDF funds for the cross-border co-operation programe were drawn. For the proposals the PA 2 was intended only. For 3 successful projects the NSRG gained 7 106 514.86 EUR, most of them in the measure 2.4 (Table 1, Figure 5).

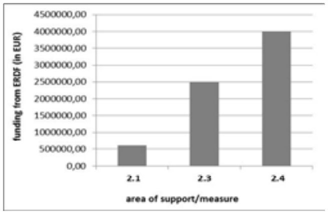

Figure 5: Funds drawing according to area of support in HU-SK CBC programme in the year 2013 in the NSGR (5th call)

Within the measure 2.1 Joint actions to encourage the protection of the natural environment won the project of non-profit organization EMEK Nagykovácsi with a non-profit organization Biogas Dry Fermentation from Komárno. Another successful project was “HU-SK Cyclopath connected to EUROVELO 6” under the measure 2.3 Small road construction, bicycle paths, public transport. In the district of Komárno it was launched in 2014.

Within the measure 2.4 Facilitating better border-crossing across the border rivers one of the successful projects was the construction of freight ferries between Esztergom and Štúrovo (Nové Zámky district).

2.2 Synthesis of funds drawing by area of support of HU-SK CBC Programme 2007–2013 in the Nitra Self-governing region

Throughout the eligible area in the programming period 2007–2013 358 projects were successful, for which were allocated funds amounting to 185 396 682.06 EUR in total.

The NSRG received for 68 projects an amount of 35 610 421.47 EUR, of which 14 401 748.23 EUR were for PA 1 and 21 253 788.74 EUR were for PA 2 (Figure 6).

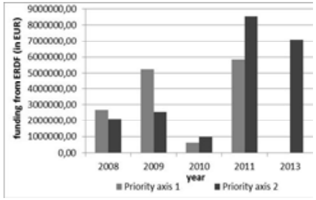

Figure 6: Funds drawing from ERDF of the supported projects of the HU-SK CBC programme 2008 – 2013 in the NSGR according to the priority axes

The most successful district regarding to the number of projects were the districts of Komárno and Nové Zámky (each had 23 successful projects). Levice district (14), Nitra district (7) and Šaľa (1). Topoľčany and Zlaté Moravce districts had not obtained any project (Figure 7).

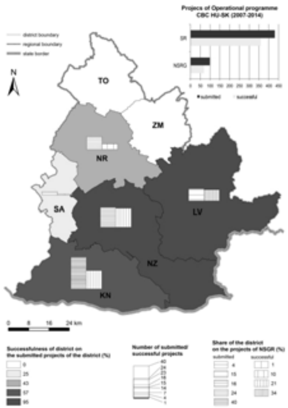

Figure 7: Successfulness of NSGR districts in projects

For inspiration for next applicants could as the examples of good practice serve e. g. projects “Martovské jazerá (lakes)” (Figure 8); “In the footsteps of the Romans on the Danube” (Figure 9); “Creative industry” (Figure 10). (http://www.husk-bc.eu/, 2014).

Figure 8: Successfull project "Martovské jazerá (lakes)"
Source: http://www.husk-bc.eu/, 2014

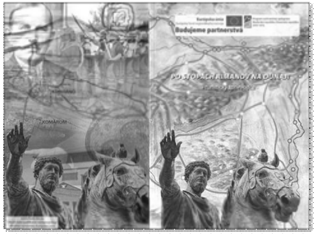

Figure 9: Successfull project "In the footsteps of the Romans on the Danube"
Source: http://www.husk-bc.eu/, 2014

Figure 10: Successfull project "Creative industry"
Source: http://www.husk-bc.eu/, 2014

When comparing the funds drawing from the aspects of individual actions for the whole programming period, most of the funds were spend in the measure 2.3 Small road construction, bicycle paths, public transport (21.52%), the measure 2.2 Joint nature conservation activities (16.93%) and the measure 1.1 Support of cross-border bussines co-operation (14.55%). In total they accounted for over 50% of all funds drawn through individual projects (Figure 11).

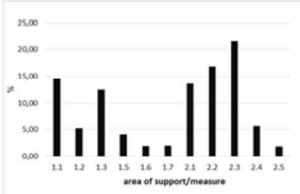

Figure 11: Funds drawing from ERDF of the supported projects of the HU-SK CBC programme 2008 – 2013 in the NSGR according to the measures of the priority axes

3. CONCLUSION

In September 2014 the Government of the Slovak Republic approved the Program of cross-border co-operation Slovak Republic – Hungary 2014-2020 and in November 2014 it was sent for approval to the European Commission. Its aim is to promote cross- border activities, methods of co-operation, networks and joint development. This way enables the region to contribute effectively to achieving the goals of the Europe 2020 strategy.

Through five priority axes (PA1: Nature and culture, PA2: Strengthening of cross-border mobility, PA3: Strengthening of sustainable and quality employment and supporting labour mobility, PA 4: Promoting cross-border co-operation of the public administration authorities and people living in the border area, PA5: Technical assistance) the allocation of 183 304 694 EUR is being considered (of which the EU support covers 155 808 987 EUR and the national funds 27 495 707 EUR), which is approximately 24 338 222 EUR less in comparsion with the previous period of the programme (207 642 916 EUR). The cross-border co-operation programme SK-HU 2014-2020 will contribute to fulfilling the Europe 2020 strategy that concerns the inteligent, sustainable and inclusive growth and, at the same time, it will support reaching the economic, social and territorial cohesion (http://www.rokovania.sk/Rokovanie.aspx//RokovanieDetail/761). Operational programmes of the cross-border co-operation that supports border areas by this means significantly contribute to the reduction of regional disparities (Rajčáková, Švecová, 2015, Švecová, Rajčáková, 2014, Rajčáková, Švecová, 2014).

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SELECTED FOREIGN RETAIL CHAINS IN SLOVAKIA

Miroslava Trembošová[1], Viktória Vlačuhová[1]

[1] 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,
e-mail: mtrembosova@ukf.sk

ABSTRACT

Trade is one of the main drivers of the economy with significant variability in space and time. The economy of many countries of the world is mainly dependent on foreign trade. For the most temporal dynamics and spatial diversity of retail resulted in the need of specialization course "retail geography". Since the turn of the millennium the foreign retail chain is a new phenomenon in the transformed economy of Slovakia.

The paper analysis of chain trends for Slovak consumer market in the period 2001-2013, according to their basic indicators – the number of stores and sales revenue. From the 10 most important companies we have selected four foreign chains (Tesco, Billa, Kaufland and Carrefour) with a wide range of products. The first condition for selection into the analysis file has been selling food as a basic commodity sales. The second condition was the time of their business in the Slovak Republic (2001 to 2013). The average growth rate in the number of enterprises and size of turnovers of available data, we determined from a geometric theory. As example a strongest "player" among foreign retail chains doing business in Slovakia – a joint-stock company Tesco Stores SR – documents the characteristics of the development trends.

Key Words: *chain stores, turnovers, growth rate, Tesco Stores SR a.s.*

1. RETAIL CHAINS IN SLOVAKIA

Retail chains are big business entities owning and operating a larger number of outlets (Antimonopoly Office, 2001). Economic pressure of foreign retail companies forced the Slovak merchants to create custom integration alliance. Jednota has thus become the most powerful business group in Slovakia. Its total profit (i.e. sum of turnover of all Jednota legal subjects in Slovakia) shows that even a strengthened leading position in the retail sale of food and everyday products. Its market share in 2001 was over one fifth. Revenues from retail sales exceeded the amount of 26.3 billion Sk, which represents almost a quarter-on-year increase, despite the fact that 2001 was characterized by further strong entry of foreign retail chains (Zamkovská, 2002).

Since the turn of the millennium is the phenomenon of foreign retail chains new feature on the Slovak market. Implementation of its trade policy continues to significantly influence and change the traditional structure of trade existed previously. The critical range of goods taken directly from the manufacturer, thus eliminating the wholesale and therefore present a stong competition in both the retail market, both on the wholesale market. Retail chains are building their enterprises in large or medium-sized cities. According to Baran (2012) retail chains have advantages stemming from the size and organizational structure, and not least the extensive experience (especially for foreign entities), which allows offering consumers a diverse and reasonably inexpensive goods.

Entry of multinational retail chains in the mid 90s of the 20th century, marked by Mitríková (2008) a major breakthrough in the spontaneous development of the retail network from the beginning of the transformation period. He only took place with the participation of Slovak capital.

Unlike the economically developed West countries it was at the end of the 20th century not only in Slovakia several times lower purchasing power of the population, but also the growth in the number of hypermarkets significantly outpacing the growth of purchasing power. In developed countries, unlike the SR they operate mechanisms to protect domestic small and medium enterprises, agriculture and manufacturing.

The first alliance concentrating dependent but also independent members, such as shopping centers (Slovakia Coop, Coop Tatras, Slovzdroj) began to emerge in the Slovak Republic from 1995 to 1998. Given the lack of know – how they cannot work effectively. The members of the alliances reached in 1998 a total turnover of 19.8 billion Slovak crowns. Activities such as advertising, sales promotion and presentation of the product itself and the brand at the point of sale significantly influenced the consumer perception. The germs of pressure on business networks of suppliers arose. The level of trade in Slovakia started with a slight dynamization qualitative and quantitative expansion of foreign chains such as a joint-stock company Tesco Stores SR a.s. (Tesco), BILLA s.r.o., (Billa), Baumax. Their input is compared with neighboring countries V4 delayed for three years. Retail chains significantly entered the Slovak market in 1999, but the real boom began after 2000.

Foreign chains Billa, Kaufland Slovenská republika, v.o.s., (Kaufland), Lidl, Tesco and Metro Cash&Carry (Metro) wholesale initiated in 2014 the formation of the first industry association trade in Slovakia – Slovak modern trade alliance itself. Association formally operates within the Slovakia-Germany Chamber of Commerce and is also open to other traders. Affiliates of SAMO currently operate 449 stores and six wholesale outlets and employ more than 23,000 people. The self strives for the contractual freedom of the customer-supplier relations, because only free competition leads to increased competitiveness among suppliers, to increased supply and variety of products sold and their better quality and fairer price (www.istp.sk, 2015-3-28).

2. Overview of the major foreign retail chains in Slovakia

In 2000, the position of the top ten companies with FMCG in the Slovak market ranked two multinational retail chains, British Tesco and Austrian Billa. In 2001 there were already five, were added Metro, Carrefour Slovensko, a.s. (Carrefour) and Kaufland (Zamkovská, 2002).

On the Slovak market in 2001 was the largest and most prosperous company Slovak network Coop Jednota Slovensko, spotrebné družstvo, (COOP Jednota) with an annual turnover of € 878.1 million. Tesco reached second place with a total turnover of € 451.4 million, which at that time amounted to 13.6 billion Slovak crowns with only 13 enterprises across Slovakia (Table 1, Figure 1).

Table 1: The largest retail chains in Slovakia in 2001 and 2013

2001				2013			
Nr.	Chain store	Total turnover million €	Number of stores	Nr.	Chain store	Total turnover million €	Number of stores
1	COOP Jednota	873,1	2 400*	1	Tesco	1 381,9	155
2	Tesco	451,4	13	2	COOP Jednota	1 210,3	2226
3	Metro	272,2	4	3	Lidl	795,4	123
4	Billa	205,8	39	4	Kaufland	743,4	50
5	Zdroj	136,1	85	5	Billa	422,9	123
6	Carrefour	132,8	4	6	Labaš	196,7	20
7	Kaufland	126,1	9	7	CBA	149,5	340
8	M-Market	119,5	172	8	TERNO	81,7	20
9	Labaš	84,3	1	9	Retail Value Stores Carrefour	75	5
10	Smoker	81,3	2	10	Noba – Smoker	29,3	2

*Source: Zamkovská, 2002 Vlačuhová, 2015, * estimated*

In third place in it placed the company Metro with a total turnover to € 272.2 million, with only four enterprises.

As Billa was placed fourth, which, although the 39 plants overtaken Tesco and Metro, but the total turnover of this is not reflected. Billa total turnover was € 205.8 million. Further the company Prima Zdroj Holding (CBA's), Carrefour and Kaufland were placed with almost identical turnovers moving from 136 to 126 million € (see Figure 1). The difference however is in the efficiency of work for while Prima Zdroj Holding operated 85 stores, Kaufland and Carrefour just 94. The eighth position of the largest companies took the company M-Market, which comes from Slovakia, and in 2001 its total turnover was 119 million € with 172 enterprises.

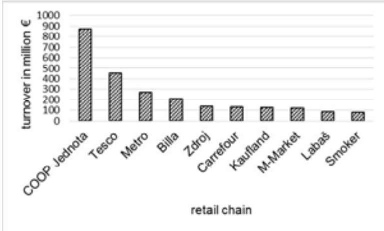

Figure 1: Turnover of the largest retail chains in Slovakia 2001
Source: Zamkovská, 2002 Vlačuhová, 2015

Currently the company CBA incorporates the M-Market, which is its most important tenant. On the ninth ranked is company Labaš, which focused its business in retail only in eastern Slovakia. In 2001, although operated only one shop, with whom she had a financial turnover to € 84.3 million, but currently operates 20 retail stores and incorporates the sale of tobacco and the press called L.A. PRESS. On the tenth place in 2001 it placed Smoker company with a turnover of € 81.3 million. Smoker company today operates only two stores in Trenčín and Žilina.

Due to the internationalization a lot of enterprises and other foreign chains came to Slovak market. In 2013 (see Figure 2), according to the total turnover of leadership acquired by Tesco, the second in 2013 was retail chain COOP Jednota. A discount retail chain Lidl of German company enforced emphatically, which entered the Slovak market in 2004. In the first year the company had just 14 stores, but by 2013 the number of enterprises rose to 123.

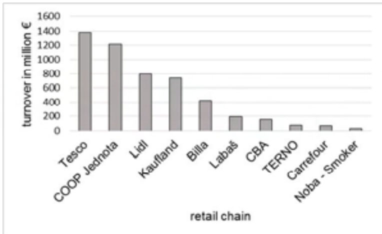

Figure 2: Turnover of the largest retail chains in Slovakia 2013
Source: www.finstat.sk, 2015-3-27

Tesco trading company had in 2001 in Slovakia, only 13 stores, but in 2013 was in Slovakia to 155 Tesco enterprises. In second place located alliance COOP Jednota remained the largest Slovak retail chain and also has the largest number of 2226 stores in Slovakia. Among the biggest foreign retail chains in 2013 belongs clearly Lidl. Lidl had 2013 total sales to € 795.4 million, which got him up to third place among the 10 largest retail chains with their 123 establishments. In fourth place was placed Kaufland, which has enterprises grew from 9 to 50 in 2013 with a total turnover of 743.4 million €. On the other partitions in 2013, the company Billa, Labaš, CBA, which includes the Slovak Hypernova, Retail Value Stores (RVS), incorporating the Carrefour and the tenth place obtained the Slovak company Noba – Smoker with a turnover of 29.3 million €.

Further we draw our attention to the four most important foreign retail chains: Tesco, Billa, Kaufland and RVS.

3. THE DYNAMICS OF SELECTED INDICATORS OF FOREIGN CHAINS IN SLOVAKIA

Another aim of our paper was to determine the average rate of increase in the number of enterprises and total turnovers in selected chains. The calculation is based on the knowledge of geometric theory. According to Bartsch (1987), where it is not possible to identify the individual values of observation (number of stores and sales), the dynamism observed phenomenon speak through the average growth rate:

$W = (n\text{-}1\sqrt{x_n / x_1}).\ 100$ (in %)

where “n” is the number of years in the period

x_n – last measured data during the period

x_1 – the first measurement data during the period

Eligibility criteria in the evaluation group was foreign chains selling food as a basic commodity and the sales period in the retail business in the Slovak Republic (2001-2013). From the presented companies we selected four most known foreign chains (Tesco, Billa, Kaufland and RVS) with a wide range of saling goods.

According to Figure 3, the largest increase in the number of stores over 12 years had just Tesco, which has managed to expand its retail store up to 142 enterprises.

Other foreign companies which are over 12 years done very well, it was Billa, with an increment of 84 stores, which currently represents 123 enterprises. German owner of Kaufland, in Slovakia managed to build a further 41 stores and a chain of RVS in last 12 years as Carrefour expanded to 19 stores.

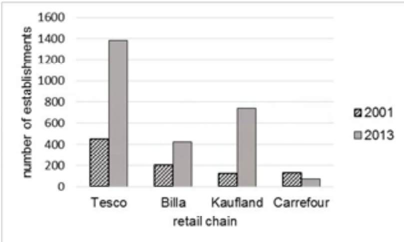

Figure 3: Comparison of the number of enterprises selected foreign chains for 2001 and 2013
Source: www.finstat.sk

The store number of selected foreign chains all over 12 years experienced a growing momentum measured by the average growth rate (Table 2).

Table 2: Size dynamics measured by the growth rate of retail outlets and turnovers in selected foreign chains in the Slovak Republic for the period 2001-2013

Retail chain	Number of establishments					Turnover in million €				
	2001	2013	x_n/x_1	$\sqrt[11]{x_n/x_1}$	W v %	2001	2013	x_n/x_1	$\sqrt[11]{x_n/x_1}$	W v %
Tesco	13	155	11,923	1,244	124,4	451,4	1381,9	3,0613	1,105	110,5
Billa	39	123	3,1538	1,105	110,5	205,8	422,9	2,0549	1,065	106,5
Kaufland	9	50	5,5555	1,158	115,8	126,1	743,4	5,8953	1,157	115,7
Carrefour	1	20	20	1,313	131,3	132,8	75	0,5647	0,949	94,9

Calculation: Trembošová, 2015

The growth of stores is dominated by a chain with a new name RVS with an average value of the rate of growth 131.3%. Followed by Tesco chain with an average growth rate of 124.4% and Kaufland company with a value of 115.8%. At the last place, the company Billa of 110.5% annual rate. This growing trend in opening outlets are not reflected in the turnovers. Even in the chain RVS with first place in the annual rate of opening stores in revenues recorded a drastic reduction, and its average annual growth in the years 2001-2013 (see Figure 4) in Slovakia was only 94.9%. While other foreign chains have increasing average growth in revenue, but not all were identical to increasing the number of outlets. Most balanced state has been achieved in the company Kaufland, where the average rate of increase in the number of operations was 115.8% and average growth in revenue 115.7%. At Tesco and Billa was recorded higher growth in the number of stores than turnovers. Even chain Billa in this comparison is better than Tesco, where the average rate of increase in the number of enterprises was 124.4% and average growth in revenue only 110.5%, i.e. the difference is 13.9 points and company Billa (110.5 % of sales revenue and 106.5%), the difference is lower by only 4 percentage points.

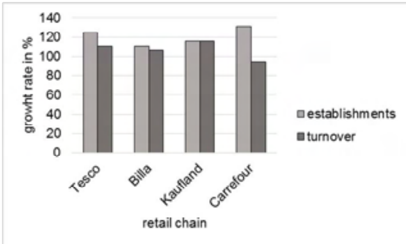

Figure 4 Size measured by dynamic growth rate of retail enterprises and turnovers in selected foreign chains in the Slovak Republic for the period 2001-2013
Source: Zamkovská, 2002, www.finstat.sk

5. TESCO STORES SR, A.S.

5.1 History of Tesco Stores SR, a.s.

Tesco brand history dates back since 1924 in the UK. In 2015, Tesco operated in 12 countries: Great Britain, Ireland, Hungary, the Czech Republic, Poland, Slovakia, Turkey, Thailand, Malaysia, South Korea, China and India. On the Slovak market it has joined Tesco in 1996, in 2014 there operated 161 stores, 18 gas stations, two distribution centers and employs nearly 10 thousand employees. Tesco currently cooperates with more than 800 Slovak suppliers, especially fresh food – meat, sausages, milk and milk products, fruits and vegetables and of course, the local bakery (www.finstat.sk, 2015-3-27).

5.2 Tesco Stores SR, a.s. enterprises and management

Most enterprises of Tesco are located in the capital Bratislava, where the company has 35 stores. It has 3 hypermarkets, supermarkets 3, 1 store, 1 commercial gallery, 3 extra outlets, one gas station Tesco and up to 23 Expres stores. In second place with the same number of 7 stores are Žilina (two supermarkets, two hypermarkets, one department store, one Expres and one gas station) and the city of Košice (1 store, 2 Expres, 1 hypermarket, 1 extra hypermarkets and 2 petrol stations). Third city with the highest number of stores is the city of Martin, which has a total of four enterprises (2 supermarkets, 1 hypermarket and petrol station 1, Figure 5).

Over the years 2008/2009 company chain Tesco has stagnated somewhat, but the situation has improved since 2010, thanks to accelerating the building of fast-service enterprises network Tesco Expres. Top sales and revenues recorded a chain Tesco in 2012 and up to € 1,408,500,000. In 2013, however, sales and revenues declined to € 1.381 billion (see Figure 6). In 2014 the company firstly insinuated a possible leaving of our retail area.

The largest retail chain Tesco of British owner recorded in the 2013/14 second decline in full-year profit. The main reason for the decline in sales in the British market, competition from discount chains and reduce food prices. A strong competition from discount chains such as Lidl, according to the British group consists primarily in the second half of 2014 (www.hnonline.sk, 2015-3-12).

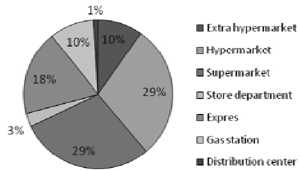

Figure 5: Store types of a joint-stock company Tesco Stores in Slovakia in 2014
Source: www.tesco.sk, 2015-3-27

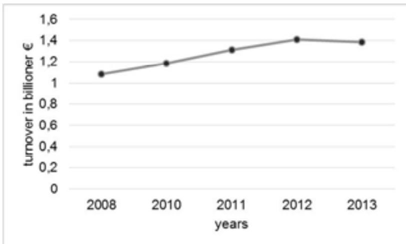

Figure 6: Revenue of joint-stock company Tesco Stores SR (2008-2013)
Source: www.finstat.sk, 2015-3-29

The largest retail chain in Slovakia had in recent years rather declining than flourishing prosperity. In 2008, the company had more total profit to 35.02 million €. But since 2008 net profit chain fell so that in 2009 the company had a profit of only € 20 million, which is € 15 million less per year. We assume that a significant impact on the global economic downturn had also. In 2010, the company prospered, as profit increased year on year by € 4,940,000. The year 2011 was for the British chain store certainly the most prosperous, since this year, the company had net profit to 38.94 million €. Tesco so in Slovakia this year defended the name of the best foreign chain was opening a new store across our territory. But in 2012, the company is again in decline and the company declines to profit of € 4.78 million compared to 2011. The year 2013 was the retail chain Tesco definitely the worst, since their total sales and revenues were up € 1.381 billion and profit of just 16,75 million €. Its profit fell year on year 2012/2013 up to € 17,410,000. For the company it was a huge loss (see Figure 7).

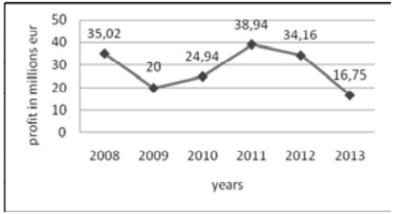

Figure 7: Net profit for Tesco in million € for the years 2008 to 2013
Source: www.finstat.sk, 2015-3-29

For profitability evaluation it is necessary to analyze the profit margin indicator. The average net profit margin (ratio of net income and the amount of sales) in the last six years in the case of Tesco at 2.4%, or an average of 2.4% of the total sales of the company remains in the form of net profit. The average profit margin in the retail sector in Slovakia is at 0.85%, which means that the profit margin of the company Tesco are among those above average (Gulka, 2015).

The average gross margin for Tesco last six years is at 14.6%, i.e. in average 14.6% of total sales after paying the cost of goods and intermediate consumption will remain the company to cover the additional costs and operational overheads. Average gross margin in the retail sector in 2013 was 11.4%. We can say that based on indicators of profit the chain Tesco is one of the successful retail chains (Gulka, 2015).

5.5 Location of Tesco enterprises

Tesco operates in Slovakia with 181 enterprises, which also includes two distribution centers, 18 service stations and 161 outlets. Most Tesco stores are located in our capital Bratislava, where over 35 stores. It has 3 hypermarkets, 3 supermarkets, 1 store, 1 commercial gallery, 3 extra outlets, gas stations and even 23 Expres. In Bratislava region there are more 3 hypermarkets and it is in the region of 38 affiliated companies Tesco, which means that the company has in the Bratislava region represented 21.1% of enterprises from all over Slovakia (Figure 8).

County of Žilina, which is up to 24 stores (13.3%) represents the second one with the highest number of Tesco's enterprises. By type stores in this region is dominated by supermarkets with the number 11, the highest number of supermarkets in one region. According to the store number follow Trenčín and Košický region. In each of them, Tesco operates 22 enterprises (12.2% of all Tesco stores). In Trenčín region is also one distribution center Tesco in Beckov. To the Banská Bystrica region belong 20 enterprises (11%) of Tesco, they are mostly supermarkets, 7 hypermarkets, 2 extra outlets, 2 type formats Expres and one gas station. In the Trnava region Tesco operates 19 stores (10.2%), Nitra region has 18 enterprises (10%). Prešov region with only 18 enterprises, of which is one distribution center and one gas station, and so has a share of only 10% of plants from all over Slovakia.

Figure 8: Location of chain Tesco enterprises 2014

Localization strategy of foreign Tesco chain in terms of the theory of Guya (1998) prefers 2 possibilities: edge of the city center (edge-of-center) and located outside the city (out-of-town), using a convenient location along the main road. Their strategy has a significant impact on urbanization, urban settlements.

Location of sales enterprises Tesco corresponds to purchasing power and economic of Slovakia regions. Preferred is western Slovakia, with the largest localization magnet in the capital city Bratislava and its surroundings. The lowest number of enterprises has the company in Northern and Central Slovakia. All stores are logically and strategically placed along highways, I. and II. Class routes.

6. CONCLUSION

A large number of stores that are strategically placed alongside the largest and most important trunk routes reflects the strength of foreign chains in Slovakia. Foreign chains are concentrated in shopping centers with a large number of customers, too.

The results show that the best marketing strategy has Kaufland chain with shows almost identical and consistent growth of annual rate, where yearly sales increased steadily with the number of newly built stores. The Billa and even more Tesco chain presents a significant disparity. RVS, before Carrefour performed the worst results and our findings reflect the confirmation of the chain decision to leave our retail area. Rethinking other marketing strategy is essential not only for the company RVS, as well as chain Tesco. Both companies despite the opening of new facilities have from year to year lower sales. Even in the media appeared information about the Tesco withdrawal and terminated enteprise, respectively or its merger with another chain.

Though these company became in 2013 the fifth largest chain in the world, on the Slovak market recorded in this period great loss of customers because of the extensive offer of food in the discount retail chains. An increasing number of customers from 2013 are buying the traditional domestic products in newly established farmers' markets in Slovakia.

Tesco remains the market leader in the food retail industry. The amount of revenue is sufficient to enable the company to cover all its costs, and yet it also showed a certain proportion of the profits.

Marketing strategies of multinational retail chains have an effect on space-time formula customer buying behavior.

ACKNOWLEDGEMENT

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ANALYSIS OF POPULATION AGING PROCESS IN THE NITRA SELF-GOVERNING REGION (2000–2014)

Gabriela Repaská[1] and Katarína Vilinová[1]

[1] Department of Geography and Regional Development, Faculty of Natural Sciences, Constantine the Philosopher University in Nitra, e-mails: grepaska@ukf.sk, kvilinova@ukf.sk

ABSTRACT

One of the most distinguished characteristic of demographic static is the population structure. But its features are directly results of previous and the resource of continues population development. Population aging belongs to characteristics, by which the file of analytic regards a methods of population study. Especially the population age structure provides the important information about population, by which many demographic and geographic characteristic result. The aim of the paper is the analysis of population aging through selected indicators, which can give to a large extent accurate and concise information on the aging of population of the selected region. To fulfill this aim, we used standard geographic methods, methods of analysis, synthesis, mathematical-statistical and cartographic methods.

Key Words: *aging, age structure, Nitra Self-governing Region, aging index, age index*

1. INTRODUTION

The issue of the aging process is currently in the spotlight in several countries. It is one of the most frequent topics not only in demogeography (Bacsó, Czaková, 2009, Czaková, 2008, Mládek et al. 2006, Káčerová, Bleha, 2007), but also sociology (Brezák, 2005, Muffels, 1998) or medical geography (Ahtonen, 2012; Hudáková, Majerníková, 2013).

One of the typical characteristics of an economically developed society is aging. Studying this phenomenon at different geographical levels (global, regional, local) is the central topic of experts from different scientific disciplines.

The aim of the paper is an analysis of population aging on the example of the Nitra Self-governing Region (NSR). We point to the development of this phenomenon in different time horizons through selected indicators, which provide to a large extent accurate and concise information on the population aging of the selected region.

2. THEORETICAL-METHODICAL BASES

In the context of population growth and demographic development, the term population aging is often referred to in the works of geographical character while it is being understood as an increase in the number or share of population of older age categories (aging from above) as well as decreasing the number of child component due to declining natality (aging from the bottom). In addition to these types of division, we can distinguish absolute and relative aging of population. According to Brezák (2005), absolute population aging is a natural process that occurs as a result of decrease in mortality, increase of life expectancy and thus most of the population living to higher age categories. By this, there is an absolute increase of older population because from the same born generations more and more people reach higher age. Relative population aging is such demographic process whereby there is an increased of relative representation of the older population due to decrease of children and people in the so-called middle-aged.

Population aging is the result of previous demographic development and it is mainly due to a decline in natality levels. Several experts asked themselves a question: Is population aging a tragedy? This question can be viewed from two perspectives. The first vies is presented e.g. by Eich (2004 in Loužek 2008), who reported that increased life expectancy and the associated health standard should be welcomed as one of most admirable success. The similar view is presented by Kovács and Jeszenszky (2006) who define the aforementioned phenomenon as one of the greatest social achievements and also the greatest societal challenges of the current period. The second perspective, which is pointed e.g. by Mládek and Káčerová (2008) but also Loužek (2008), is presented by the opinion that aging brings with it also a number of problems mostly in financing of pension and social system, in the public policy, in demographic policies, etc. Often, the study of aging applies two different approaches. In the first case, the effort focuses on the comparison of several regional population structures (Mládek, Káčerová, 2008). In the presented paper, we preferred the second approach which speaks of studying aging in various time periods within one geographical unit. The study area is represented by the municipalities of the Nitra Self-governing Region while the aging process itself was studied in 2000 and 2014.

Mládek et al. (2006) divide an extensive set of methods and techniques to study population age structures into three groups. The first group comprises simple one component indicators e.g. indicators of absolute and relative number of age categories. The second group includes more complex rates of aging – aging index, age index, Billeter index, mean age. The third group of assessment tools and presenting age structure and the aging process is created by graphical outputs. A good example is the age pyramid.

In terms of a comprehensive approach in this paper, we used all three mentioned methods.

The interpretation of individual indicators in the studied period was processed in the form of map outputs using the ArcGIS software (Boltižiar, Vojtek, 2009). To calculate the aging index and age index, the following formulas were the basis:

$$Iv = \frac{P\,(0-14)}{P\,(50+)} x\ c \qquad\qquad Is = \frac{P\,(50+)}{P\,(0-14)} x\ c$$

where Is is the aging index, Iv is the age index, P is age and “c” is a constant value of 100.

3. INDICATORS OF POPULATION AGING IN THE NITRA SELF-GOVERNING REGION

We can observe changes in demographic trends in the Nitra Self-governing Region. These are the reflection of economic and social situation of the region. There are long-term trends of slowing down the reproduction of the population and decreasing the natural increase of population. One of the most important characteristics of each population is population age structure. From the aspect of aging, the increase of population in older age categories and the subsequent decline in child component of the population is studied. Based on this, there is also an increase in the share of older population.

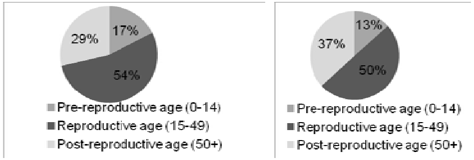
3.1 Simple indicators of aging

The population age structure of the Nitra Self-governing Region as well as the age structure of other Slovak regions shows the dominance of productive age groups. When comparing the years 2000 and 2014, there was a decrease of child component in the productive age groups (according to the classification of the EU) and increase in population in older age categories, based on which we can point to the aging of population (Figure 1). When studying the reproductive groups of population, where the post-reproductive age is in the category of 50+, we can see a similar situation. From 2000 to 2014, there was an increase of post-reproductive age group by 4% (Figure 2).

2000 **2014**

Figure 1: Productive age groups in the Nitra Self-governing Region

Source: Statistical Office of the Slovak Republic, 2015



2000 **2014**

Figure 2: Reproductive age groups in the Nitra Self-governing Region

Source: Statistical Office of the Slovak Republic, 2015

Post-productive and post-reproductive age belong to simple indicators of aging. They are one component indicators that characterize only one typical age category.

In the municipalities of the Nitra Self-governing Region, the lowest post-productive age 10% was in 2000 in the towns of Vráble, Levice, Topoľčany, Šaľa and a Nové Zámky as well as in two municipalities near the towns of Nitra, Topoľčany, and Levice. By 2014, the percentage value of post-productive age in these areas has increased (Figure 3).

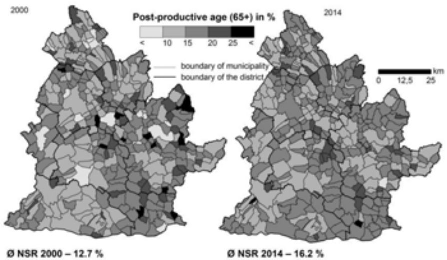


Figure 3: Population in post-productive age in the municipalities of Nitra Self-governing Region in 2000 and 2014

Within post-reproductive age, we can see more significant differences in the Nitra Self-governing Region. While in 2000 this age group was represented by a relatively high share (up to 30%), by 2014 this share significantly increased. The lowest post-reproductive age in 2014 occurred in the municipalities of the Nitra and Šaľa districts. The oldest population with the highest post-productive age is localized in six municipalities of the Levice district, one municipality in the districts of Nitra and Komárno (Figure 4).

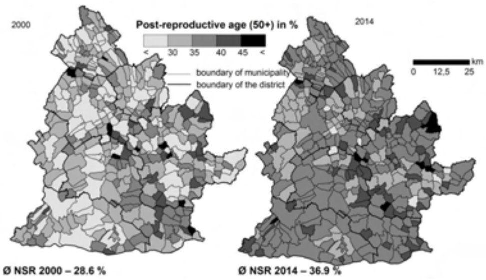


Figure 4: Population in post-reproductive age in the municipalities of Nitra Self-governing Region in 2000 and 2014

3.2 Complex indicators of aging

The more complex indicators of aging include statistical rates. Their construction takes into account several characteristic ages categories of population or they take into account all age categories. They are represented e.g. by age index, aging index, Billeter index, mean age (Mládek et al., 2006).

The **Billeter index**, which is defined as the share of the difference of population in pre-reproductive age (0-14) and post-reproductive age (50+) and the population in reproductive age (15-49) multiplied by the value of 100, points to the indirect proportion of relation and aging of population. The higher the Billeter index is, the younger the population. If it has negative values, the number of post-reproductive age group is higher than the number of pre-reproductive age group. Within the Nitra Self-governing Region from 2000 to 2014, we can see a decrease of the index value from -20 to -47.

The **mean age** of the population of Nitra Self-governing Region increased slightly from 2000 to 2014. Whereas in 2000 it had the value of 37.28 years, in 2014 its value increased to 41.38 years, which us an increase by 4.1 years.

Spatial differences in the age structure of population, which indicates aging of population, is expressed by **age index**. The age index characterizes the relation between the pre-reproductive component of population (0-14 years) and post-reproductive component of population (50+) multiplied by the constant value of 100. If the age index has greater value than 100, it shows rejuvenation of the population. If the value is lower than 100, it is aging of population.

In the Nitra Self-governing Region, the age index has a downward trend reflecting the increase of population aging. Its development can be divided into 3 stages. The first stage is the period of 2000–2001 where we record its increase. The second stage 2001–2002 reflects the stagnation and the third stage from 2003 reflects the steady decline until 2014 (Figure 5).

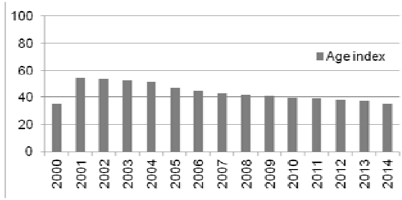


Figure 5: Age index in the Nitra Self-governing Region in 2000–2014
Source: Statistical Office of the Slovak Republic, 2015

When comparing the years 2000 and 2014 in municipalities of the Nitra Self-governing Region, we can see significant differences. While in 2000 the age index had the average value of 52.8%, in 2014 it decreased to a value of 36.6% which documents the aging of population in almost every municipality of Nitra Self-governing Region (Figure 6).

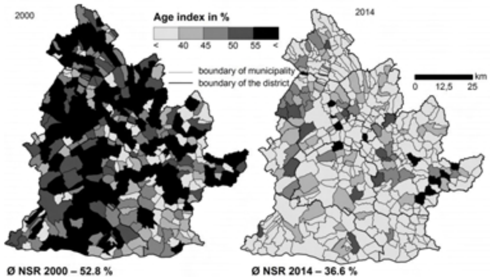


Figure 6: Age index of population in the municipalities of the Nitra Self-governing Region in 2000 a 2014

Low values of age index show a regressive type of population, which results in reducing the number of births. This type of population can also be expressed through **aging index** which characterizes the relation between post-reproductive component of population (50+) and pre-productive component of population (0-14 years) multiplied by the constant value of 100. If the value of aging index is greater than 100, it shows aging of population and if its value is lower than 100, it say about the rejuvenation of population.

In recent years, the aging process in the region was intensified. The value of the aging index in the studied period constantly rises (except for a slight decline in 2000) reflecting increasing number of inhabitants older than 50 years per 100 children aged 0-14 years. In 2000, over 72 inhabitants aged 50+ accounted for 100 children. However, in 2014 there were already 113 inhabitants aged 50+. The reason is mainly the low level of reproduction of population in the region which is connected with increasing life expectancy (Figure 7).

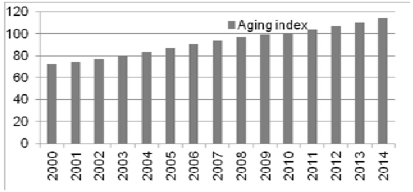


Figure 7: Aging index in the Nitra Self-governing Region in 2000–2014
Source: Statistical Office of the Slovak Republic, 2015

In municipalities of the Nitra Self-governing Region, we can see an increase in the aging index until 2014. The highest values are in the south and east of the studied area. Based on abovementioned, there are several types of population age structure in the Nitra Self-governing Region:

- A strongly progressive age structure (aging index 50-75)
- Progressive age structure (aging index 76-100)
- Stationary – regressive age structure (aging index 101-125)
- Regressive age structure (aging index over 125).

The territory of the Nitra Self-governing Region currently belongs to the regressive population age structure since up to 99% of the municipalities of the region ranges over the value of the aging index 125 (Figure 8).

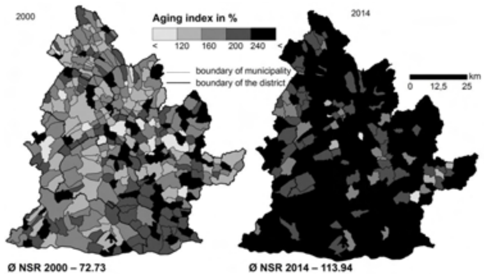


Figure 8: Aging index of population in the Nitra Self-governing Region in 2000–2014

3.3 Graphic indicators of aging

The third group of aging indicators is represented by graphic indicators which include the age pyramid. The age pyramid is considered the best way of expressing the types of population. The regressive type of age pyramid represents the aging of population. The Nitra Self-governing Region has the regressive type of population in both comparing years (Figure 9). While in 2000 the share of children component reached 36.9% (127,591), in 2014 it was only 27.5% (91,748). Post-productive part of the population recorded increase from 26.3% to 30.9% which means that about a third of the population of the region consists of old population. This shape of age pyramid is a result of the events of the previous century. During the war there was a significant reduction in the population and increase of the number of deaths. The period after the war, however, led to an increase in the birth rate which caused the increase in the number of inhabitants. At present, the Slovak population is in the period of realization of deferred deliveries of very specific generation of women from the 70s. I tis the people of this age who are moving the economy. Boomers of the 70s are entering the most productive phase of their life and they stimulate the economic growth by their consumption.

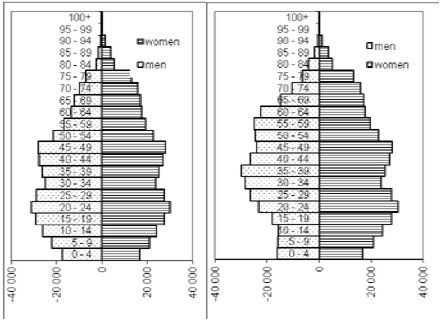


Figure 9: Age pyramid of population in the Nitra Self-governing Region in 2000–2014
Source: Statistical Office of the Slovak Republic, 2015

4. CONCLUSION

The aging of population is based on the population age structure and its changes which affect all inhabitants. This is reflected in the development of birth rate, death rate, but also processes of migration and other demographic indicators (development of marriage, divorce, abortion rate). The Nitra Self-governing Region recorded the population aging and regressive age structure of the population, which is based on the reduced natality. Due to the postponement of motherhood and births of mothers is higher age, maximum two children families are preferred. Moreover, with increasing age, there is proportionally increasing risk of spontaneous abortion. In the current period, increasing the number of inhabitants in productive age in the municipalities is most often addressed by mass construction of houses and flats that attract new and particularly young population. Therefore, we can see the process of rejuvenation of population in suburban zones of towns of the Nitra Self-governing Region.

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TRAVEL & TOURISM COMPETITIVENESS INDEX IN SLOVAKIA AND CZECH REPUBLIC

Slavomír Bucher[1], Silvia Slivková[2] and Tomáš Pasternák[2]

[1] Institute of Geography, Faculty of Science, Pavol Jozef Šafárik University in Košice, Jesenná 5, 040 01 Košice, Slovak Republic, e-mail: slavobucher@yahoo.com

[2] Department of Geography and Applied Geoinformatics, Faculty of Humanities and Natural Sciences, University of Prešov, 17. November 1, 081 16 Prešov, Slovak Republic, e-mails: slivkova.unipo@gmail.com, tomi.paster@gmail.com

ABSTRACT

This paper considers the evaluation of 13 factors that affect destination competitiveness and tries to compare the competitiveness levels in Slovakia and Czech Republic The goal of this paper is also to provide a better understanding of the competitiveness of the tourist destination and the elements that affect the competitive position of the destination, and to consider the position of both countries in tourism trends and its competitiveness in the international market.

Secondary data, comprised of the Travel and Tourism Competitiveness indexes 2008-2013, were included in data analysis. Travel & Tourism Competitiveness Index – TTCI consists of few wider categories whose variables affect the competitiveness of the tourism in certain countries, or, in this case, destinations or its carries. These categories are summarized in three basic sub – indicates: index of regulatory frames of tourism and travel, sub – index of work surrounding and infrastructure of tourism and travel followed by the sub – index of human, cultural and natural resources. Each of the sub – indices contains certain pillars of competitiveness which have several indicators (total of 14) whose measurement value is obtained for each sub – index, and the sum of all the values gives the total index of competitiveness for the tourism in the country.

Tourism has the characteristic of a sector necessitating and encouraging new investments. Tourism plays a significant role in the closing of the balance of payments deficit with the contribution to national income and also exchange revenue in provides. The countries that are active in the international tourist market are constantly enforced in finding the best ways that will enable satisfaction of the clients – tourists.

Key Words: *competitiveness, Slovakia, Czech Republic, tourist destination, tourism.*

1. INTRODUCTION

Measuring of competitiveness devote to the World Economic Forum in Geneve (Blanke, Chiesa, 2008, 2009, 2011, 2013), which annually publishes The Global Competitiveness Report. It represents the most comprehensive assessment of the comparative strengths and weaknesses of national economies in the World. The model bases on the theoretical bases followed the research and evaluations of authors Gooroochurn and Sugiarto (2005).

The research of Travel & various form of Tourism has been increasing in the last two decades in Slovakia, which is documented not only by the number of scientific papers and their citations and web pages (Klamar, Pasternak, Slivkova 2014; Miscikova, Novakova, Slivkova 2014; Matlovičová, Kolesarova, Gavalova 2013).

Travel & Tourism Competitiveness Index – TTCI consists of few wider categories whose variables affect the competitiveness of the tourism in certain countries, or, in this case, destinations or its carries. These categories are summarized in three basic sub – indicates: index of regulatory frames of tourism and travel, sub – index of work surrounding and infrastructure of tourism and travel followed by the sub – index of human, cultural and natural resources. Each of the sub – indices contains certain pillars of competitiveness which have several indicators (total of 14) whose measurement value is obtained for each sub – index, and the sum of all the values gives the total index of competitiveness for the tourism in the country.

The most numerous category is represented by indicators summarized the basic indicators of economic conditions of destinations. The specification of that model is a set of indicator which not directly linked with quantitative data gathered from various public sources published by (UNESCO, UNWTO, WTTC, etc.).

Thus, the most valuable qualitative data regarded the social, cultural and economic development of destination are provided through polls and analysis reviews of the respectable business entities operated in the segment of tourism and hospitality. The contemporary tourism is a segment or branch of the economy that is rapidly transformed on the side of the demand and the side of the offer, which affects the intensity and quality of the development of the tourism.

2. OBJECTIVES AND METHODS

This paper aims to evaluate and identify secondary data of the World Economic Forum, which annually publishes *Travel and Tourism Competitiveness Report.* The purpose of the report is to determine the strengths and weaknesses of selected countries/destinations in the international tourism market. The goal of the analysis is also restricted specification competitiveness indicators that should be expressed by previously mentioned sub-indices:

(I.) Regulatory framework,

(II.) Work surrounding and infrastructure,

(III.) The human, cultural and natural resources

As a result of following facts, in our paper we analyzed ensuing sub-indicators as an arithmetic average for the years 2008-2013.

(I.) Regulatory framework – includes indicators such as rules and regulations, environmental sustainability, safety and security, healthcare and hygiene, giving priority to tourism

(II.) Work surrounding and infrastructure – consist of indicators such as air travel infrastructure, land travel infrastructure, tourism infrastructure, information and communication infrastructure, competitiveness of the prices in the tourism industry

(III.) The human, cultural and natural resources – contains indicators of human resources, affinity towards tourism, natural and cultural resources.

3. THE ASSESSMENT OF TOURISM COMPETITIVENESS INDEX IN CZECH AND SLOVAK REPUBLIC

We have measured data attained from an average factor score of Travel & Tourism Competitiveness Index for the years 2008-2013 in Slovak and Czech Republic (Blanke, Chiesa, 2008, 2009, 2011, 2013).

Slovakia and Czech Republic have an admirable predisposition for development of tourism, the extraordinarily favorable tourist geographical position, abundance of natural resources, as are the many interesting anthropogenic, cultural-historical and ethnographic patterns. For this objective a way has to be erected such to incorporate all tourism potentials these countries possess, how they can be valorised and positioned in the tourism market and thus increase the visibility of the Slovakia and Czech Republic as a tourist destination.

For the both countries as a competitive advantage should be considered the high index values in terms of price competitiveness in the tourism industry, which means the possibility of getting the best tourist service for value of money, as well as the safety and security, which perhaps is the most crucial feature in the development of tourism.

3.1 Regulatory framework

The regulatory framework (I.) – rules and regulations (I.A) were calculated indicators such as the implementation of effective fiscal policy, necessary expenditure to obtain business licence, share of foreign direct investments invested in destination, development of legislative rules for coordination and sustainable tourism entrepreneurship by local authorities and public sector. Czech Republic (4.69) obtained a higher score in that indicator than Slovakia (4.89).

Term of natural environment sustainability (I.B) exemplify various laws and legal standards in the field of environment and ecology preservation, as well as the range of activities pursuing the environmental protection. From the point of environmental protection is essential to ensure the sustainability of tourism development, which is based on a mutual partnership between the public and business representatives. The higher score of environmental sustainability gained Slovakia (5.07) than Czech Republic (5.1).

Further indicator deals with safety and security in tourism (1.C). It means that tourism development won't be successful in destinations the current war and armed conflicts are on-going. The higher score obtained Czech Republic (5.44) than Slovakia (5.38).

Healthcare and Hygiene (I.D) are among the primary indicators of competitiveness in tourism industry. There is also an important the healthcare and tourist protection in case of emergency, using properly health services, transportation to hospitals and pharmacies. The higher values reached Czech Republic (6.79) than Slovakia (6.50).

Table 1: Regulatory frames as a sub-indicator of competitiveness for the Slovakia, Czech Republic and Visegrad Group (average 2008-2013) and positioning in Europe (out of 42 countries)

Regulatory frames	Slovakia	Czech Republic	Visegrad Group
A1 Rules and Regulations	4.89/*18*	4.69/*21*	4.70
A2 Environmental sustainability	5.07/*22*	5.10/*20*	5.01
A3 Safety and security	5.38/*25*	5.44/*22*	5.32
A4 Healthcare and Hygiene	6.50/*13*	6.79/*4*	6.28
A5 Prioritizing the tourist industry	3.58/*38*	4.70/*15*	4.26
A REGULATORY FRAMES	5.08	5.35	5.11

Source: The Travel and Tourism Competitiveness Report, 2008-2013

Prioritizing the tourism industry represents the last indicator among the regulatory framework (I.E). It should be various projects related to activities in the area of infrastructure, services and education in tourism undertaken by public or private authorities. The higher score obtained Czech Republic (4.70) than Slovakia (3.58).

3.2 Business environment and infrastructure

The second in term of Travel & Tourism Competitiveness Index was work surrounding and infrastructure sub-index (II.). It is formed by a set of five indicators.

The quality of air travel infrastructure (II.A) provides movement of tourists between the place of origin and tourist destination. The indicator is calculated by the evaluation of the number of seats, kilometers flown, the number of departures and arrivals, density of airports, number of operators and the number of domestic and international flights. The higher values reached Czech Republic (3.55) than Slovakia (2.26).

The most common transportation in Czech Republic and Slovakia is provided by ground infrastructure (II.B). In that context, it is essentially crucial for tourism competitiveness the quality of roads, railways, ports as well as the spatial distribution of the national transport network providing easy access to tourist destinations. The higher score obtained Czech Republic (5.07) than Slovakia (4.28).

The third indicator focuses predominantly on tourism infrastructure (II.C). It is mainly associated with the accommodation facilities, car rental, catering, sports and recreational facilities. The higher values reached Czech Republic (5.15) than Slovakia (4.82).

Given the growing importance of information and communication technologies (II.D) in tourism industry we have tried to assess the quality of services associated with online purchases of electronic ticketing, reservation and payment for accommodation or booking the hotel reservation. The higher values reached Czech Republic (4.28) than Slovakia (3.82).

The last indicator in the sub-group of work surrounding and infrastructure is the competitiveness of the prices in the tourism industry (II.E). Indicator compares for instance flight prices, airport charges, taxes, fuel prices and accommodation. The higher values reached Slovakia (4.33) than Czech Republic (4.25).

The infrastructure (air travel infrastructure, land travel infrastructure, information and communication infrastructure), which is very significant for the development of tourism, as well as development of tourism and travel represent a competitive disadvantage and Slovakia have to make a great efforts to increase the operational efficiency of the tourism in order to position itself better as a tourist destination.

Table 2: Work surrounding and infrastructure as a sub-indicator of competitiveness for the Slovakia, Czech Republic and Visegrad Group (average 2008-2013) and positioning in Europe (out of 42 countries)

Work surrounding and infrastructure	Slovakia	Czech Republic	Visegrad Group
B1 Air travels infrastructure	2.26/*39*	3.55/*23*	2.86
B2 Land travel infrastructure	4.28/*25*	5.07/*14*	4.39
B3 Tourism Infrastructure	4.82/*25*	5.15/*21*	4.77
B4 Information-communication Infrastructure, technologies	3.82/*29*	4.28/*21*	4.00
B5 Competitiveness of the prices in the tourism industry	4.33/*12*	4.25/*17*	4.32
B WORK SURROUNDING AND INFRASTRUCTURE	3.90	4.46	4.07

Source: The Travel and Tourism Competitiveness Report, 2008-2013

3.3 The human, cultural and natural resources

The last sub-indicator represents the index of the human, cultural and natural resources (III.), whose base consists of the selected four indicators:

The quality of human resources (III.A) in the economy ensures that the secondary (manufacturing) and tertiary (services) sector has enough manpower to its growth and development. Countries in a more advanced state of development, with a medium national income, generate their income mostly in the secondary sector. In highly developed countries with a high income, the tertiary sector dominates the total output of the economy. The appointed indicator specifies further education and training linked to the practice, as well as measure to ensure the quality of the education system. The higher values reached Czech Republic (5.28) than Slovakia (5.17).

The second indicator of sub-index represents the affinity to tourism (III.B), which could be understood as to open the destination and economy towards foreign development investments (FDI) and visitors from abroad. In this case the fundamental indicators are revenue generated by inbound tourism, expenditures of outbound travellers and tourism contribution to GDP in %. The higher values reached Czech Republic (4.65) than Slovakia (4.46).

Table 3 Human, cultural and natural resources as a sub-indicator of competitiveness for the Slovakia, Czech Republic and Visegrad Group (average 2008-2013) and positioning in Europe (out of 42 countries)

The human, cultural and natural resources	Slovakia	Czech Republic	Visegrad Group
C1 Human Resources	5.17/*23*	5.28/*19*	5.17
C2 Tendency towards tourism	4.46/*38*	4.65/*29*	4.39
C3 Natural Resources	3.91/*8*	3.00/*26*	3.30
C4 Cultural Resources	2.80/*29*	5.33/*12*	4.38
C THE HUMAN, CULTURAL AND NATURAL RESOURCES	4.09	4.57	4.31

Source: The Travel and Tourism Competitiveness Report, 2008-2013

The last two indicators of human, cultural and natural resources summarize localization factors of tourism. There are a natural resources (III.C) and assumptions that are fundamental factors for the creation and initial stage for formation recreational processes and sustainable development in the destination. The higher values reached Slovakia (3.91) than Czech Republic (3.00).

Culture resources (III.D) represent the second component of the localization assumptions in tourism. Cultural resources contain the following variables: cultural and historical monuments, facilities and events. The higher values reached Czech Republic (5.33) than Slovakia (2.80).

The mutual comparison of tourism competitiveness indicators, we found that the greatest differences between Slovakia, Czech Republic on one hand and top European destinations (Switzerland – CH, Germany – D and Austria – AT) on the other hand with the best score of the tourism competitiveness index are in the quality of the business environment and infrastructure.

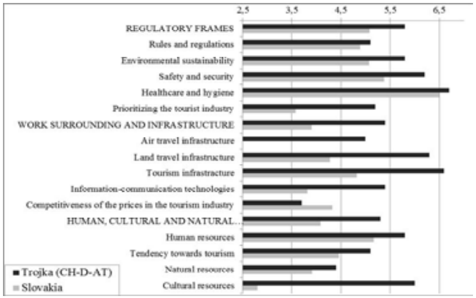

Figure 1: Comparison of competitiveness factors in tourism for Slovakia and European top destinations CH-D-AT

Source: Author's elaboration

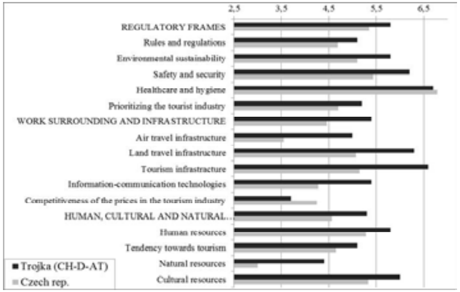

Figure 2: Comparison of competitiveness factors in tourism for Czech Republic and European top destinations CH-D-AT
Source: Author's elaboration

International tourism receipts are expenditures by international inbound visitors, including payments to national carriers for international transport. These receipts include any other prepayment made for goods or services received in the destination country. They also may include receipts from same-day visitors, except when these are important enough to justify separate classification.

International inbound tourists (overnight visitors) are the number of tourists who travel to a country other than that in which they have their usual residence, but outside their usual environment, for a period not exceeding 12 months and whose main purpose in visiting is other than an activity remunerated from within the country visited. When data on number of tourists are not available, the number of visitors, which includes tourists, same-day visitors, cruise passengers, and crew members, is shown instead.

In Slovakia and Czech Republic we can observe during the 2004-2012 an increase the number of arrivals as well as receipts from tourism. In 2010, there were also slightly decrease of both indicators due to global economic crisis.

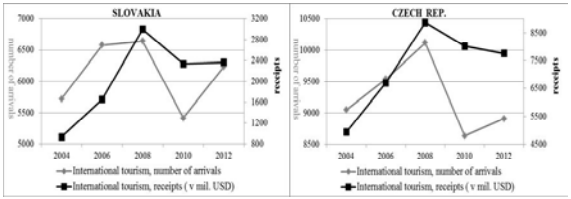

Figure 3: Development of International tourism, number of arrivals and receipts in Slovakia and Czech Republic
Source: Author's elaboration

4. CONCLUSION

It is of great importance for the Slovakia and Czech Republic, as relatively young tourist destinations, the following of modern changes and occurrences in the international tourist market, which are the more diverse needs and demands of the tourist clientele. For the implementation of new positive changes, it is necessary for continuous bringing forward of news strategies, plans initiatives from a more narrow regional of a wider national character. This means active inclusion, from the lowest to the highest level, where all the stakeholders and carriers of the tourist politics in the Slovakia and Czech Republic. The contemporary tendencies in the tourism should be in the center of attention for both countries.

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PRESIDENTIAL ELECTIONS IN SLOVAKIA IN 2014 AND THEIR GEOGRAPHICAL DIMENSIONS

Alfred Krogmann[1], Ján Veselovský[1], Andrej Svorad[1] and Magdaléna Nemčíková[1]

[1] 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,
e-mails: akrogmann@ukf.sk, jveselovsky@ukf.sk, andrej.svorad@ukf.sk, mnemcikova@ukf.sk

ABSTRACT

Presidential elections in March 2014 were important, due to the political situation in Slovakia, since any victory of the nominee of SMER-SD party (social democratic party) would mean the concentration of power in the hands of one party. The aim of this paper is to analyze the spatial differentiation of the results and voting behavior in the I. and II. round of presidential elections. Relations of regional deployment of electoral support of candidates were studied by the method of identifying electoral support areas and then we applied the method of diversification of electoral preferences.

In the I. round, voters behaved mainly on the basis of the party principle which is determined by the geographical specifics of the Slovak regions. In addition to the party candidate Fico, there was also a civic candidate Kiska who proceeded to the II. round and won the elections. His victory was influenced by the fact that the electorate of unsuccessful right-wing candidates from the I. round inclined for this candidate.

Key Words: *elections, candidates, region of electoral support, diversification of electoral preferences, president*

1. INTRODUCTION

In Slovakia, democratic elections have been an important phenomenon since 1989. Election results, besides the redistribution of power, offer a chance to analyze them by various scientific disciplines, which include also electoral geography as a part of political geography.

A quarter of century of research on electoral geography in Slovakia brought the space for analyses during each elections which were focused mainly on identifying regions of electoral support for political parties and stability of electoral preferences in different regions. These topics are reflected e.g. by the works of Baráth, Szöllös, Černák (1995), Mariot (1991, 1994, 2003, 2004), Brunn and Vlčková (1994), Vlčková (1995), and Madleňák (2006, 2010a). These works concerned on the spatial analysis of parliamentary election results. Since 1999, after the change in electoral system, other studies started to appear focusing on the analysis of results of presidential elections e.g. Mariot (2000) and Madleňák (2010b). Mariot (2000) worked with data at the local level (municipalities) and as the basic criterion for allocating regions of electoral support, he chose the proportion of received votes of particular presidential candidate out of the total votes. At the regional level (districts), the regions of electoral support of presidential candidates were identified by Madleňák (2010b) who used relative and absolute data due to greater objectivity. He allocated regions of electoral support for candidates in the following structure: core and periphery of electoral support.

The aim of this paper is to analyze the spatial differentiations of election results and voting behavior in the I. and II. round of presidential elections. Based on the statistical data at the level of districts of Slovakia, we will carry out the spatial differentiation of election results in the I. round and degree of diversification of electoral preferences of individual candidates. After that we identify regions of electoral support of candidates proceeding to the II. round and we will carry out their comparison with the results of the I. round.

2. METHODOLOGY

Input data for the analysis of spatial differentiation of election results and voting behavior were data from the Statistical Office of the Slovak Republic on the results of voting in the presidential elections in 2014 (http://volby.statistics.sk/prez/prez2014/). The basic administration units are, due to availability of statistical data, districts which can be seen, according to Madleňák (2010b), as political regions at the subnational level. The input data were processed into maps of spatial differentiation of election results and voting behavior using the ArcGIS software (Boltižiar, Vojtek, 2009).

There are several methods within the electoral geography used to detect relations of regional deployment of electoral support of presidential candidates. For our needs, we chose the generally accepted **method of identification of electoral support areas** from Jehlička and Sýkora (1991) which was also used by Szöllös (2006), Madleňák (2012), Mikuš (2014), etc. This method is a combination of relative data on electoral support with numbers of votes in individual regions, which partially removes the disadvantages associated with only one side use of relative or absolute data. Regions are listed in descending order based on the relative values of electoral support for a certain presidential candidate. According to this order, which expresses the decrease in intensity of electoral support, absolute numbers of votes for a certain candidate are cumulatively counted. Regions which are located, based on the cumulative relative share of votes for a certain candidate, in the first quarter of the total number of the candidate's votes represent a core area of electoral support. According to Madleňák (2010b) and Plešivčák (2011), regions which are in the range from 25 to 50% are marked as periphery of electoral support areas. The considered category includes also regions beyond its threshold – that is the case where the cumulative sum of votes in a given category was, after counting this region, closer to the determined threshold than after its excluding.

In terms of the analysis of electoral preferences, it is also appropriate to apply the **method of diversification of electoral preferences** which examines the relation of electoral votes of rival presidential candidates in different regions. Particularly, it is an identification of a position of dominant presidential candidate(s) in relation to the votes of the other candidates. As stated by Madleňák (2012), determining the degree of diversification of electoral preferences differentiates individual regions to three typologically distinct forms:

- Regions with dominant position of one presidential candidate whose electoral votes significantly outweigh the votes of the others,
- Regions with dominant position of two presidential candidates whose electoral votes are relatively equal to each other, but the electoral votes of the other presidential candidates are significantly lower; so-called regions with polarized voting behavior,
- Regions where the electorate is quite evenly divided among several rival candidates, where differences in electoral votes are not significant; they are called regions with fragmented electoral preferences.

For the purposes of identification or, on the contrary, exclusion of dominance of one presidential candidate in a certain area, we used the index of dominance by Kowalski and Śleszyński (2000, p. 52):

$$I_D = \frac{A_{max}(A_{max} - B_{max})}{(A_{max})^2}, \text{ where}$$

I_D is an index of dominance, A_{max} is a relative number of votes for the candidate with the highest number of votes in a given region, and B_{max} is a relative number of votes for the candidate with the second highest number of votes in that region. The region with dominant position of one presidential candidate has to fulfil the condition of 30% < A_{max} > 133% B_{max}. This condition causes that the index of dominance can have values in the range from 0.25, which is the minimum dominance of winning candidate, to 1 which is the maximum dominance of presidential candidate in the studied region. Using the given index, presidential candidate would gain 100% of the valid votes in the region. Therefore, we decided to determine three categories within the given index, which help us to specify better the degree of dominance:

- Low degree of dominance (0.25 to 0.449)
- Medium degree of dominance (0.45 to 0.649)
- High degree of dominance (0.65 and above).

As stated by Plešivčák (2013), if the selected area does not show the dominance of one presidential candidate, in this case we can consider the existence of polarized formula of electoral behavior. This can be identified according to Kowalski and Śleszyński (2000, p. 51):

$$I_P = \frac{A_{max} + B_{max}}{100} \cdot \frac{B_{max}}{A_{max}} \cdot \frac{C_{max} \times B_{min}}{2(A_{max} \times B_{max})}, \text{ where}$$

I_P is an index of polarization, A_{max} is a relative number of votes for the candidate with the highest number of votes in the region, B_{max} is a relative number of votes for the candidate with the second highest number of votes in the region, C_{min} is a relative number of votes for the candidate with the third highest number of votes in the region, and D_{min} is a relative number of votes for the candidate with the fourth highest number of votes in the region. The polarized formula of electoral preferences has to fulfil the condition of $60\ \% - B_{max} < A_{max} < 2B_{max} - C_{min}$.

If in the studied region in the case of assessing the mutual ratio of election results of presidential candidates the dominance and polarization of their electoral support was not confirmed, we speak of a fragmented pattern of electoral preferences of the population.

3. THE ELECTORAL SYSTEM IN SLOVAKIA AND ITS DEVELOPMENT

Since 1993 (establishment of the Slovak Republic), presidential elections passed transformation from indirect (by parliament) to direct elections (by citizens). This was due to the period of incapacity of the parliament to elect the head of the state. In addition, the parliamentary way was often a matter of political transactions. Since 1999, the president is have been elected directly by the citizens, which has undoubtedly increased his legitimacy even though it has not increased his powers. The position of the president in the Slovak political structure is weak (Malová, Rybář, 2008). Furthermore, by gaining independence from parliamentary parties, president can become a control element in the country which, however, was not the case of the last president Ivan Gašparovič who as the people's candidate had no secrets for his sympathies to the ruling party.

The way of election of the president is defined in the Constitution of the Slovak Republic (Ústava SR) in Articles from 101 to 107 and in the Act No. 46/1999 Coll. on the Method of Election of the President of the Slovak Republic (Zákon 46/1999 Z. z).

One presidential term lasts five years. The right to elect the president belongs to citizens who reached the age of 18 in the polling day and stay in Slovakia on the day of elections since the election of the President of the Slovak Republic is limited to its territory. Candidates for the president are proposed at least by 15 members of the National Council of the Slovak Republic or at least by 15,000 citizens based on a petition. Every citizen of Slovakia who reached the age of 40 may become the president. The presidential campaign officially begins 15 days before the first round (but generally, candidates begin with it immediately after the announcement of their candidacy). The act also sets a maximum amount of campaign expenses which must not exceed € 132,775. The elections are announced by the speaker of the parliament in the way that the I. round of elections is held no later than 60 days before the expiration of the term of the acting president (Constitution of the Slovak Republic). “The interesting thing about the Slovak presidential elections is an insurance against the radical candidates in the first round. Generally, in the world it is the second round itself in the case of not reaching the absolute majority in the first round. In the Slovak case it is strengthened and it was introduced by the then-ruling coalition to prevent the potential Mečiar's victory in the first round because he had a lot of support and disciplined electorate.” Victory in the first round is given to the candidate who gains more than a half of all eligible votes, not just those involved.

If none of the candidates receives the necessary majority of votes, the speaker of the parliament declares the II. round to be held within 14 days of the declaration. The II. round of elections has those two candidates who received the highest number of votes. The II. round is won by the candidate who received the highest number of valid votes of involved voters. It is thus a shift from absolute to relative majority. This ensures that the head of the state will always be elected and avoids the state that the Slovak Republic will be without the president (Horváth, 2005). According to Šimíček (2001), the benefits of direct election of the president are greater legitimacy, as directly elected president is a representative of the majority of population, and greater chance to promote a charismatic personality. This method of election reduces the manifestations of partokratism and eliminates the risk of unelected president in parliament.

4. THE RESULTS OF THE PRESIDENTIAL ELECTIONS

In 2014, the citizens of Slovakia directly elected the fourth president. Elections were held in a specific environment. It was influenced by the parliamentary elections from 2012 of which the first monochromatic government since 1989 was created from the winning SMER-SD party (Rybář and Spáč, 2014). The result of parliamentary elections was also reflected in the occupation of all relevant constitutional positions in the state. The last position which the party did not control was the presidential office and naturally they wanted to gain it.

The presidential elections in 2014 registered a total of 15 candidates, which was historically the highest number of candidates for this type of elections. However, only 14 candidates attended the election campaign and elections itself as one of them gave up the candidacy. A total of 1,914,021 voters participated in the first round of the presidential elections on March 27, 2014, representing a total of 43.4% of voters. Compared to the last presidential elections in 2009, we can see a slight decline in participation by 0.23 percentage points (p.p.). The participation of voters at the district level fluctuated from 31.78% (district of Revúca) to 57.60% (district of Bratislava I.) while in the cities/towns it was higher by 2.11 p.p. than in rural areas.

The winner of the I. round of the presidential elections became the candidate of SMER-SD (social democratic party) Robert Fico with 531,919 votes representing 28% of all valid votes. This candidate dominated in 50 districts (out of 79), particularly, in the northwest and east of the country where in the districts of Medzilaborce and Sobrance, he received the largest share of votes (57.13% and 51.53%).

The second place belonged to the independent candidate A. Kiska with the 455,996 (24%) votes. He won in 17 districts of the Slovakia, particularly, in western Slovakia and in a narrow strip extending from Košice through Rožňava, Poprad to Kežmarok. The highest share of votes were from his native district of Poprad (43.28%). The third place went to R. Procházka with 403,548 (21.24%) votes and he won in 5 districts (Fig. 1). The fourth place with 244,401 (12.86%) votes belonged to the independent candidate M. Kňažko who won in three urban districts of the capital city of Bratislava. The last presidential candidate who won at least in one district was a nominee of SMK (Hungarian Community Party) G. Bárdos (97,035 votes – 5.1%). He succeeded in 4 southern districts with significant presence of the Hungarian minority.

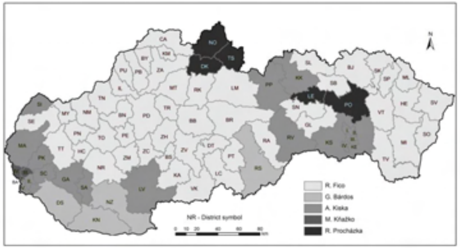

Figure 1: Winners of the I. round of elections in the districts of Slovakia

The obtained results enabled us to allocate, through the **method of identification of electoral support areas in the I. round**, the core and peripheral support areas of presidential candidates. We analyzed the results of candidates who gained more than 5% of votes in the first round.

As for R. Fico, we allocated three regions of electoral support (Fig. 2) while according to Jehlička and Sýkora (1991) these regions do not have to be continuous. The first and largest is the northwest of Slovakia formed by 21 districts of which 10 were core districts (Topoľčany, Zlaté Moravce, Žarnovica, Partizánske, Bánovce nad Bebravou, Prievidza, Turčianske Teplice, Bytča, Kysucké Nové Mesto, Čadca) which is by Madleňák (2012) a region with the nationalist-populist electoral pattern of behavior. The second type is the east of Slovakia formed by 12 districts of which 8 were core districts (Medzilaborce, Snina Sobrance, Humenné, Vranov nad Topľou, Stropkov, Svidník, Stará Ľubovňa) which is mostly compatible with the Madleňák (2012) leftist type of election pattern. Besides these, there is also one isolated core region (district of Gelnica). Spatially, the smallest region of electoral support of R. Fico is central Slovakia formed by five districts two of which were core districts (Poltár, Detva).

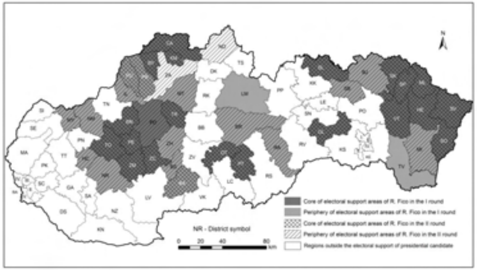

Figure 2: Identification of electoral support areas of R. Fico in the I. and II. round

In the case of A. Kiska, we identified three regions of electoral support (Fig. 3).

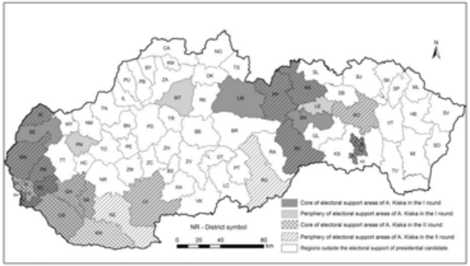

Figure 3: Identification of electoral support areas of A. Kiska in the I. and II. round

Spatially, the largest is the area of districts of Liptovský Mikuláš, Poprad, Kežmarok, Spišská Nová Ves, and Rožňava which are also core districts. Districts of Levoča and Prešov formed the periphery in this region. The second region is the west of Slovakia which includes 13 districts of which 6 were core districts (Skalica, Senica, Malacky, Pezinok, Senec, Bratislava V.). The smallest is the Košice region formed by four core urban districts.

As for R. Procházka, we similarly identified three regions of electoral support. The largest region is located in the central Slovakia stretching from north to south. It includes a total of 10 districts of which 6 were core districts (Námestovo, Tvrdošín, Ružomberok, Žilina, Dolný Kubín, and Žiar nad Hronom) and 4 peripheral districts (Fig. 4). At this point it is necessary to be noted that the districts in the north of the country are, according to Madleňák (2012), districts with a traditional preference for conservative parties (traditionally KDH – The Christian Democratic Movement). R. Procházka, as the former member of KDH party, gained this electorate. The second region of his electoral support was profiled in western Slovakia containing 10 districts of which 3 are core districts (Bratislava I. and V., Trnava).

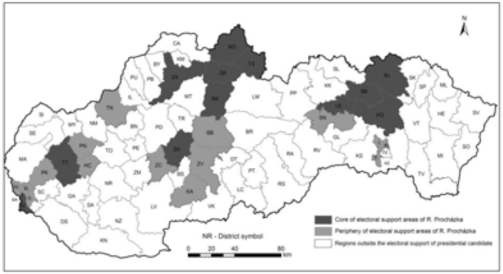

Figure 4: Identification of electoral support areas of R. Procházka in the I. round

Other region of electoral support of R. Procházka is located in eastern Slovakia. It includes 8 districts of which 4 districts are his core districts (Bardejov, Sabinov, Levoča, and Prešov).

Three regions of electoral support emerged also in the case of M. Kňažko. The most important is the region in the west of the country with 8 districts. Among these, most of them are his core electoral support. These are the districts of Bratislava (Bratislava I.-V.) which correspond to right-wing electoral pattern of behavior by Madleňák (2012). Similar case is the districts of Košice, where Košice I. is the core of his election and other urban districts are the periphery of the electorate. The last region of his electoral support is the strip stretching through the central Slovakia from the south to the north and consists of only four peripheral districts. Two peripheral districts are isolated (Prešov and Piešťany) (Fig. 5).

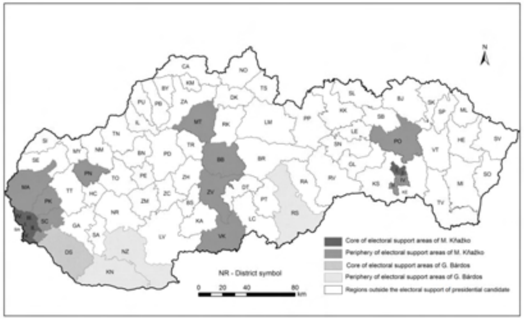

Figure 5: Identification of electoral support areas of M. Kňažko and G. Bárdos in the I. round

Region of electoral support of G. Bárdos is linked to the Hungarian minority. It consists of 3 continuous districts (Fig. 6), of which the district of Dunajská Streda is the core of his electoral support, and isolated district of Rimavská Sobota. Those districts create, according to Madleňák (2012), a region with absolute dominance of the Hungarian political parties (Dunajská Streda and

Komárno) and ethnically mixed type with a slight dominance of the Hungarian political parties (Rimavská Sobota, Nové Zámky).

Based on the results of the I. round, we created **types of regions according to the degree of diversification of voting behavior** by applying the index of dominance or polarization. The dominance was confirmed in 3 candidates (R. Fico, A. Kiska, and G. Bárdos) in 40 districts of Slovakia (Fig. 6). For better visualization, the dominance was divided into 3 intervals (see Methodology). The candidate R. Fico recorded most of the districts with dominance – it is recorded in three regions. The first is a continuous region in eastern Slovakia, which traditionally tends to leftist parties. It is in this region, where we identified the highest degree of dominance regarding the mentioned three candidates (districts of Medzilaborce I_d 0.74 and Sobrance I_d 0.7). The second is the region of northeast of Slovakia. In this region in his native district of Topoľčany, we recorded the third highest value of I_d (0.58). The last region is the central part of Slovakia (e.g. districts of Detva and Poltár).

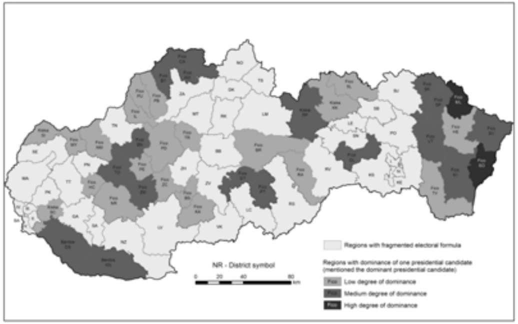

Figure 6: Diversification of electoral preferences in the districts of Slovakia in the I. round

The candidate A. Kiska again showed the native element because the index of dominance in the district of Poprad reached 0.49, the other three districts recorded only a low degree of dominance. Medium degree of dominance was reflected in the case of the candidate of SMK party (Party of the Hungarian Coalition) G. Bárdos in two districts of southwestern Slovakia (Nitra and Komárno).

In the remaining 39 districts, we did not confirm the polarized voting behavior by applying index of polarization which suggests that the electorate has fragmented electoral behavior in those regions.

The results of the I. round confirmed that citizens elected based on party principle since 10 out of 14 candidates had a link to a political party. Out of these, 7 candidates declared their support from a particular political party (R. Fico, R. Procházka, G. Bárdos, P. Hrušovský, J. Jurišta, J. Šimko, and S. Martinčko). The other three candidates were included into this group as exposed political personalities holding the leading state functions (J. Čarnogurský, M. Kňažko, H. Mezenská). These candidates were chosen by 75% of voters.

The second round of presidential elections took place two weeks after the first round – March 29, 2014. It was attended by 2,224,382 voters representing 50.48% of eligible voters who selected from the two most successful candidates from the I. round (R. Fico and A. Kiska). The winner became A. Kiska having 1,307,065 votes (59.38%). As compared to the I. round, it was an increase by 851,069 votes representing 65.1%. At the level of districts, he won in 51 districts (Fig. 7) which is more by 34 districts. Shares of votes for the winning candidate varied within the limits from 14.95% (district of Medzilaborce) to 92.74% (district of Nitra).

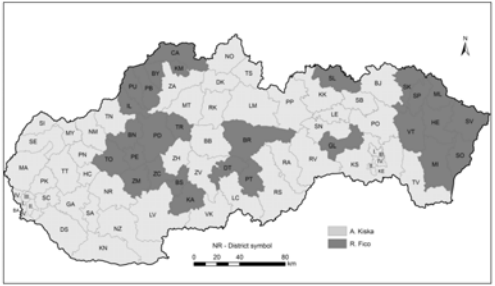

Figure 7: Winners of the II. round in the districts of Slovakia

The defeated candidate gained 917,317 votes (40.62%) and he won only in 38 districts. As compared to the I. round, he lost 12 districts. Shares of votes for the defeated candidate fluctuated in the range from 7.25% (district of Nitra) to 71.26% (district of Medzilaborce).

In the case of proceeding candidates, we again **identified electoral support areas in the II. round**. The electoral support area of A. Kiska was formed by 25 districts with 647,227 votes. On the contrary, the electoral support area of the defeated candidate was formed by 39 districts where he received 449,345 votes. As for A. Kiska, this area its smaller regarding its numbers. Therefore, A. Kiska had in the II. round of presidential elections a higher concentration of votes in the electoral support region than R. Fico in his region of electoral support.

Regarding A. Kiska, we identified two regions of electoral support where the spatially largest region of the I. round connected with the Košice region. Across the whole region, only one core region remained (Košice I.). Compared to the I. round, it is necessary to note the loss in two core districts (Liptovský Mikuláš and Spišská Nová Ves) which in the II. round did not form even a periphery. The second region is the southwest of Slovakia which is formed by the continuous strip of 10 core districts. Attention is drawn to the Bratislava core region (districts of Bratislava I. to V.) which was a periphery in the I. round. In the case of this region, we can assume that initially the electorate of M. Kňažko in the II. round voted for A. Kiska. A continuous strip of core districts continues to the southeast where A. Kiska addressed voters formed by the Hungarian minority in the II. round who voted in the I. round on the basis of an ethnic principle (in particular district of Komárno which was not even a periphery of A. Kiska in the I. round).

As in the I. round, we allocated 3 similar regions of electoral support of R. Fico also in the II. round. The northwest region remained the largest while the periphery enlarged by the districts of Žilina and Námestovo. The number of core regions increased to 12 – enlarged by the districts of Krupina, Púchov, and Považská Bystrica and core district of Prievidza became peripheral in the II. round. Most of the region of electoral support in eastern Slovakia remained identical to the I. round excluding the district of Trebišov which lost the status of being the "periphery". The third region of electoral support of this candidate was reduced by one district (Liptovský Mikuláš), which lost the position of peripheral district. The standalone core district without the periphery was Gelnica, similarly, as in the first round.

The victory of A. Kiska in the elections was influenced by the fact that he was able to reach voters who voted other candidates in the I. round. For example, in the districts that belonged to the electoral core of R. Procházka the winning candidate recorded an increase from 161% votes (Žiar nad Hronom) to 288% (Bratislava I.) in the II. round (Fig. 8).

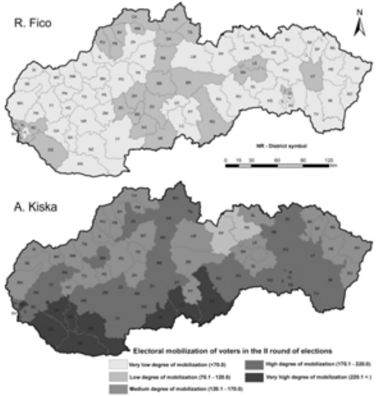

Figure 8: Mobilization of voters in the II. round of elections

In these districts, R. Fico recorded an increase of votes by 61% (Prešov) to 90% (Námestovo). In the cores of the election support of M. Kňažko, voters elected A. Kiska and his election results increased by 181% (Košice I.) to 288% (Bratislava I.). The defeated candidate in this area recorded an increase by 68% (Bratislava II.) to 89% (Bratislava V.). In the case of a single core district of support of G. Bárdos (Dunajská Streda), we can see the most striking acceleration of electoral preferences of A. Kiska by 367%. In contrast, votes for R. Fico in this area increased only by 89%.

5. CONCLUSION

From the results of elections in the I. round, it is clear that the party principle of election dominated since 75% of voters voted for the candidate with the linkage to a political party. In this paper we identified the core and periphery of electoral support of candidates who exceeded the limit of 5% of votes. In the case of the I. round, we confirmed six of the nine cases of patterns of voting behavior in Slovakia formulated by Madleňák (2012).

By applying the method of diversification of electoral preferences, we identified two types of regions: regions with varying degree of dominance of one candidate (40 districts) and regions with fragmented electoral formula (39 districts). Dominance was confirmed in three candidates.

The winner of the II. round of the presidential elections became a political newcomer A. Kiska and with the difference of 389,748 votes he defeated his rival Robert Fico. His victory is the result of several factors e.g. he was politically non-involvement and had charitable activities. By comparing electoral support areas of both presidential candidates, we can see the stability in spatial differentiation of electoral support of R. Fico in the I. and II. round. Conversely, core electoral support areas of A. Kiska changed radically in the II. round which results in his greater ability to reach voters who preferred mainly right-wing candidates in the first round. His results were affected also by the factor of ethnicity because he reached the electorate of Hungarian minority as evidenced by the increase of 367% of the votes in the district of Dunajská Streda. Results of the II. round were influenced also by the share of urban population which tended to A. Kiska. This candidate gained 34.4% of his votes in eight districts in which regional capitals are located.

Results of the II. round of presidential elections in Slovakia confirmed the will of the electorate to choose representatives from various political parties or candidates without political ties to decisive constitutional functions.

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MILITARY INSTALLATIONS AND LANDFORMS ON SELECTED MAPS PUBLISHED IN THE YEARS 1938–1941

Peter Mackovčin[1] and Martin Jurek[1]

[1] Department of Geography, Faculty of Science, Palacký University Olomouc, 17. listopadu 12, 771 46 Olomouc, Czech Republic, e-mails: peter.mackovcin@upol.cz, martin.jurek@upol.cz

ABSTRACT

In the 1930s, Germany started to prepare updated map sets of Czechoslovakia and of other European countries before invading their territories. Permanent fortifications and short-term positions of the armed forces of the enemy were imprinted into those maps. The first map sets were elaborated in 1938 covering the territory of Czechoslovakia and certain parts of Poland. Later on, in 1939 such maps were also prepared to cover other parts of Poland and also France, Belgium, the Netherlands and Switzerland; the last three mentioned were additionally updated in 1940. For the military campaign to the Balkans, Austrian general maps to the scale 1:200,000 were used for imprints of fortifications in Romania, Yugoslavia, Greece and Turkey. Maps of certain parts of the territory of the Soviet Union were elaborated in 1941 for the Operation Barbarossa and for the following invasion of the German army towards Moscow.

The authors searched the archives and collections for the map sets of Befestigungskarte Tschechoslowakei. Newly found items increased the total number of known preserved map sheets to the scale 1:25,000 from 2 to 140 and for map sheets to the scale 1:75,000 from 2 to 10 map sheets. One map sheet of the Befestigungskarte Tschechoslowakei to the scale 1:300,000 was also found.

Key Words: *fortification, German espionage maps, map sheets, military landforms*

1. INTRODUCTION

The German readiness for military campaigns into other territories required thorough cartographic preparation. Before invading the individual countries, German map sets were used to the maximum possible extent. For the military campaign to the Balkans, Austrian maps to the scale 1:200,000 were used. For the Eastern Front, the Germans used Soviet maps to the scale 1:100,000. In cases when suitable maps did not exist, the available map sources of the respective country were utilized with necessary adjustments for the German army. This led to the production of map sets to various scales ranging from 1:25,000 through 1:50,000, 1:75,000, 1:100,000, 1:200,000 up to 1:300,000. Maps of larger scales were only created for specific site preview of fortifications. Legend to these maps was not directly presented by a set of stabilized map symbols on the map sheet. Among the first elaborated and printed maps we find German maps of Czechoslovak territory.

The authors aim to describe in detail the scales to which German map sets were elaborated in the period 1938-1941. Historical, statistical and cartographic methods were used to research the archives and private collections for an overview on the numbers and content of German fortification maps (*Befestigungskarte*).The statistical method was used to quantify the objects depicted on the maps, the cartographic method served as a tool for the visualisation of spatial data using GIS applications.

The maps may further be used among the available resources to the study of military forms, even if they contain only partial situation of the constructed objects. This is true in particular for the territory of Czechoslovakia.

2. SOURCES OF INFORMATION ON FORTIFICATION MAPS

Many publications were issued on fortifications, their construction, armoury, and other parameters (for the territory of Czechoslovakia e.g. Aron et al. 1998, for Central Europe Kaufmann, J.E. and Kaufmann, H.W. 2014). Information on issued German maps of European fortifications is relatively scarce and hard to obtain form a single source. Among the large sources belong web portals such as www.mapywig.org. The issued map set to the scale 1:200,000 covering Central Europe and the

Balkans are described by Arnaud (2012) who apparently derived information from the publications of the Geographical Section of the General Staff (GSGS). In Czech expert background the map samples are rather complementary to pure military history publications that focus primarily on contemporary context and technical parameters of the objects (Lakosil, Svoboda 2013).

In order to contribute to the knowledge extent on this issue the authors had to obtain information from a wide range of archives. A rather extensive research had to be carried out in private map collections in the Czech Republic and abroad (Germany, United Kingdom, Slovakia) to bring a cardinal breakthrough in the information content.

3. CONTENT OF THE GERMAN FORTIFICATION MAPS 1938–1941

Among the first elaborated map sets were those covering Czechoslovakia (in 1938) and Poland (1938-1939). Mackovčin and Jurek (2013) describe which Czechoslovak map sources were used for the imprint of map symbols into map sets to the scales 1:25,000 and 1:75,000, including detailed description of those map symbols. The maps were designated secret (*Geheim*). They were issued by the General Staff of the German armed forces, Section 10, Group IIb (*Bearbeitet vom Gen. St. d. H.-10 Abt. Gr. IIb*). The dimensions of the map to the scale 1:25,000 is ~55.5 cm (height) and 70.5 cm (width). This map set was provided with an imprint of Czechoslovak fortifications as of July 15, 1938. The legend contains a total of 33 symbols that were later used also in German maps of other European countries (namely Poland and France). The map to the scale 1:300,000 (depicting situation as of September 15, 1938) contains only point symbols (squares indicating medium-size fortifications) to delineate the position of fortifications without discriminating for the size or importance of the forts and fortifications. Apparently three combined map sheets 1:300,000 covering the territory of Czechoslovakia and depicting the location of fortifications existed (Tschechoslowakei west, T. mitte, T. ost). Photographic documentation was obtained from a fan of military forms showing parts of the combined map *Übersichtskarte von Mitteleuropa Tschechoslowakei west* (the combined print consists of map sheets N49 Passau, N50 Pilsen, N51 Chemnitz, O49 Budweis 050 Igalu, 051 Prag). Not all information about the map is preserved because of trimming. By researching the German fortification maps covering Czechoslovakia to the scale 1:25,000 we raised the number of known preserved map sheets from 2 to 140 and for the map set to the scale 1:75,000 from 2 to 10 map sheets.

The fortification maps covering the territory of Poland were elaborated to the scales 1:25,000 and 1:100,000. For the scale 1:25,000 the original Austrian topographic sections were used with partial updates, just like in the case of Czechoslovakia. In order to illustrate the locations of points and lines of fortifications, maps of the German Empire (*Karte des Deustchen Reiches*) were selected and as 2-4 map sheets combined into editions called *Einheitsblatt* and *Grossblatt* to the scale 1:100,000 (depicting situation as of June 15, 1939). The size of the map is ~55-56 cm (height) and 65-70 cm (width). These maps are archived namely in the British National Library in London (49 map sheets) and also in various Polish archives. The set of map symbols corresponded to the Czechoslovak form of the legend (33 items). Fortification maps of Poland to the scale 1:300,000 (*Befestigungskarte Polen*) displayed the situation as of August 1, 1939 and were elaborated by the General Staff of the German armed forces, Section 12 (*Gen St. d. H.-12 Abt*). Before the outbreak of the Second World War extensive works were commissioned on fortification maps covering territories of France, Belgium and the Netherlands. For France the scale 1:50,000 was selected (*Befestigungskarte Frankreich*, using 37 map symbols derived from earlier editions – see map sheet Diedenhofen XXXIV-11) with the fortification situation as of June 15, 1939. These maps were issued by the General Staff of the German armed forces, Section 3 (*Gen St. d. H.-3 Abt*). The dimensions of the map sheet Diedenhofen XXXIV-11 was 41.5 cm (height) and 53 cm (width). In 1940 corrected and updated fortification maps were issued under the designation Tactical Edition (*Befestigungskarte – Taktische Ausgabe*) using a total of 56 map symbols in its legend (e.g. map sheet Montmedy XXXI-10, situation as of May 10, 1940). The comparison of legends is attached in Appendix 2. A total of 9 map sheets were found in Czech private collections. Maps to other scales were also prepared, primarily for the overview of fortifications, as combined maps 1:300,000 (*Zusammendruck Belgische Befestigungen*) with the situation as of October 10, 1939 and with dimensions of 110.5 cm (height) and 90.5-97.5 cm (width). Similar gigantic combined map sheets were prepared for French and Dutch fortifications as well. The maps were issued by the General Staff of the German armed forces, section IV west (*Gen St. d. H.-O. Qu. Fr. H. (Fremde Heere) Abt. West*).

During the military campaign to the Balkans fortification map sets to the scale 1:200,000 were prepared, covering the territories of Romania (8 map sheets), Yugoslavia (25 map sheets, situation as of June 15 or November 1, 1940), Greece (11 map sheets) and Turkey (9 map sheets). These maps were issued by the General Staff of the German armed forces, section IV east (*Gen St. d. H.- O. Qu. Fr. H. (Fremde Heere) Abt. Ost (1)*). The dimensions of the map sheet corresponded to the original Austrian general maps – one map sheet comprised of six so-called special maps covering 30′ longitude and 15′ latitude. After the occupation of the Balkans the production of fortification maps shifted its focus to the territory of the Soviet Union. Fortification maps to the scale 1:100,000 were produced (e.g. a combined print N-37-3,4,15,16 from November 28, 1941) which contained 28 symbols partially identical with the legend of French fortifications. These maps were issued by Verm. U. Kart. Abt. (mot.) 604. The dimensions of the above-mentioned combined print are 74 cm(height) and 62-63 cm (width). Only a few of these maps have been preserved and are thus quite rare. They used Soviet maps as their basis, namely to the scale 1:100,000 in black-and-white or later coloured corrected, or maps 1:200,000 rescaled to 1:100,000. Also maps to the scale 1:300,000 were used, where the name *Mitteleuropa* was later replaced with *Osteuropa*.

4. APPLICATION OF THE RESEARCH

The assembled map set enables to properly validate information that has been published so far about the described fortification maps and add new facts or missing pieces of knowledge. The fortification maps of Czechoslovakia, Poland, France and Russia share 10 identical map symbols in their legends. The rest of the symbols differ across the map sets for individual countries; they reflect the specific features of the defence systems of those countries as well as the level of detail that was recognized by the producers of those maps. By research of German maps of the Czechoslovak fortifications it was possible to broaden the list of preserved map sheets to the scale 1:25,000 from 2 to 140 map sheets, with map sheets to the scale 1:75,000 from 2 to 10 map sheets and 1 map sheet was discovered of a map to the scale 1:300,000. By comparing the content of the legends of the fortification maps it is possible to analyse the common and features and differences among the used map symbols. The design of the map symbols also allows to interpret the level of simplification of the reality concerning the state of the constructed military forms.

5. CONSLUSION

The historical method also enables to further develop application methods of identifying military forms that are currently hidden below the surface. This is intended especially for the study of Czechoslovak fortifications constructed between 1935 and 1938. The current results will be continuously supplemented by further research. Assessment of the used map symbols will be carried out and a map key will be developed to use in GIS applications for further processing of the georeferenced fortification maps. A statistical analysis will allow for evaluating the accuracy of the mapped features in relation to the real situation. The assembled fortification maps of the above-mentioned European countries will be shared or incorporated into Czech or foreign map servers.

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REGIONAL DIFFERENTIATIONS OF LIVESTOCK PRODUCTION IN SLOVAKIA AFTER JOINING THE EUROPEAN UNION

Jana Némethová[1], Daša Oremusová[1], Marek Civáň[1] and Gabriela Szusztorová[1]

[1] Department of Geography and Regional Development, Faculty of Natural Sciences, Constantine the Philosopher University in Nitra, Trieda Andreja Hlinku 1, 949 74 Nitra, Slovak Republic,
e-mails: jnemethova@ukf.sk, doremusova@ukf.sk, marek.civan@ukf.sk

ABSTRACT

The paper deals with the effects of the Common Agriculture Policy of the European Union (hereinafter referred to as "EU") on the livestock production in Slovakia. The accession of Slovakia to the EU in 2004 and the acceptance of the Common Agriculture Policy (hereinafter referred to as "CAP") of the EU has reflected in the general decrease of livestock production, but also in the deepening of regional differentiations within the Slovak livestock production. Till 2004, a livestock production prevailed over the plant production, but the ratio changed right after the accession to the EU and a plant production started to reach the higher proportion on the aggregate volume of gross agricultural production than the mentioned livestock production. Within the paper, we pay attention to the dynamics of changes of the livestock production development in the particular regions of Slovakia at the NUTS III level (Regions) and LAU I level (districts) in 2004 and 2013. Through selected indicators of the livestock production (number of livestock, intensity of livestock production) are analyzed regional differentiations within the livestock production in Slovakia.

Key Words: *Slovakia, Livestock production, Common Agriculture Policy of the European Union, Regional differentiations*

1. INTRODUCTION

A livestock production was subsidized by the state during the period before the transformation of agriculture. This state support was minimized after the mentioned period, resulting into the decrease of number of livestock due to the financial loss necessary to cover the costs for breeding and production. This situation subsequently caused the increase of market prices of livestock, what has shown in the descending demand for beef and pork meat. On the other hand, there was registered a growing demand for poultry that has been cheaper in the comparison with other types of meat. The process of downsizing of livestock has begun in the middle of the 90th of the 20th century, what greatly contributed to the deepening of regional differentiations of livestock production in Slovakia. A self-sufficiency of Slovakia in the scope of meat was gradually replaced by its import. Chrastinová et al. (2014) present that a livestock production in Slovakia has a downward tendency on a long-term basis. It is also connected with the economic conditions, such as higher costs for livestock breeding. The decrease of production is closely associated with the decline of the number of livestock as well as import of ready-made products to our market.

A strengthening competitive environment in the common labour market in the EU and unequal conditions for farming between old and new EU countries resulted into another decline of number of livestock, especially pigs and cattle. In Slovakia was registered not only a rapid decrease of number of livestock, but many farms were shut-down in various regions. Notwithstanding this fact, there was also a positive feature due to the increase of livestock yield. The changes in the Slovak agriculture after the joining the EU in 2004 and CAP of the member states have made regional differentiations of livestock production larger and deeper. The livestock production prevailed over the plant production till 2004, but the Slovak accession to the EU changed this situation and the higher proportion on the aggregate volume of gross agricultural production was typical for plant production.

We used an indicator for the evaluation of changes in the Slovak livestock production after accession to the EU in 2004 and current status in 2013. The development index (D_{iA-B}) reflects a change between the two time horizons *(A, B)*, while it shows a change of proportion in the area of the comparable territorial unit.

$$D_{iA-B} = 100\,x\,\frac{P_{iB}}{P_{iA}}$$

P_{i4} – proportion of i category at the beginning of reference period

P_{i13} – proportion of i category at the end of reference period

The development index may reach values from 0 to infinity, while a 100% value shows no change, higher values mean an increase and lower numbers (below 100%) characterize a decrease of the monitored indicator. The value of 0% describes that the selected element is not registered, while the infinity (theoretically) means the absence of element in the comparable territorial unit at the beginning of reference period (Bičík et al. 2010). Using the development index we evaluated the dynamics of changes within the development of livestock production in the particular parts of Slovakia at the level of Regions and districts in 2004 and 2013. Using other selected indicators of the livestock production – number of livestock, intensity of livestock production in number of units per 100 ha of agricultural land or arable land – were described regional differentiations of Slovak livestock production. The data used in the paper were obtained from the Regional office of the statistical office of the Slovak Republic.

The changes within the Slovak agriculture connected with the effects of accession to the EU as well as with the acceptance of CAP were the matter of scientific studies of many authors, such as Némethová, Dubcová, Kramáreková (2014), Spišiak et al. (2005), Spišiak (2011), Spišiak, Némethová (2008), Némethová (2009a, 2009b, 2010). A comparison of the effects of CAP to the development of agricultural production and the volume of foreign trade (according to the EU-27 states since 2004) was explored by Buday et al. (2012). The expected impacts of CAP on the development of agricultural production in Slovakia were presented by Falťanová (2008). Marušinec and Škriečka (2008) focused on the analysis of agricultural support system in Slovakia. A detailed analysis of effects of potential CAP scenarios in Slovakia after 2013 was published by Uhrinčaťová (2011).

The impact of CAP of the EU member states on the agriculture and rural territories in Czech Republic and regional differentiations were analysed by various authors, such as Věžník, Svobodová (2012), Král, Palasová, Svobodová, Věžník (2012), Svobodová, Věžník (2011), Svobodová (2011), Věžník, Konečný (2011), Kabrda, Jančák (2006), Doucha, Štolbová, Lekešová (2012) and many others. The last 30 years has brought a rapid downsize of some farming animals in the Czech Republic as well as an internal change of their structure and way of breeding. Areas under crops and the position of agriculture throughout the general food vertical have changed, too (Věžník, Král, Svobodová, 2013). There were made different studies focused on the comparison of the structural changes of agriculture in the selected new member states of the EU after their accession (Buchenrieder, Möllers eds., 2009, Csaki, et al., 2010, Kulikowski, 2005, Kolodziejczak, 2006, Kolodziejczak, Kossowski, 2011, etc). Just in the case studies published by Buchenrieder, Möllers eds. (2009) was analysed the development of countryside and comparison of the structural changes in agricultural sphere in the selected new EU member states after their accession (Romania, Poland, Hungary, Bulgaria).

2. DEVELOPMENT OF NUMBER OF CATTLE UNITS

Right the year 2004 was an unfavourable year for livestock production in Slovakia. The Slovak Republic was just a new EU member state and had to adapt to the new conditions of livestock production as well as market demands as soon as possible in order to accommodate to other, mostly older member states. Those different conditions among EU countries reflected into another downsizing of cattle and pigs, what led to the loss of self-sufficiency in the field of production and processing of meat in Slovakia. A pork meat dominates over the consumption of other types in Slovakia, reaching approximately 30 kg per capita. The second most favourite is poultry (20 kg per capita). A consumption of beef decreased from the level of 21 kg per capita in 1990 to less than 4 kg recently.

The total number of cattle in Slovakia was 540,146 units in 2004 – at the beginning of reference period. This number dropped to 467,820 (down by 72,326 units) by the end of 2013. The mentioned decline also reflected in the value of the development index that reached just 86.61%. In the scope of Slovak Regions was registered the highest value of the indicator (101.29%) in the Prešov Region that was the only one signalizing the increase in cattle breeding. Other Slovak Regions showed a decline, whilst the highest decrease was registered in the Bratislava Region, because the development index reached just the level of 74.67%.

The highest increase of the development index in the Bratislava Region was recorded in the Malacky District (100.26%). On the other hand, the lowest value reached the Senec District (45.62%). Within the Trnava Region was registered the best score in the Trnava District (104.96%), while the Skalica District was typical due to the worst value (67.66%) of this indicator. In the Trenčín Region was noticed the most favourable level in the Nové Mesto nad Váhom District (98.79%) and contrary to that, the lowest level was typical for the Partizánske District (68.29%). Both aforementioned numbers showed the decline in the number of cattle units. Within the Nitra Region was found out the highest value of the development index in the Šaľa District (110.16%), while the Levice District was characterized by the highest decline, because the value of the development index was just 54.07%. The best score (113.66%) in the Žilina Region reached the Námestovo District, while the opposite effect (the lowest value of the indicator) was typical for the Dolný Kubín District. In the Banská Bystrica Region was realized the most rapid increase in the Revúca District (117.11%). On the other hand, the Zvolen District reached the lowest value of the indicator within this Region. Within the Prešov Region was showed the best score of the development index in the Svidník District (179.82%), while the lowest value was registered in the Vranov nad Topľou District (78.52%). The highest increase (114.47%) of the selected indicator in the Košice Region was evaluated in the Rožňava District. On the other hand, the lowest value (58.73%) was typical for the Košice-okolie District (Fig. 1).

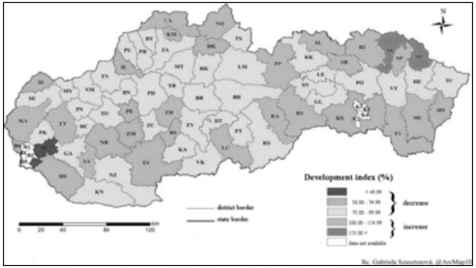

Figure 1: Development of Cattle Units in Districts of Slovakia in 2004 and 2013
Source: Regional Office of the Statistical Office of the Slovak Republic, 2015

Another indicator – a number of livestock units per 100 ha of agricultural land – shows a change in livestock production in 2013 compared to 2004. The mentioned indicator had been characterized by the value of 27.9 livestock units per 100 ha of agricultural land in 2004, but nine years later it reached just 24.3 units. This decline of livestock units occurred in all of the Slovak Regions, excluding the aforementioned Prešov Region (Fig. 2).

The accession of Slovakia to the EU has brought a positive policy especially in terms of obtaining grants and non-returnable financial contributions. Within the cattle was registered a positive impact on cattle breeding without a market milk production. This type of breeding is important mostly for submontane and mountainous regions, where a livestock production has a dominant position. A number of cows without a market milk production showed the increase in every Slovak Region. The mentioned type of breeding reached the growth at the level of 79.45%. The highest increase was registered in the Bratislava Region (155.82%), followed by the Banská Bystrica Region (125.61%). On the other hand, in Slovakia was registered a decline (28.18%) in terms of dairy cows (Szusztorová, 2015).

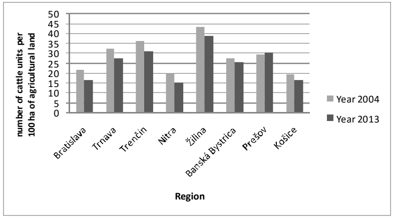

Figure 2: Intensity of cattle breeding in Regions of Slovakia in 2004 and 2013
Source: Regional Office of the Statistical Office of the Slovak Republic, 2015

3. DEVELOPMENT OF NUMBER OF PIGS

The decrease of pigs breeding was affected mostly by the fact that they were excluded from the possibility of obtaining subsidies for their breeding as the result of general overproduction of pigs across the Europe. This decline was also influenced by higher prices of feed as well as lower purchase prices of meat and cheaper import from abroad. This drop of number of pigs was related to the every Slovak Region, whereas the highest decrease (more than 50%) was registered in the Žilina Region, Banská Bystrica Region, Košice Region and Nitra Region, too.

There are considerable differentiations not only among Slovak Regions, but among their districts as well. In the Bratislava Region was registered the highest value of the development index in the Pezinok District (161.54%). On the other side, the highest decline reached the Malacky District (15.18%). Within the Trnava Region was noticed the most favourable increase in the Senica District (205.72%), while the worst score reached the Trnava District (21.97%). In the framework of the Trenčín Region was recorded the highest value of the indicator (238.36%) in the Prievidza District. On the contrary, the Nové Mesto nad Váhom District was characterized just by the value of 15.42%. The districts located in the Nitra Region were typical by the decrease in the number of pigs, because the values of the development index fluctuated from 13.23% to 72.67%. Within the Žilina Region was registered the highest increase in the Námestovo District (103.88%), while the most distinctive drop was in the Tvrdošín District (19.91%). The districts in the Banská Bystrica Region were in the similar position as the ones in the Nitra Region, because there were noticed just the decrease in the number of pigs (the values of development index were below 100%). The lowest score (7.13%) was recorded in the Žiar nad Hronom District. Within the Prešov Region was reached the highest increase in the Humenné District (382.44%), while the worst value was typical for the Bardejov District (22.25%). In the Košice Region reached the best score (145.76%) the Gelnica District, but on the other hand, the Košice-okolie District was characterized by the most distinctive decrease in number of pigs (25.94%) (Fig. 3).

The value of the development index in Slovakia (national level) reached 55.44%, reflecting the decrease at 44.56%. In 2004 had been registered 1,149,282 pig units, while nine years later this number dropped to 637,167 units. A self-sufficiency of pork meat production in Slovakia has fallen far below the level of 40%. A pork meat is imported from states across the whole Europe, but mostly from neighbouring countries. More than the half of slaughter pigs is exported due to the shut-down of many important slaughterhouses, e.g. in Lučenec, Rimavská Sobota, Humenné, Zbrojníky or Sereď. Nowadays are functioning just smaller ones, e.g. in Myjava, Tešedíkovo or Komárno, which have had only a local importance. The majority of slaughterhouses in Slovakia process a meat coming from foreign production, because it is for them more effective in economic way. Slovakia tries to boost pig breeding through subsidies, because this was ignored by the EU as well as own state. The attention is nowadays paid to the freshness and quality of meat that can be provided not by imported meat, but by meat coming from national breeders. In light of future development is noticeable a growth potential of Slovakia in pig breeding with assumption to reach the complete self-sufficiency in pork meat production, even to export it abroad.

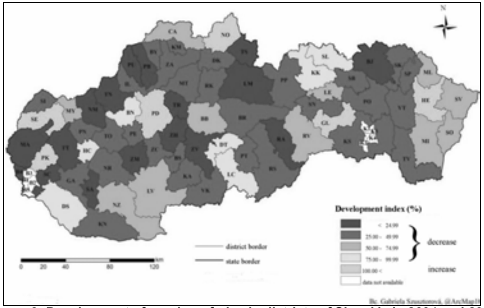

Figure 3: Development of number of pigs in districts of Slovakia in 2004 and 2013
Source: Regional Office of the Statistical Office of the Slovak Republic, 2015

The drop in the number of pig units in Slovakia and its Regions during the reference period can be evaluated through the intensity of pig breeding by the number of pig units per 100 ha of arable land (Fig. 4). This indicator had reached the value of 84.5 units in 2004, but then it was just 55.38 units in 2013.

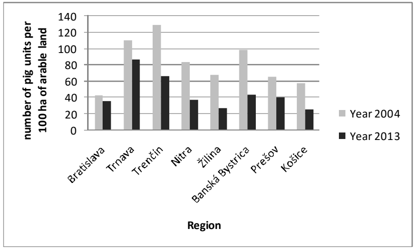

Figure 4: Intensity of pig breeding in Regions of Slovakia in 2004 and 2013
Source: Regional Office of the Statistical Office of the Slovak Republic, 2015

4. DEVELOPMENT OF NUMBER OF POULTRY

A production and breeding of poultry did not record as negative results as other subcategories of livestock production. A number of poultry units in Slovakia had reached 8,065,778 units in 2004 and dropped to 5,288,003 units in 2013 (down 34.44%). The shown decline was influenced mostly by the openness to European market and related import of cheaper and low-quality poultry meat. Poultry has been imported to Slovakia especially from Hungary and Poland. A national production of this type of meat has been affected by the trade policy. Chain stores are used to favour a poultry meat from foreign suppliers that offer it cheaper than Slovak producers. A national production of poultry reaches just 50 – 60% share on its overall consumption. During the reference period (2004 – 2013) was registered the increase in the number of poultry units just in the only area – the Prešov Region. In

2004 there had been 590,588 units, while in 2013 were registered 1,195,002 units, what shows the increase at the level of 604,414 units. Other Slovak Regions are characterized by the decline of breeding and production of poultry.

There are also some significant differentiations among poultry breeding and production across the districts of Slovakia. Within the Bratislava Region is shown just decrease in all of the districts. The highest one was registered in the Bratislava IV District, where the development index reached 20.88%. In the Trnava Region got the best score the Senica District (138.83%), while the most visible drop was in the Dunajská Streda District (1.08%). The highest growth in the number of poultry units in the Trenčín Region was typical for the Partizánske District (134.87%). On the other hand, the worst value reached the Považská Bystrica District (3.66%). Districts belonging to the Nitra Region did not reach any positive values, what was confirmed by the values of the development index. The most significant decrease was registered in the Nové Zámky District (18.39%). The highest value of the indicator in the Žilina Region was 4,061.66% in the Martin District, where the number of poultry units increased from 2,994 units in 2004 to 121,606 units in 2013. On the contrary, the highest drop (down by 116,710 units) was recorded in the Kysucké Nové Mesto District, where the development index reached just the level of 2.19%. Another extremely high value of the development index (3,737.62%) was noticed in the Brezno District belonging to the Banská Bystrica Region. There was the most favourable growth in the number of poultry units in the Region, from 2,113 in 2004 to 78,976 in 2013 (up by 76,863 units). The number of poultry units in the Banská Štiavnica District fell from 704 in 2004 to zero in 2013, so the development index reached just 0.00%. On the contrary, it reached the most extreme value (30,905.97%) in the Stará Ľubovňa District that is a part of the Prešov Region. It is the highest growth not only in the mentioned Region, but in Slovakia, too. There had been just 3,549 units in 2004, but nine years later were registered 1,096,853 units (up by 1,093,304 units). On the other hand, in the Medzilaborce District was registered the same phenomenon as in the aforementioned Banská Štiavnica District. The development index reached the value of 0.00%, because the number of poultry units dropped from 16,752 in 2004 to zero in 2013. Within the Košice Region was evaluated the best score of the development index (917.86%) in the Sobrance District. The lowest value (0.34%) in this Region – reflecting the highest decline – was typical for the Rožňava District (Fig. 5).

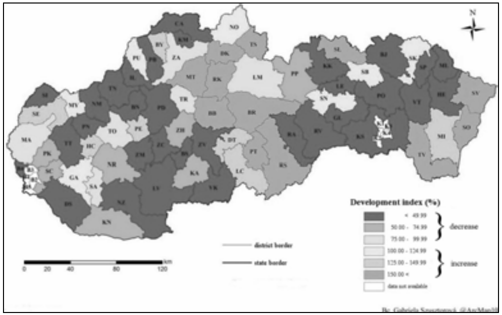

Figure 5: Development of number of poultry in districts of Slovakia in 2004 and 2013
Source: Regional Office of the Statistical Office of the Slovak Republic, 2015

The presented decline in the poultry breeding can be evaluated also by another indicator – intensity of livestock production through the number of poultry units per 100 ha of arable land. This indicator had reached 1,007.7 units per 100 ha of arable land in 2004, but it dropped to 805.4% in 2013. The growth was registered only in the Prešov Region and the Bratislava Region (Fig. 6).

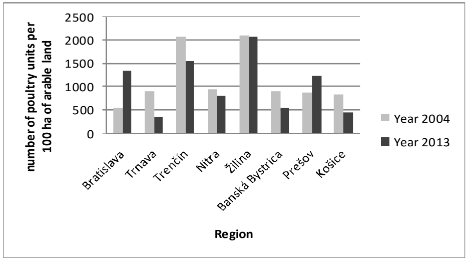

Figure 6: Intensity of poultry breeding in Regions of Slovakia in 2004 and 2013
Source: Regional Office of the Statistical Office of the Slovak Republic, 2015

5. DEVELOPMENT OF NUMBER OF SHEEP AND GOATS

In the scope of the development of number of sheep and goats was registered the growth at the level of 20.85% during the reference period. In Slovakia had been registered 16.6 units per 100 ha of arable land in 2003, whereas it increased to 20.7 units by the end of 2013. The main reason was the support from the EU for livestock breeding on the permanent grasslands. A growth of this number was registered almost in all Slovak Regions, except for the Nitra Region, where a decline at the level of 5% was recorded. The increase of number of sheep units in Slovakia can be evaluated through an intensity of livestock production (Fig. 7). A sheepmeat is not very popular in Slovakia and therefore the majority of it is exported to markets of developed EU countries. Under the influence of support and payments for permanent grasslands is estimated further boost of sheep and goat breeding in Slovakia.

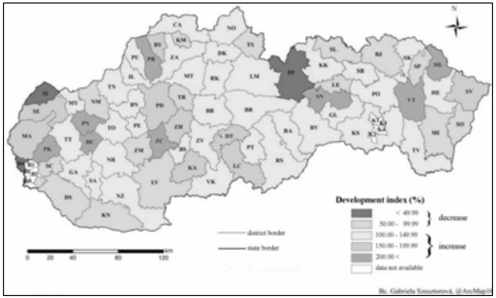

Figure 7: Development of number of sheep and goats in districts of Slovakia in 2004 and 2013
Source: Regional Office of the Statistical Office of the Slovak Republic, 2015

Regional differentiations among Slovak districts are registered also within the number of sheep and goats. In the Bratislava Region was evaluated the highest value of the development index (391.85%) in the Pezinok District. The most significant decline of sheep and goat units was typical for the

Bratislava IV District (47.87%). Within the Trnava Region was reached the highest growth in the Hlohovec District (314.78%), while the most obvious drop occurred in the Skalica District (41.94%). The growth in the number of sheep and goats was noticed almost in the all districts of the Trenčín Region. The highest score was registered in the Považská Bystrica District (214.62%), while the decline was typical only for the Nové Mesto nad Váhom District (97.85%). Within the Nitra Region was recorded the highest value of the development index in the Topoľčany District (145.61%). On the other hand, the most significant decrease of the number of these units was shown in the Zlaté Moravce District (55.95%). In the Žilina Region was reached the highest value of indicator (189.84%) in the Bytča District. On the contrary, the worst score (75.48%) was typical for the Kysucké Nové Mesto District. The most favourable values were obtained within the Banská Bystrica Region, because the development index reached in every district value above 100%. Absolutely the best score (235.98%) in this Region was registered in the Žarnovica District. Within the Prešov Region was recorded the highest growth in the number of sheep and goats in the Medzilaborce District (341.87%), while the highest drop was characterized in the Poprad District (48.97%). In the Košice Region were obtained extreme results in the Michalovce District and the Spišská Nová Ves District. The second one was typical for the best score of development index (228.56%) in the Region. On the other hand, the lowest value (58.04%) was reached in the mentioned Michalovce District, where was registered the largest loss of the number of sheep and goat units (Fig. 7). In the process of monitoring and evaluating data were detected two difficulties – unpublished data for the districts of Košice in 2012 and 2013 and incomplete data for the districts of Bratislava, as well as in the cases of other explored livestock units.

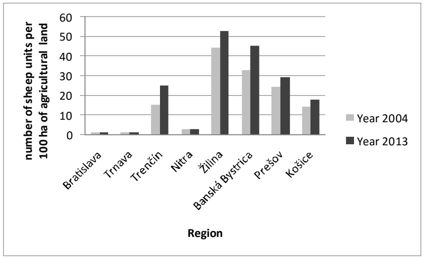

Figure 8: Intensity of sheep breeding in Regions of Slovakia in 2004 and 2013
Source: Regional Office of the Statistical Office of the Slovak Republic, 2015

6. CONCLUSION

The accession of Slovakia to the EU has brought new opportunities for obtaining grants and non-returnable financial contributions. However, it has not contributed to the mitigation of decreasing trend of livestock units, especially cattle, pigs and poultry. Acceptance of the CAP of EU member states meant an adaptation to the constantly changing requirements of the EU. A currently valid CAP 2014–2020 has brought an reassessment of the direct payments to farmers and rural development policy, as well as greener (more ecological oriented) state policy (with an emphasis and focus on the environmentally friendly agriculture), support for small farms and farmers, support for cattle breeding without a market milk production and last but not least an abolition of the milk quota scheme, what is also associated with the fear of over-production of milk and milk products on the European market. A new reform should cause a progressive increase of the effectiveness of agriculture as well as a decline of the share of agricultural policy at the total EU budget. There is an estimation of a drop from the level of 41.6% in 2014 to the value of 38% in the last year of programming period (2020) (Reform on the Common Agricultural Policy 2014–2020, 2015).

The Ministry of Agriculture and Rural Development of the Slovak Republic decided to raise a financial support; within the new programming period 2014–2020; for the breeding of particular livestock animals, such as dairy cows, sows and pigs for fattening, broiler chickens and sheep, too. The height of this sum is based on the number of particular livestock units and the costs necessary for their lives (Rural Development Programme 2014–2020, 2015). The main goal is to increase a number of livestock animals at the particular breeding units. There is also necessary to follow breeding procedures leading to the improvement of living conditions for these animals. This step should subsequently reflect in the improvement of their health. Within the every scope of livestock breeding is a priority to respect a natural way of breeding and natural needs of animals.

A support from the EU; during the programming period 2014–2020; is directed especially to the revitalization of deteriorating livestock production. Despite the fact that Slovakia is not self-sufficient in the production of any type of meat, this country has a potential to change this course. Nowadays are Slovak consumers focused not only on the quality of meat, but its origin, too. The freshness of meat is a symbol of quality and this is not provided by any meat coming from abroad. An ordinary Slovak consumer is becoming choosy and therefore is looking more and more for national producers, what creates an increasing potential within the livestock production.

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TYPIZATION OF MUNICIPALITIES OF THE NITRA SELF-GOVERNING REGION ACCORDING TO MIGRATION POPULATION CHANGE

Katarína Vilinová[1], Gabriela Repaská[1] and Maroš Čaládik[1]

[1] Department of Geography and Regional Development, Faculty of Natural Sciences, Constantine the Philosopher University in Nitra, Trieda Andreja Hlinku 1, 949 74 Nitra, Slovak Republic,
e-mails: kvilinova@ukf.sk, grepaska@ukf.sk

ABSTRACT

One of the demographic processes which induces changes in geographic, economic, and social structures is the population migration. It is an important element of urbanization process and spatial concentration of population. It is the population displacement which includes a change of residence. It affects the conditions of demographic reproduction of selectivity of migrants by sex, age, and marital status. This process has its specific signs also in rural areas of the Nitra Self-governing Region. The aim of the paper is to typify the municipalities of the Nitra Self-governing Region according to migration change in the period of 2001-2013.

Key Words: *migration change, typization, Nitra Self-governing Region, municipality*

1. INTRODUCTION

Migration is a natural part of human life. Almost each of us will change the place of residence at least once in a lifetime whether because of study, work or various personal reasons. Migration is thus one of two components of the total population change. According Pavlík (1986), this process belongs to important processes which can be seen in several areas. It is a certain component of the process of urbanization and spatial concentration of population. Often, it is an accompanying process of professional and social-class changes where it affects the conditions of demographic reproduction of migrants by sex, age, marital status as well as other indicators. At the current stage of population development, the migration flows become the most significant component of population dynamics (Bezák, 2006) as a result of changes in the second demographic transition (Caselli, Vallin, Wunsch, 2006).

2. MIGRATION CHANGE AND ITS TYPIZATION IN MUNICIPALITIES OF THE NITRIA SELF-GOVERNING REGION

The migration process is not simple, but by its complexity it is the result of various phenomena that fall within the scope of scientific fields such as geography, economics, sociology, and others. Worldwide, the migration becomes one of the most important phenomena of the 21st century. Migration is, formally, a two-way movement – emigration and immigration. Migration is thus considered the most important type of geographical mobility of population. It is very closely related to urbanization which represents a difficult process of population flows from rural to urban environments in the context of their development (Bačík, 2010). Within migration, there are two types of factors influencing the population. The first are so-called push factors – factors which “push out” the population. These are generally negative impacts such as low living standard, lack of employment opportunities, high living costs, and others. The second are so-called pull factors – factors which “attract” the population (Jackson, 2001).

2.1 Typization of the Nitra Self-governing Region by migration change

Migration change is one of two components of the total population change (along with the natural change), therefore, the chosen typization is based on the migration change at the level of municipalities of the Nitra Self-governing Region. The typization of migration change in the studied period was also processed in the form of map output using the ArcGIS software (Boltižiar, Vojtek, 2009). According to the stated typization, we divided the period of 2001-2013 into three periods. Since we studied 13 years, which are divided into three periods, 1st and 3rd period last four years and the middle period is one year longer. The periods are divided as follows:

- 1st period: 2001-2004 (4 years)
- 2nd period: 2005-2009 (5 years)
- 3rd period: 2010-2013 (4 years)

In terms of typization from Nemeškal, Riška, Špačková (2015), it is not important whether the municipalities reached migration increases or decreases, but the trend is important, which they showed in the periods. That is, if there was an increase or decrease of net migration between the periods regardless the migration increase or decrease. According to this typization, the municipalities were divided into ten types A-J while 6 types A-E had the highest net migration in the 3rd period. Types G and H had the highest value of net migration in the 1st or in the 2nd period. Municipalities of the types I and J are mostly stagnant in all studied periods. Typization is as follows:

Municipalities with the highest net migration in the 3rd period:

Type A – high increase (>10.00‰) in the 3rd period, slowing down the rate of increase (increase in the 2nd period higher as in the 3rd period)

Type B – increase (<10.00‰) in the 3rd period, slowing down the rate of increase

Type C – high increase in the 3rd period (>10.00‰), decrease before

Type D – increase in the 3rd period (<10.00‰), decrease before

Type E – increasing municipalities in the long-term, raising the rate of increase (increase in the 2nd and 3rd period while in the 3rd period it was higher)

Type F – increasing municipalities with crises (migration decrease) in the 2nd period

Municipalities with the highest net migration in the 1st or 2nd period:

Type G – increase in the 1st period, decrease later

Type H – increase in the 2nd period, decrease later

Stagnating municipalities:

Type I – decrease in the 2nd period, otherwise stagnation (± 1 ‰)

Type J – uncertain development, low deviations (during all periods maximum ± 1 ‰).

From these types it is clear that the most favorable situation is in the first group of municipalities and thus in the municipalities of types **A-F** which grew mostly in the 3rd period. When distinguishing between the terms “high increase” and “increase” we chosed, according to the values of net migration of municipalities of the studied area, the interval of 10 ‰ which differs the type A, type B, and also type C from type D. The first two types are distinguished by the highest value of net migration in the 3rd period. The increase was recorded also in the 2nd period, but it was higher. It follows that the municipalities of **types A and B** increased throughout the whole period of 2001-2013, but the rate of increase is slowing down. In **types C and D**, we see an increase in the 3rd period, but previously they were marked by decrease. **Types E and F** include municipalities that have long-term increase with raising rate of increase suggesting that the increase in the 3rd period was higher than in the 2nd period while the **type F** had a crisis or migration decrease in the 2nd period. As for municipalities in **type G**, it is the highest net migration in the 1st period and in **type H** the highest values are in the 2nd period. The last two types I and J are stagnating. The stagnation was defined as differences between periods not exceeding 1 ‰. Regarding the municipalities of **type I**, there was a decrease in the 2nd period. However, when we compare the 1st and 3rd period, we can see that the values were almost identical and therefore stagnant. The last **type J** includes municipalities which had maximum increase or decrease up to 1 ‰ during all three periods. This means that they were stagnant in the years 2001-2013.

The **most favorable type is E** because municipalities in this type increased during all periods while in recent years they increased most significantly. This does not mean that they reached migration increases because this type includes also municipalities which had migration decreases and their decrease was gradually reduced or they reached increase at the end of the period. The **worst type is G** because there was the highest net migration in the 1st period and later it was reduced. This also includes the municipalities that had migration increase at the beginning of the period and this was gradually reduced or they have already reached migration decrease at the end or also those municipalities that had migration decrease all the time and this decrease was later even higher. In the Nitra Self-governing Region, the highest share regrads the municipalities of type G (128 municipalities, 36.16%) and the municipalities of type H (114 municipalities, 32.20%). Conversely, the lowest representation has the migration type A (4 municipalities, 1.13%) and type J which includes only 2 municipalities (0.56%) (Table 1 and Figure 1).

Table 1: Migration typization of municipalities in the Nitra Self-governing Region

Type	Number of municipalities (abs.)	Number of municipalities (%)
A	4	1,13
B	21	5,93
C	14	3,95
D	11	3,11
E	37	10,45
F	12	3,39
G	128	36,16
H	114	32,20
I	11	3,11
J	2	0,56
Total	354	100.00

Source: Statistical Office of the Slovak Republic, 2015

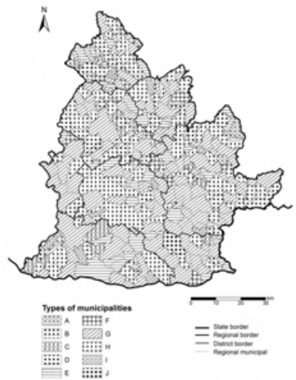

Figure 1: Migration typization of municipalities in the Nitra Self-governing Region
Source: Statistical Office of the Slovak Republic, 2015

The **type A** with an increase in the 2nd period and high increase (over 10 ‰) in the 3rd period includes four municipalities – Čakajovce and Čeľadice in the district of Nitra, Brhlovce and Jabloňovce in the district of Levice. **Type B** with an increase of 10 ‰ in the 3rd period includes 21 municipalities (5.93% of all municipalities in the Nitra Self-governing Region). They are located mostly near towns and border areas. The migration **type C** has 14 (3.95%) and **type D** 11 (3.11%) municipalities. Such municipalities can be especially found around urban areas which is a result of suburbanization and thus inhabitants moving away from towns to the countryside. Municipalities with long-term increase, where the rate of growth increased, include 37 municipalities (10.45%) and it is the **type E**. Such municipalities are located not only near towns, but also in peripheral parts of districts. Some municipalities had migration increase (e.g. Svätý Peter), others changed from migration decrease to increase (Veľký Kýr, Krnča) or had migration decrease all the time, but this decrease was reduced (Štúrovo).

Although the type E is most favorable because of high variability of this type, we cannot always speak of high migration increases. The **type F** is specific in that in the 3rd period, as compared to the 1st period, the net migration increased, but in the 2nd period (2005-2009) there was a crisis which was manifested by migration decrease. Overall, there are 12 municipalities in the Nitra Self-governing Region with this type representing 3.39% share of the total number of municipalities. They are located in the edge parts of districts (e.g. Nová Ves nad Žitavou, Tehla, Obid). **Types G and H** are the most numerous and they have a mosaic representation throughout the territory of the Nitra Self-governing Region. The most continuous areas are, however, occupied in the southwest of the Nitra Self-governing Region (between Šaľa and Nové Zámky), south from the town of Levice and west from the town of Nitra. The last two types are characterized by stagnation in net migration. In **type I**, however, there is a decrease in the 2nd period, but the 3rd period is almost identical to the 1st what distinguishes this type from type F. It is represented by 11 municipalities which is 3.11%. They are located mainly in the districts of Komárno and Topoľčany, but we can find them also in the districts of Levice and Nové Zámky. The last type is J. The major feature of this type is stagnation during all three periods with a maximum deviation between the periods up to 1 ‰. The **type J** includes only two municipalities. Svodín in the district of Nové Zámky with migration increase around 2 ‰ and Svätoplukovo in the district of Nitra with migration increase 7 ‰.

In terms of typization, it is important to point out to the situation of urban settlements where the most favorable state is in the town of Šahy (type B) and also in the towns of Komárno and Štúrovo (type E). The type H with the highest net migration in the 2nd period includes the towns of Topoľčany, Šurany, and Nové Zámky. The least favorable migration situation is in the towns of type G which includes 9 towns Nitra, Vráble, Zlaté Moravce, Tlmače, Levice, Želiezovce, Šaľa, Kolárovo, Hurbanovo. Migration decrease during all three periods was recorded in the towns of Vráble, Zlaté Moravce, Tlmače and Levice. Towns of Želiezovce and Šaľa had migration increase in the 1st period, but later they had migration decrease. However, towns of Kolárovo and Hurbanovo showed migration increases during all three periods which steadily decreased and therefore they also belong to the type G.

From the above mentioned it can be concluded that the favorable types A-F occurred mostly near towns, some along the border with Hungary, while almost all towns had the type G or H. This phenomenon is associated with suburbanization which according to Repaská (2012), is a significant trend not only in the Nitra Self-governing Region, but also in the whole Slovak Republic. Suburbanization is connected with emigration of population from towns to rural municipalities in the surroundings of the town. Such municipalities has better atmosphere, good transport accessibility to towns and technical infrastructure, and cheaper housing compared to the town. Therefore, it is better for urban residents to live in the municipalities of the suburban zone than in the town itself.

In terms of Pacioni (1983), urban population which moved to rural area brings new job opportunities for builders and gardeners to the countryside, taxes on new homes increase the income of the municipality, renovation means better visual quality of the landscape. Rural residents who are in touch with immigrated people from towns gain a broader view. Therefore, municipalities with migration increase which are situated near the town gradually lose their typical rural look.

3. CONCLUSION

Nitra Self-governing Region is specific in terms of migration change which varied in the period of 2001-2013. For the whole studied period, we found that the largest migration decreases were in the municipalities with peripheral position in a relatively large distance from the nucleus (center). Typical examples of such municipalities are e.g. Plavé Vozokany (-28.58 ‰) and Pečenice (-20.74 ‰) in the district of Levice or Svrbice (-23.53 ‰) belonging to the district of Topoľčany. Conversely, the highest long-term increases can be seen in municipalities located near the town in its suburban zone. The absolute highest migration increase is in the municipality of Malý Lapáš (district of Nitra) up to 63.83 ‰. As for the typization of the municipalities of Nitra Self-governing Region based on the net migration, the location of favorable migration types A-F was situated near towns, in some larger municipalities or also in some border municipalities. On the contrary, municipalities with negative migration development were located mainly in small rural municipalities with edge location.

The least favorable situation was in the municipalities of type G and H which include 12 towns of the region, as suburbanization causes population moving from towns to nearby municipalities. The most frequent occurrence of these types can be seen particularly in the west and southeast of the Nitra Self-governing Region. The most favorable situation was in the municipalities of type E because they were increasing in the long-term and rate of increase also raised. In addition to municipalities in the surroundings of the town (Lúčnica nad Žitavou, Machulince), also some peripheral municipalities can be included here which did not reach migration increase, but they could also have decrease while the decrease gradually reduced (e.g. Uhliská).

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NEW INSTRUMENTS OF COHESION POLICY EU IN PROGRAMM PERIOD 2014+

Libor Lněnička[1]

[1] Department of Geography, Faculty of Education, Masaryk University, Poříčí 7, 603 00 Brno, Czech Republic, e-mail: lnenicka@ped.muni.cz

ABSTRACT

The policy of economic, social and territorial cohesion EU (also known as regional policy or cohesion policy) are now among the most important policy of the European Union ("EU"). This policy should contribute to reduce differences between the economic levels of the various regions of the Member States of EU.

The aim of this paper is to provide information on new instruments that are applied at the level of cohesion policy EU in programm period 2014–2020 at the level of member states EU. In this period they will be applied two types of instruments – financial and integrated.

Key Words: *Cohesion policy, European Union, Integrated territorial investment, Integrated development strategy, Instruments*

1. INTRODUCTION

The policy of economic, social and territorial cohesion EU should contribute to reduce differences between the economic levels of the various regions of the Member States EU (Kokoška et al., 2006). Cohesion is expressed as the balanced development as a whole and to reduce disparities in the development of their countries and regions (Rumford, 2000). Regional policy and serve to reduce the differences between rich and poor regions (or countries) in the context of social and economic cohesion (Dinan, 1994). In other words, regional policy should help to achieve a balance in the market mechanisms. The only way they can reduce negative effects on the regions financial compensation (Allen, 1996), through special payments or subsidies. According to Moll (2007), the consistency can be expressed such level differences between countries, regions or groups that are politically and socially tolerable.

Currently are in the law documents EU three dimensions of cohesion:

- Economic – assesses the economic convergence and can be expressed by reducing disparities between the levels of development of the various regions (states) using economic indicators such as. Gross domestic product GDP per capita, employment, productivity, etc.
- Social – focuses on achieving the objectives of employment and unemployment, level of education, social exclusion and various groups in demographic trends in the EU.
- Territory – is a complementary concept to economic and social cohesion. The concept of territorial cohesion, developing economic and social cohesion that the main objective of the EU, ie. The balanced and sustainable development into a territorial setting.

The aim of this paper is to provide information on new instruments that are applied at the level of cohesion policy EU in programm period 2014–2020 at the level of member states EU. In this period they will be applied two types of instruments – financial and integrated.

2. BASIC IDEAS AND CONCEPTUAL THEMES

To the foreign authors who are focused in their work area on cohesion policy EU in recent years, is possible to classify for example Marks (1993), Rumford (2000), Bailey, Propris (2002), Schmidt (2002), Leonardi (2005), Baldwin, Wyplosz (2007), Bachtler, Mendez (2007), Molle (2007), Bachtler, McMaster, (2008), Bache (2008; 2010) or Mendez (2001; 2013). In the Czech Republic to deal with the problems of cohesion policy also geographers, though it is rather the domain of public economics, regional economics and management.

The first publication activities in the Czech Republic are focused on pre-accession funds PHARE, ISPA and SAPARD – for example Cihelková, Eva et al. (2001), Fiala, Pitrová (2003), Fajmon (2004) or Vilamová (2004). From geographers their work published for example Mates, Wokoun et al. (2001), Wokoun (2004) or Rumpel (2002; 2004). After accession to the EU in 2004 were comming the papers and publications about pumping structural funds EU. There were specialized publications from Abrhám (2005; 2008), and sub-articles Lněnička (2008, 2009), Šauer (2008), Vystoupil, Studnička, Šauer (2010), Kramáreková (2010), Cicoňová, Kramáreková (2013) or Némethová, Dubcová, Kramáreková (2014).

In the Czech Republic we had opportunities to pumping finance from structural funds EU interim two programm periods (2004–2006 and 2007–2013). From 1 January 2014 ran the new programm period of cohesion policy EU 2014–2020. Multiannual financial framework for the period was approved by EU on 2 December 2013 at its regular meeting, taking aim at 1b, on the right consistency, allocated 366 791 million EUR (in 2011 prices). The Czech Republic has fulfilled the condition of preparation the Partnership Agreement through the Czech government resolution no. 242/2014. On 11 August 2014, the Partnership Agreement in final form was send to the European Commission via SFC2014 for approval. European Commission Partnership Agreement formally approved on 26 August 2014. It was completed nearly three-year process of negotiations on the partnership agreement. Parallel to the Agreement on the level of managing authorities are prepared thematic operational programs (according to the Czech Government Resolution no. 867 of 28 November 2012), which was in May and June 2015 gradually all approved by the European Commission.

Financial instruments are defined by Title IV of the European Parliament and Council Regulation (EU) No 1303/2013 of the European Parliament and of the Council of 17 December 2013 laying down common provisions on the European Regional Development Fund, the European Social Fund, the Cohesion Fund, the European Agricultural Fund for Rural Development and the European Maritime and Fisheries Fund and laying down general provisions on the European Regional Development Fund, the European Social Fund, the Cohesion Fund and the European Maritime and Fisheries Fund and repealing Council Regulation (EC) No 1083/2006**.** The real implementation of cohesion policy EU, in other words, reducing development disparities between EU regions, serving the Structural Funds (Rumford, 2000) as the main financial instrument. In the programming period 2014-2020 used new labeling structural and investment funds. Financial contributions from the structural funds for development activities of the Member States are not refundable. Among the most important financial instruments European Regional Development Fund, European Social Fund, the Cohesion Fund, the European Agricultural Fund for Rural Development and the European Maritime and Fisheries Fund.

Cohesion policy for the programming period 2014–2020 brings new term – territory dimension. The goal of this dimension is to substantively and geographically mainly concentrate financial resources on interventions implemented in areas with the greatest problems and the strongest development potential. One of the means for applying a territorial dimension are **integrated approaches**. For application of this integrated approaches, the Ministry for Regional Development prepared Guidance on the use of integrated tools in the programming period 2014-2020 (available at http://www.strukturalni-fondy.cz/cs/Fondy-EU/2014-2020/Metodicke-pokyny/Metodika-vyuziti-integrovanych-nastroju).

The territorial dimension in the context of raising funds from Structural and Investment funds ("ESI") in the programming period 2014–2020 is possible to see as a opportunity to focus the resources of programs in specific areas to support both types of competitiveness (depending on the development potential) of the Czech Republic. And also taking into account the requirement of balancing regional disparities (in relation of internal differentiation territory and concentration problems in economic, social or environmental area). Integrated instruments are defined by Chapter II and III of Regulation (EU) no. 1303/2013. There are defined **two fundamental approaches** (ie. a **Community-led local development** – Chapter II of Regulation and **Territorial development** – Chapter III of the Regulation). The financial instruments and community-led local development through Local Action Groups and through the LEADER approach were applied in the programming period 2007–2013, the following text will address only the "new" Integrated approaches.

Support for Local Actions Groups in new programming period 2014–2020 will be extended to other ESI, through which it will be possible to use LEADER as a community-led Local Development (Community-led local development – the "CLLD"). The implementation CLLD addition to the Rural Development Programme also involves the Integrated Regional Operational Program (managed by Ministry for Regional Development), Operational program Employment (managed by the Ministry of Labour and Social Affairs) and Operational program Environment (managed by the Ministry of the

Environment). For coordinating aid CLLD within the ESI funds are responsible Ministry for Regional Development.

The “new” integrated instruments are directed mainly to the urban area of the Czech Republic's largest cities and their suburban area. The most important instruments are – **Integrated territorial investment** (“ITI”) and **Integrated development strategy** (“IDS”). These two instruments will be donated to the text, which aims to bring the current state of preparation of these strategic documents. All upcoming strategy in major cities linked to the original integrated urban development plans (hereinafter referred to as “IDP”), through which the interventions were implemented in the 2007–2013 period. Therefore it can be assumed that cities already have experience with this documents and can suppress errors with the preparation of new documents.

The main basis source for concrete solutions to the territorial dimension and application of appropriate instruments is the Regional development strategy of Czech Republic 2014–2020, approved by Government Decision no. 344 dated May 15, 2013 (http://www.mmr.cz/getmedia/5ce20928-de14-4d42-8e21-833c0868e227/Usneseni_344_15052013.pdf?ext=.pdf). This document classifies regions into categories according to the development potential and introducing them to each type of integrated strategies in relation to territory dimension. Approved strategy has outlined three basic regions under the settlement structure (development areas – metropolitan area, housing agglomerations and regional centers, stable areas and peripheral areas). More about the classification and definition of specific regions can be found in the document section 2.3 Typology of regions (http://www.mmr.cz/getmedia/08e2e8d8-4c18-4e15-a7e2-0fa481336016/SRR-2014-2020.pdf?ext=.pdf).

3. INTEGRATED INSTRUMENTS

Integrated plan or document is one of the instruments of cohesion policy, which ensures coordination of sectoral policies in certain areas. It is a form strategic document, which handles so-called. “Bringer” presented by the city within the metropolis, or agglomeration (Fig. 1).

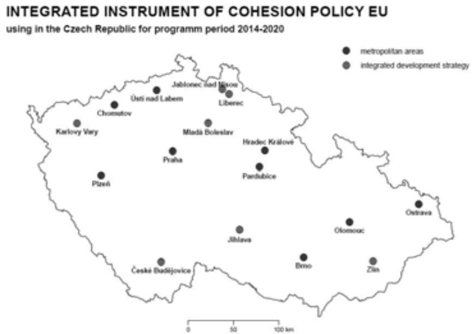

Figure 1: Integrated instrument of cohesion policy EU using in the Czech Republic for programm period 2014–2020

Source: Dokuments are available on web site http://www.mmr.cz/cs/Microsites/PSUR/Vyzva-c-2/ITI-a-IPRU, 2015. Adjusted author

Integrated Territorial Investment (ITI) is a tool to implement integrated regional strategies. In doing so, it is not a separate area, even a partial one priority of the operational program. Integrated territorial investments allow Member States to implement operational programs comprehensively and combine financial resources from several priority axes of one or more operational programs, to ensure the implementation of an integrated strategy for the territory. To simplify ITI can be thought of as an investment plan that is based on the development strategy territory. To achieve the objectives of this plan allows ITI combine resources across several priority axes of one operational program, and even be used to finance more operational programs at once.

It opens space to the most complex problems in the territory and a more coherent invest in areas with growth potential. You can combine hard infrastructure investments with soft projects. This tool will give Member States greater flexibility in the preparation of operational programs and allow effective implementation of integrated actions through simplified financing. The foundation is to develop an integrated strategy for development across different sectors, which will focus on the necessary development in the area. The strategy should be designed so that measures can build on the synergistic effects of the coordinated implementation. The object of the planned investments may become any geographical area with a specific territorial delimitation of municipal districts with several gradations to urban, metropolitan, urban-rural, sub-regional or inter-regional level. Integrated territorial investments may also be used for the implementation of integrated actions in isolated geographic units with similar characteristics within the region (eg. A network of small or medium-sized cities). These investments are not obliged to cover the entire territory of the administrative unit. In addition, the integrated territorial investment suitable to implement measures in the context of European territorial cooperation. In border areas may for example be used to implement an integrated strategy for urban development in the border towns.

Measures tailored to the specific needs of the region can be supported by integrated territorial investments. However, it must still respect the context in which the cooperation takes place. Therefore, the EU requires the intermediary body to be responsible for the implementation of the integrated territorial investment was either a legal entity established under the laws of one of the participating countries (if it is made by public authorities or bodies of at least two participating countries).

Regional development strategy of Czech Republic 2014–2020 identified within the supported development areas include 7 metropolitan areas. The basic criterion for defining the area where it is concentrated min. 300,000 inhabitants. These are mainly the core region of the Czech economy (55 % of GDP generation CR) and the largest city in the Czech Republic (Prague, Brno, Ostrava, Plzen – more than 45 % inhabitants) – Table 1. They are concentrated in the highest order function (administration, financial sector, science and research, higher education, infrastructure, management structure). An important trend in the evolution of their spatial structure is intense suburbanization, however, with a number of negative consequences, affecting their overall development. These four cities in the strategies defined for 2 areas where they are concentrated similar problems, and it Ústecko-Chomutov agglomeration (the area where they are concentrated mainly problems arising from coal mining, electricity generation, allocated chemical production and damaged the environment with the need for reclamation large areas) and Hradec-Pardubice agglomeration (area with two dominant core, in significant part focused on chemical production affected by the disappearance of a significant part of the production base).

Table 1: Basic data of ITI in the Czech Republic

Name of ITI	Area (in km^2)	Population	Number of communities
ITI Praha	4 983,1	1 999 732[1)]	515
ITI Brno	1 755	609 114[1)]	167
ITI Ostrava	3 896	990 000[1)]	233
ITI Plzeň	1 364	309 395[2)]	117
ITI Olomouc	221 406	435 683[1)]	233
ITI Ústí-Chomutov	154 286	521 577[3)]	75
ITI Hradec-Pardubice	1 320,4	335 118[4)]	145

Note: 1) 25. 3. 2011; 2) 1. 1. 2013; 3) 1. 1. 2014; 4) 31. 12. 2013
Source: Documents of ITI, available on the Web: http://www.mmr.cz/cs/Microsites/PSUR/Vyzva-c-2/ITI-a-IPRU, 2015.

Some ITI dokuments were supported by external financing from the European Regional Development Fund through the OP Technical Assistance 2007–2013 and the state budget of Czech Republic (see Table 2).

Table 2: Basic data about financing of ITI in the Czech Republic from OP Technical assistance 2007–2013

Name of ITI	Project registration number	Grants from EU (in CZK)
ITI Praha	CZ.1.08/3.2.00/14.00341	2 500 000
ITI Ostrava	CZ.1.08/3.2.00/14.00342	2 500 000
ITI Plzeň	CZ.1.08/3.2.00/14.00320	2 497 425
ITI Olomouc	CZ.1.08/3.2.00/14.00340	2 500 000
ITI Hradec-Pardubice	CZ.1.08/3.2.00/14.00309	1 080 764

Note: ITI = Integrated Territorial Investment; EU = European Union
Source: Regional Information Service, available on the Web: http://www.risy.cz/cs/vyhledavace/programy-eu/detail?id=26419#o8, 2015.

Integrated development strategy (IDS) means a set of content and time related activities and projects that aim to develop tourism in a particular territory, with an emphasis on concentration and coherence of activities and their effectiveness. IDS define the basic strategic directions of development of tourism. Regional development strategy of Czech Republic 2014–2020 identified six functional areas. The territory in which investments will be directed through a sophisticated and conceptual approaches of individual carriers IDS (cities located in the heart of agglomeration). Basic overview of agglomerations created following brings Table 3.

Table 3: Basic data about IDS in the Czech Republic

Name of IDS	Area (in km^2)	Population	Number of communities
IPRÚ České Budějovice	1 638	155 589[1)]	79
IPRÚ Jablonec nad Nisou – Liberec	254	161 000[2)]	24
IPRÚ Jihlava	903,68	99 768[3)]	75
IPRÚ Karlovy Vary	403,60	114 064[2)]	27
IPRÚ Mladá Boleslav	128,73	57 53[2)]	18
IPRÚ Zlín	212,94	106 635	11

Note. 1) k 25. 3. 2011; 2) k 1. 1. 2013; 3) k 31. 12. 2013;
Source: Documents of IDS, available on the Web: http://www.mmr.cz/cs/Microsites/PSUR/Vyzva-c-2/ITI-a-IPRU, 2015.

All IDS respond to the ties in the area and also meet the requirement of the CFR, which defines the urban agglomeration as an area with a population density of 100 000 to 300 000 inhabitants. The processing of all documents IPRÚ done through external funding from the European Regional Development Fund through the OP Technical Assistance 2007-2013 and the state budget (see Table 4).

Table 4: Basic data about financing of IDS in the Czech Republic from OP Technical assistance 2007–2013

Name of IDS	Project registration number	Grants from EU (in CZK)
IPRÚ České Budějovice	CZ.1.08/3.2.00/14.00347	728 300
IPRÚ Jablonec nad Nisou – Liberec	CZ.1.08/3.2.00/14.00327	1 395 600
IPRÚ Jihlava	CZ.1.08/3.2.00/14.00310	1 400 000
IPRÚ Karlovy Vary	CZ.1.08/3.2.00/14.00312	865 500
IPRÚ Mladá Boleslav	CZ.1.08/3.2.00/14.00346	1 100 000
IPRÚ Zlín	CZ.1.08/3.2.00/14.00265	2 500 000

Note: IDS = Integrated Development Strategy; EU = European Union
Source: Regional Information Service, available on the Web: http://www.risy.cz/cs/vyhledavace/programy-eu/detail?id=26419#o8, 2015.

4. CONCLUSION

Europe (not just EU Member States) are facing diverse challenges (economic, environmental or social). It turns out that their effective solution requires integrated and geographically focused approach. This approach involves multiple dimensions and corresponds exactly to the conditions and outcomes in specific areas. Going beyond traditional administrative boundaries and requires a greater willingness to cooperate and coordinate measures at various levels of government to achieve common goals. On the other side the new territorial cohesion objective superiors Treaty of Lisbon which recognize that economic and social cohesion at the European level can not be achieved without a stronger focus on the territorial impact of EU policies.

Integrated strategies (ITI, IDS or CLLD) are essential to enable Europe to achieve smart, sustainable and inclusive growth as envisaged by the Europe 2020 Strategy. The basic idea is to develop an integrated strategy for development across different sectors, which will focus on needed development in the area. The strategy should be designed so that measures can build on the synergistic effects of the coordinated implementation. The object of the planned investments may become any geographical area with a specific territorial delimitation of municipal districts with several gradations to urban, metropolitan, urban-rural, sub-regional or inter-regional level. Integrated territorial investments may also be used for the implementation of integrated actions in isolated geographic units with similar characteristics within the region (eg. A network of small or medium-sized cities). These investments are not obliged to cover the entire territory of the administrative unit.

In the Czech Republic applies the principle of territorial investments, based on the definition of regions (areas) in the Regional development strategy of Czech Republic 2014–2020. Strategies identified for more efficient utilization of ESI 3 types of regions (Development, stabilized and peripheral areas), the article is primarily devoted to developing territories. In this category of regions defined by the 7 metropolitan areas (originally 6, later it was the Czech government in 2013 approved capital territory Olomouc) and 6 called. “Urban agglomerations”. Because of entities (cities) that have significant experience with drawing funds from SIF using integrated tools is expected simpler and more efficient pumping.

All territories have in year 2015 already processed their draft strategies (ITI or IDS) submitted to the SEA process and are now waiting to start the whole mechanism drawdown in the individual calls of operational programs. Different strategies have been developed under the umbrella of a single methodology (by the Ministry for Regional Development), but with different approaches and methods of defining its own territory. At the beginning of the process of drafting it was clear that some cities have experience in defining a larger area than their own administrative areas (eg. Mladá Boleslav, Karlovy Vary or České Budějovice).

Other areas have been defined previously using sophisticated methods based purely on statistical data (eg. Brno, Plzeň and Prague or Jihlava). Important role in defining the region played a collaboration of entities and links with academics at prominent universities. Opportunity was given and territories covered by its multi-functionality not fall within the category of cities or agglomerations, but they are still residential structure in the Czech indispensable role. Such territories are regional centers (Jihlava and Mladá Boleslav), which are defined as an economic centers of regional significance and their facilities with greater population densities, higher number of business entities. While these methods ministry has been on a general level, created well-crafted strategies that are currently being prepared for the implementation of specific projects. Self-financing strategies will be solved with the support of the operational programs ESI. Integrated strategies will be able to draw from the Integrated Regional Operational Programme OP Transport, OP Environment, OP Enterprise and Innovation for Competitiveness, OP Research, Development and Education, OP Employment and OP Prague – Growth Pole of the Czech Republic.

Finally, it must be said that the provisions relating to integrated strategies have several potential benefits:

- Integrated territorial investments represent a tool that supports integrated use of the funds and has the potential to provide a better overall results in the same amount of public finances.
- Ability to delegate management of ITI gives subregional entities (local or municipal stakeholders) opportunity to participate in the preparation and implementation of the program and assume responsibility for these tasks.
- In the case of ITI is initially secured several sources of financing, and thus more certainty about funding for integrated action.
- Integrated tools are designed to implement development based on local approach that may help unlock the untapped potential hidden at local and regional level.

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RETAIL NETWORK AND ITS PERSPECTIVES (INTRODUCTION INTO THE ISSUES)

Miroslava Trembošová[1], Marek Civáň[1], Alena Dubcová[1] and Hilda Kramáreková[1]

[1] Department of Geography and Regional Development, Faculty of Natural Sciences, Constantine the Philosopher University in Nitra, Trieda Andreja Hlinku 1, 949 74 Nitra, Slovak Republic,
e-mails: mtrembosova@ukf.sk, marek.civan@ukf.sk, adubcova@ukf.sk, hkramarekova@ukf.sk

ABSTRACT

In urban residential settlement the retail amenities are creating the basic and integral part of the spatial structure of the network of civic amenities. Retail network in our cities has always been an important area for shopping. Changing factors of supply, demand and resources cause that many of us use the latest forms of retail establishments also for leisure, recreation, meeting up with friends and loved ones. These tendencies lead to further construction of shopping centres that are significantly changing our lives. These centres are changing not only the image of our cities, but also our buying habits and ways of spending our free time as well. In our paper, we undertook to present the theoretical principles and factors of shaping the retail network, land-use planning standards for retail and perspective of development of retail networks.

***Key words**: retail network, land-use planning standards, development perspectives*

1. INTRODUCTION

Retail as a part of tertiary sector is among the sectors of the economy with the most striking transformation. A network of retail establishments has gone through a development which can be described as spatially the most variable. Its basis was the change of ownership in the industry; centrally managed in the past; thereby starting the highly competitive environment. In addition to the change in ownership we observe also other transformations, in particular in the localisation of the retail network in Slovakia. A characteristic feature is the ejection of the retail network on the territory with a good transport accessibility and dynamic growth of sales areas, often caused by the construction of new large-capacity business units on the so-called “green meadow”. The development of a business network shapes a new network of civic amenities of many cities especially in the outermost zones or peripheral urban areas. The deployment of these large-area retail establishments is dependent on many factors such as more convenient traffic location and communication availability (highway, railway), sufficient area (own business facilities with parking lot), land price, purchasing power of inhabitants, age of inhabitants etc. Developers look for sites appropriate for new large-area stores behind city boundaries, whereas they trigger the mechanism of commercial suburbanization.

2. PRINCIPLES AND FACTORS OF RETAIL NETWORK FORMATION

According to [2] and [18] the factor of spatial arrangement of retail network within the internal parts of urban city structures follows three principles: i) relative equability of creation and concentration of retail network, ii) hierarchy (zonation) of retail equipment, iii) complexity of retail equipment. These mentioned interconnected tendencies form the retail network of cities.

In accordance with [6] is possible to deduce a formation of retail network in cities in the context of the Central place theory from following internal impacts: i) increase of purchasing power causes additional supply of new high-quality products and therefore leads “ceteris paribus” towards widening of hierarchy of central places upwards. Besides that it causes a significant extension of supply in the lower centres, ii) growth of population leads (also in conditions of constant salaries) to growth of regional purchasing power and concentration and thickening of supplying central places, iii) the higher level in mobility of population can partially skip the lower central level and the purchasing power may be functioning in the closest centre of higher level, ij) entrepreneurs' effort on continuous growth of efficiency cause enlarging of minimal size of stores and minimum turnover thresholds and thereby are displaced less profitable sellers. As a result of that; similarly as the third factor; are increased the “holes” in retail network of central places.

External impacts are located [6] outside the Christaller's model and they have higher empirical importance: i) formation of new transport possibilities operate in differentiating way; localities with better accessibility can increase preferences among customers at the expense of more distant ones, ii) advantages of horizontal and vertical interconnection; agglomerative effects in large shopping centres lead into savings in terms of time and money of customers in the process of purchasing and cause greater concentration of purchasing power in such centres that disadvantage sales units located outside them, iii) increase of commuting distance between the place of residence and the workplace cause change in customer's behaviour – they buy products more often at shopping centres located in the proximity of workplace and not at the central places related to the place of residence, ij) better storage options result in lower frequency of shopping. Similarly as the process of increasing mobility, it also leads to partial skipping of the lower centres.

Friedmann's model “centre vs. periphery” can be also applied in conditions of retail analysis. Naturally dominant position of the centre above its periphery does not remain without contradictions. Innovations spreading from the centre lead demands of elite at the periphery on its share of power and advantages on the process of development [5]. The structure between centre and periphery shows a spatial form of social conflicts with four possible results: i) massive violence of centre towards the elite of periphery in order to maintain existing spatial structure, ii) neutralization of the elite of periphery by gradual modification of structure between authority and dependency, iii) substitution of centre elite for the elite of periphery that can lead (based on the orientation of new elite) into the system line or stagnation, iiii) cooptation of the elite of periphery into the centre. This strategy causes an equal distribution of power by process of politic and economic decentralization. Authorities and dependencies are decreasing; they may even reduce; and the dichotomy between centre and periphery may be overcome. And just within this model can be found the description of the problem of retail suburbanization, respectively a disappearance of retail functions of traditional central zones in cities of countries in the process of transformation. The mentioned topic is in Slovak community analyzed by [20].

According to [12] are eight of the most decision making criteria (8P) of selection of locality for emplacement of retail store: **place, premises, product, price, promotion, presentation, personnel** and **physical distribution**. Location and also often the size of sales area do not change during the lifetime of retail store. All other factors have to be able to continuously change in order to maintain a functionality of location and storages. We can rightly assume that the above mentioned factors are applied in the spatial and functional differentiation of the retail network in the city of Nitra.

Interestingly, among the most decisive criteria there is not a **local self-government** as a special factor, which can through instruments of land-use planning and management, tax and fee policy, sell of land, amount of rent etc. strongly influence not only the selection of locality, but also some other factors (in lower measure).

The key-role for development of retail lies in the **accessibility** of large shopping centres. They are not coincidentally built at the outskirts of cities or along major transport routes. For their functioning is essential to provide parking places which may be, because of low prices of land, really sizeable and located at ground level. The possibility of parking is also very important for the small retail units in the city centres and it is the question of their survival.

Another specific factor is a **synergic effect** of many large-area retail units placed in the same locality. They are usually added with various types of services.

In the initial phase of transformation of our economy (the 1st half of the 90s) was the **change of ownership** (because of restitutions, small and large privatisation) the dominating factor of retail network development.

For the development and current features of retail in Slovakia have been in last decade the most decisive factor the arrival of **multinational chains** associated with the massive construction of shopping centres, especially at the new localities, often on the “greenfield”.

Purchasing power of population is one of the key factors. Nowadays, it is also in Slovakia significantly spatial differentiated. Although its level is far below the values known from Western Europe and it does not reach the average of EU countries, it has grown dynamically during the last years.

We can assume to the future that within the Slovakian retail network will be applied a qualitative new factor – **IT development** – and associated widening of **new forms of selling**.

3. TRANSFORMATION OF RETAIL

In the first period of transformation to market economy was under way the retail transformation in Slovakia with the minimal participation of international retail chains. The process of concentration and new poles of development (shopping centres) according to their localization in urban environment have brought many problems to discuss: the decrease of retail functions at traditional city centres, problem of dynamic and static transport, destruction of small entrepreneurs, aesthetic aspects of stores and radical changes in shopping behaviour of customers. [16] claim that the most serious problem of their construction is the loss of agricultural land. According to [19], [11], [7], [21], [15], [16], [9], [10], [23] was the process of transformation during that period mostly influenced by various factors, such as disintegration of state-owned enterprises (state does not form the retail network which is held by commercial investors), deregulation, liberalization of prices and rents, privatization, restitution, wide possibilities of private business activities, increase of employment in retail, improvement of technical parameters of sales units, growth of large-area stores, spatial changes etc. that have shown mostly in cities.

In conditions of transformed and liberalized economy in Slovakia occurred a massive aggrandizement of retail units of all types and sizes. The development of retail network lies in three pillars (need, supply, resources), where investors recognize just the simple equation – the larger the unit is, the more economicly effective it is. The allocation of large-area retail units brings a dynamics to the systems of local, regional and subregional levels, significantly changes their economic importance with feedback impacts on the particular area. Besides positive effects of construction and operation of large-area peripheral shopping centres, there is a conflict with the principles of sustainable development.

Many experts in the region of Central Europe have recently claimed an unshakeable opinion that economy with free-market mechanism is not bound by norms, standards or regulations in comparison with the common practice in centrally planned economy more than 20 years ago. Experiences from countries abroad (including Central Europe states such as Czech Republic and former GDR) show that some of views in the process of retail network development should be not only monitored, but strictly regulated as well.

Just the new federal lands of Germany came through the transformational changes in retail and services faster than other post-communist countries of Central Europe. They were the first movers. In accordance with [3] was the highest increase of large-area retail units registered even in 1992 and their dynamics later sharply fell. Megalomaniac projects of shopping centres and their rapid aggrandizement has gotten too fast into crisis that was supported by unfavourable demographic rate. In various German media was pointed out the fact that the situation at centres of German cities is polarized on consumer goods stores. On the other hand, there is decrease of shops selling food goods. Legislative changes displayed a positive factor because there were solved problems of landscape planning (e. g. Law on territorial settlement, 1990).

The economic recession in Germany after 2008 have caused (as well as in other countries) decline of purchasing power of population and consequential dwindling of the small shops, especially at city centres, because people used to shop at cheaper supermarkets such as Aldi, Lidl, Norma that were usually localized on the peripheries or residential blocks. Despite the fact of unfavourable consumer climate and growing crisis, Germans buy a lot of merchandise. Not quality, new or expansive products but rather cheaper merchandise in special offers.

The structural changes in Austria began just in 70s and were caused by increased mobility of customers [3]. The first of all were hit groceries and shops selling goods of daily consumption. Later moved to shopping centres other goods, such as industrial merchandise, and there were created various garden centres and markets offering construction materials. They are mostly concentrated in Vienna and Lower Austria because they profit from potential of spatial interconnections and links to the capital city. At the end of 20th century was Austria well-known with higher density of large-area retail units (169 sq m/1,000 inhabitantswhich was the twice amount compared to Germany [3]. Regulation of spatial development in Austria is on municipal, regional and subregional level and it is not coordinated on state level where each of the nine federal lands has its own legislation and acts in a way which significantly differ from each land. They are subordinated to a special regime of regulation such as according to the amendment valid in Lower Austria are not in the process of localization applied any restrictive criteria coming from the original system of central places. There is also a condition of assessment of impacts on environment. On the other hand, in other federal lands there are valid hierarchical levels of centres as criteria for emplacement of large-area retail stores.

The similarity of development between retail network in Czech Republic and Slovakia has been visible just after the disintegration of former Czech and Slovak Federal Republic. In many features of life are still good relations and cooperation without language barrier, so there is not any problem in taking over of good experiences. All the more that the issues connected with retail at city level are researched and worked out more precisely and particularly longer than in Slovakia.

In accordance with [18] there are not any legislative means in terms of pre-defined rules for the construction of large-area retail stores and the municipalities solve this situation on their own. There is also a methodological guide (so called "yellow book") compiled by Ministry of Industry and Trade of the Czech Republic which predicts the development of spatial standard (sales area in sq m on 1,000 inhabitants) till 2010 and it designs optimal alternatives of configuration and merchandise structure of retail network in settlement of particular size (Table 1).

Table 1: Predicted development of spatial parameter in Czech cities (sales area on 1,000 inhabitants)

Category	Foods (incl. goods of daily consumption)		Nonfood products		Total	
Number of inhab.	**2000**	**2010**	**2000**	**2010**	**2000**	**2010**
5,000–9,000	190-260	230-300	230-460	360-760	420-720	590-1060
10,000–19,000	190-250	270-330	330-550	540-940	520-800	810-1270
20,000–49,000	190-250	270-320	370-590	640-1020	560-840	910-1340
50,000–99,000	200-250	270-310	480-630	660-1040	680-880	930-1350
100,000–175,000	210-250	260-310	480-630	750-1040	690-880	1010-1350
More than 175,000	220-260	260-310	480-630	770-1040	700-880	1030-1350

Source: Szczyrba, 2005

For the purpose of comparison (Table 2) are shown average values of floor area in retail on 1 inhabitant in the city of Nitra and the selected cities in Czech Republic. It is important to add that based on the foreign experiences is the optimal level of equipment at the level of **1.2 – 1.4 sq m/1 inh.** of spatial parameter.

Table 2: Average values of spatial parameter of existing retail network equipment

City	Nitra_{1992}	Olomouc_{1998}	Nitra_{1998}	Brno_{2000}	Zlín_{2000}	Nitra_{2000}	Brno_{2009}	Nitra_{2010}
Sales area sq m/1 inhab.	**0.565**	0.846	**0.794**	1.100	0.960	**0.780**	1.780	**2.223**

Source: Szczyrba, 2002, Trembošová, 2010, 2012, www.brno.cz/sprava-mesta/magistrat-mesta-brna/usek-rozvoje-mesta/odbor-uzemniho-planovani-a-rozvoje/dokumenty/upp/pruzkum-maloobchodni-site-na-uzemi-mesta-brna/

Experiences obtained from the period of two decades of market economy "functioning" indicate that we will have to change some opinions, attitudes and directions. It was visible just after 10 years that it was necessary to pay attention not only to monitoring of retail indicators in the whole complexity (even at the national level) but to formation of particular regulations. Slovak government, proclaiming a social approach of own policy, has dealt with issues associated with retail, especially large retail chains and their activities in society and mainly negative impacts in the field of retail (Law 358/2003 Coll. on retail chains, [28]). It is understandable that in such governmental efforts expressed own dissatisfaction the entrepreneurs as the first because they did not like possible state interventions within retail industry. The disagreement with adoption of regulative arrangements was presented also by Antimonopoly office of the Slovak Republic [14].

4. RETAIL NETWORK AND ITS DEVELOPMENT PERSPECTIVES

Just at the end of the last millennium was possible to define various potential negative impacts of newly-established and uncontrolled massive construction of large-area shopping malls. Slovakia had enough time for adoption of effective and preventive arrangements such as more consistent way of punishing of tampering of decisions related to territorial planning, by planning and approval of large-area retail units with investors' direct financial interest in improving of transport infrastructure of the selected area or by adopting successful foreign practises (e. g. introduction of passportisation of business activities that is being applied for decades in Paris). Slovakia has missed this chance and the opposite happened. It is not rare that an investor with a great capital power can force a change of land-use plan assignment for the particular territory even against legislative regulations. The harsh reality in Slovak towns show a plenty of evidences associated with the negative effects:

- destructive implications on an existing retail networks in towns, instability,
- devitalisation of natural urban shopping centres,
- decline of city centres with negative impacts on the other city inhabitants,
- effects of suburbanisation on cities,
- loss of agricultural land,
- loss of green areas in peripheral urban areas,
- degradation of environment,
- increase of traffic load,
- undesirable traffic after the phase of construction,
- reckless application of substandard (pseudo-)architecture,
- inappropriate architectonical integration into the current urban structures,
- inability of connection to the surrounding building structures because of ubiquitous parking places,
- exaggerated scale of objects of shopping centres affecting the image of city and landscape in disturbing or aggressive way,
- occupation of grassland areas
- inappropriate, often just provisional, transport connectivity,
- lengthening of commuting distances,
- forced loss of immediate contact of residential complexes with basic level of equipment,
- discrimination of immobile residents,
- increase of problems related to the insufficient number of parking spaces (can be solved by supplemental construction of multi-storey parking houses),
- controversial promise of new job opportunities (the higher effectivity of sale means the lower number of employees per unit of sales area).

[3] claims that in terms of urban and land-use perspective dominates a critical view (also among the experts) on suburban shopping centres focused on negative impacts. On the other hand, the summary of pros of construction and operation of large-area shopping centres for inhabitants is hardly half-long than the list of cons:

- wider range of products and additional services,
- “experience” coming from the process of shopping,
- relaxation and culture,
- fulfilment of unused sizeable spatial areas in many Slovak cities (obstruction of spinning of suburban spiral),
- extension of competition.

A city planning design for construction of retail sales areas is focused on the possibilities of area arrangement resulting from a construction program during an observance of the particular limits and regulations and utilization of potential of the study area. The main instrument of regulation is a *land-use plan* of the city. A city planning design analyzes wider relationships, volumetric and spatial solutions of the projects such as accessibility, parking etc. The mentioned document is a result of teamwork consisting of the city planner – architect, traffic engineer, specialist for technical networks and geographer too. Projects dealing with commercial retail areas are typical for their own features. It is important to take into account a high dynamics in this sector, because after achieving of certain degree of saturation happens the change of dynamics to qualitative one and the development is concentrated on the evolving needs in character and emplacement of sales areas.

Retail equipment in cities creates a basic and integral part of spatial structure of network of civil facilities. A harmonious arrangement of city functions is currently provided by self-governmental units by activities associated with territorial planning. Strengthening the position of local governments of municipalities or cities corresponds to European trend because just municipalities know a current and future situation in the best perspective. Own land-use planning may coordinate various development activities in the territory. In terms of proper use of division of power among the holders of land-use planning can be solved possible conflict situations and thereby achieve a consensus of interested parties. This process be influenced not only by experts but by civil public as well. It ensures a sustainable protection of natural environment and efficient utilization of landscape and its elements in accordance with the principles of sustainable development. One of the essential components of the land-planning documentation must be the assessment of impacts on environment (EIA – environmental impact assessment).

The EIA studies are also worked out in Slovakia and they mean reports and intentions focused on assessment of planned activities (such as retail activity) according to the methodology within the Act No. 24/2006 Coll. on assessing of environmental influences [24], [25], [26]. Besides the basic (input) analysis is the part of such project also a creation of summary of criteria for identification and selection of optimal alternative for proposed activity (including retail).

Public units of local self-government can influence formation and location of retail sales areas, respectively objects through various instruments such as a tax policy. Regulative competences were offloaded from government to self-governments and there are some legislative acts by Ministry of Environment of the Slovak Republic in a way of standards dealing with levels of minimal equipment of regional and district towns in the process of land-use planning documentation preparation and its processing.

5. STANDARTS IN LAND-USE PLANNING

Standard means a level of quality of satisfying the needs of inhabitants in certain time period. It is limited by economic opportunities, but it should cover also the needs of society. A proposal of standard of minimal level of equipment usually comes from the current legislation and analysis of potential economic development of the particular territory and its economic optimization. Standards as proposed indicators; issued by various directives and regulations; are applied in market economy to a lesser extent. On the other hand, the higher attention is paid to a normative indicator (in the form of regulative) in market economy [27]. The summary of standards for retail is shown in Table 3.

It is really remarkable that on the turn of millennium was predicted the level of retail development which was surpassed in a much shorter time. The Centre for Spatial Development [8] prepared for the purposes of the Government of the Slovak Republic a document where were designed standards of minimal measure of equipment in the level of 600 m^2 of retail sales areas on 1,000 inhabitants for all types of shopping venues – from supermarkets through specialized retail units to shopping centres.

There were also other conclusions that in accordance with the specifics of Slovak market (population density, size structure of municipalities, cities etc.) can be expected a development of large-area retail shopping destinations (such as hypermarket); in relation to the localization criterion of the size of settlement; in cities with more than 50,000 inhabitants. Those prognoses dealt with 11 Slovakian cities (Bratislava, Košice, Prešov, Žilina, Nitra, Trnava, Banská Bystrica, Trenčín, Zvolen, Poprad, Liptovský Mikuláš), where should be realized a construction of retail units of various sales area in order to support a sustainable development of retail network. Even those authors of land-use planning recommendations did not expect so fast development of retail facilities and consequent changes in territories.

Table 3: Summary of standards of retail equipment in municipalities in Slovakia

Retail in catchment area on the number of inhabitants	Floor area/1 inhabitant [m²]		Land area/1 inhabitant [m²]	
	In Slovakia	Abroad	In Slovakia	Abroad
1,000–1,500	0.26	0.70–1.20	-	-
5,000–7,000	0.42	0.80–1.70	0.42	0.1–0.2 ha
20,000–50,000	0.70–0.80	0.80–1.50	0.62	1.2 ha
60,000+	0.70–0.80	0.75–2.50	-	4.0 ha
Average	0.33–0.72	1.00	-	15.0 ha
Proposal of SEA*	0.60	-	-	-

*Source: Vitková, 2001, *SEA – Slovak Environmental Agency*

A local self-government can decide on the location of sales units just through land-use planning regulations and it has no power on influence on the merchandise structure of sales units at objects that are not in its ownership.

In some countries in Western Europe with the longer tradition of free-market functioning [1] is an important research group focused on the regulations and creation of criteria and rules for construction in retailing. [13] talk in more details about **Retail Impact Assessment (RIA) studies** in addition to traditional EIA projects. There are strict regulations in the United Kingdom [4] because utilization of land for new retail zones is allowed only on land identified for commercial development in land-use plan. [15] together with [16] claim that similar regulations have been introduced also in some post-communist countries. In Poland and Hungary are during the process of construction of retail units required not only EIA studies but RIA studies as well. Unfortunately, in Slovakia and Czech Republic the process of planning and regulation of new retail construction is still without strict limits. New localities are assessed on the self-governmental level based on individual decisions of municipal and city councils without any reference frameworks of planning of retail development.

6. CONCLUSION

Regulation, planning and preparation of legislative measures of development of local retail through new RIA studies are a reality in neighbouring countries such as Poland or Hungary. Geographical community should pay more attention to environmental impacts of spatial expansion of retail development in cooperation with RIA studies. An inevitable part in the process of differentiation of retail network in cities and regions is the ability of adaptation to the changes occurred in retail network and shopping behaviour which strongly corresponds to social status of customers. The mentioned changes have to be included to the contexts of urban or regional planning that have not been yet analyzed in association with growing social and spatial conflicts.

A local self-government can decide on the location of sales units just through land-use planning regulations and it has no power on influence on the merchandise structure of sales units at objects that are not in its ownership. In some countries in Western Europe with the longer tradition of free-market functioning is an important research group focused on the regulations and creation of criteria and rules for construction in retailing. Many authors talks in detailed way about Retail Impact Assessment (RIA) studies in addition to traditional EIA projects. There are strict rules in the United Kingdom for utilization of land for retail zones. Those are allowed just on land that is identified for commercial development within land-use plan. Similar arrangements have been introduced also in some post-communist countries. In Poland and Hungary are necessary during the process of construction of new sales units not only EIA studies but after tightening of conditions also RIA studies too. Unfortunately, in Slovakia and Czech Republic the process of planning and regulation of new retail construction is still without strict limits. New localities are assessed on the self-governmental level just according to the individual decisions of municipal and city councils without any reference frameworks of planning of retail development. Geographical community should pay more attention to environmental impacts of spatial expansion of retail development in cooperation with RIA studies. An inevitable part in the process of differentiation of retail network in cities and regions is the ability of adaptation to the changes occurred in retail network and shopping behaviour which strongly corresponds to social status of customers. The mentioned changes have to be included to the contexts of urban or regional planning that have not been yet analyzed in association with growing social and spatial conflicts.

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PREDOMINANT CAUSES OF MORTALITY IN TOWNS OF THE NITRA SELF-GOVERNING REGION

Katarína Vilinová[1]

[1] Department of Geography and Regional Development, Faculty of Natural Sciences, Constantine the Philosopher University in Nitra, Tr. A. Hlinku 1, 949 74 Nitra Nitra, Slovak Republic, e-mail: kvilinova@ukf.sk

ABSTRACT

The interest in studying health is being increased primarily with the changes of society, politics, and economy, but also due to environmental pollution. These changes are caused by an unhealthy lifestyle, stress, but also other factors that lead to several diseases. In the Nitra Self-governing Region there are 15 towns. Residents in the towns of the Nitra Self-governing Region died in 2011 mostly because of these diseases – circulatory system diseases, cancer, external causes, digestive system diseases, and respiratory system diseases. The paper analyzes the most common causes of mortality in towns of the Nitra Self-governing Region in 2011.

***Key words**: health status, mortality, circulatory system diseases, cancers, respiratory system diseases, digestive system diseases, Nitra Self-governing Region*

1. INTRODUCTION

Interest in health and population health status is currently being intensified especially in connection with many social, political, and economic changes and with increasing environmental pollution. Due to many demographic changes in recent years, in addition to the study of population health status in terms of mortality and sickness rate, the interest is being shifted into the study of health and finding indicators that affect health to the greatest extent.

2. AIM AND METHODOLOGY

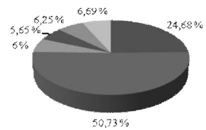
One of the reflections of population health status is its mortality rate at which not only the number of deaths, but also mortality causes are being assessed. In Slovak literature, this issue is elaborated mostly at the level of districts by the means of selected indicators such as mortality, selected mortality causes and others. In Slovakia, this issue is being dealt with e.g. by [9, 10, 11]. Topics of elaborating the population mortality, spatial differentiation and causation are dealt with by [7]. Chovancová [6] studies the relationship of mortality and population age structure at the level of districts of Slovakia. Global perspective through global diseases was analyzed by [4, 5], some cartographic aspects of the topic are shown in [2]. After 2001, the issue is being dealt with e.g. by [16, 17, 18, 19] who processes spatial disparities in mortality of selected types of diseases (e.g. circulatory system diseases, respiratory system diseases, digestive system diseases) at the level of districts of Slovakia. On the example of spreading the mortality of men from prostate cancer at the district level, this issue is analyzed in detail by [8]. Causes of death are to some extent influenced by various factors for example as age structure, in which Nitra Self governing Region analyzed [1, 3]. Furthermore, this poverty indicators which processes [13, 14, 15]. The aim of our paper is to assess the most common mortality causes in towns of the Nitra Self-governing Region (NSR) in 2011 and determine the typology according to the selected mortality causes. When processing this topic, the basis will be created by the database of the Statistical Office of the Slovak Republic.

3. MORTALITY IN TOWNS OF THE NITRA SELF-GOVERNING REGION

NSR includes 354 municipalities of which 339 are rural municipalities and 15 are towns/cities. According to population as of 12/31/2011 and in terms of size categories, there were large, medium, and small towns/cities in the region. The category of large and medium-sized towns/cities includes Nitra (78,875 inhabitants), Nové Zámky (39,585 inhabitants), Levice (34,649 inhabitants), Komárno (34,478 inhabitants), Topoľčany (27,124 inhabitants), Šaľa (23,440 inhabitants). In addition to these towns/cities in the region, there are 9 towns that were included into the group of small towns of the NSR [12]. These include the towns of Tlmače (3813 inhabitants), Želiezovce (7166 inhabitants), Hurbanovo (7740 inhabitants), Šahy (7607 inhabitants), Vráble (8983 inhabitants), Šurany (10,155 inhabitants), Kolárovo (10,683 inhabitants), Štúrovo (10,851 inhabitants), Zlaté Moravce (12,286 inhabitants).

In 2011, totally 3,053 inhabitants died in towns of the NSR. Urban population accounts for 40.3% share on the total mortality in the region. The most common causes of mortality for which residents in the towns/grapcities died were: circulatory system diseases, cancers, external causes, respiratory diseases, digestive system diseases. Together 2,868 inhabitants (2011) died because of these five causes of mortality in towns/cities of the region representing 93.9% of the total mortality of the urban population in the NSR. The remaining share was represented by other causes of mortality such as genitourinary system diseases, diseases of the nervous system, eye, and ear, but also other diseases. Overall, because of this group of diseases, 185 inhabitants (6.1%) died. More than half of the total mortality of the towns/cities in the NSR was due to circulatory system diseases (50.73%) which can be seen in fig. 1. In 2011, 1,522 inhabitants of the urban population in the NSR died from this disease. The second highest share of mortality concerned cancers representing 24.68%. Because of external causes of mortality, 199 inhabitants died in towns/cities of the NSR representing 6.25% of the total mortality. External causes were followed by respiratory system diseases accounting for 6.00% of the total mortality in towns/cities of the NSR. During this period, 186 inhabitants died due to respiratory system diseases. The smallest proportion of mortality from the major causes of mortality was recorded in the group of digestive system diseases. In this year, 177 inhabitants died due to this group of diseases which is 5.65% of the total mortality of towns/cities. Other causes of mortality of urban population accounted for 6.69% of the total mortality. It is obvious that circulatory system diseases and cancers had significantly higher proportion of mortality out of the total mortality in the towns/cities of the NSR as other causes of mortality in these towns/cities.

a) in towns/cities of the Nitra Self-governing Region



b) in the Nitra Self-governing Region (2011)

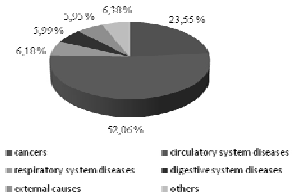


Figure 1: Share of the main causes of population mortality out of the total mortality in 2011
Source: Population Change in the Slovak Republic (2011), Statistical Office of the Slovak Republic, elaborated by Vilinová

Similarly, as in the whole NSR, mortality from circulatory system diseases dominated also in towns/cities of the NSR. This was the most frequent disease in towns/cities of the NSR and this cause of mortality recorded also the highest proportion out of total mortality in towns/cities of the region. Because of the circulatory system diseases, a total of 1,522 residents died in towns/cities of the NSR in 2011 which is more than half of the total mortality of towns/cities of the NSR (Fig. 2). The worst situation in mortality from this disease was in the town of Hurbanovo (9.9 ‰) which is more by 4.7 ‰ compared to the average value of the region. This town is followed by the towns of Kolárovo and Šahy (Fig. 3). The town of Vráble recorded the lowest mortality from this disease (3.56 ‰). Cancers, as the second main cause of mortality, occurred mostly in the towns of Tlmače (3.4 ‰), Šurany (3.3 ‰), and Hurbanovo (3.10 ‰). The average value recorded in the towns/cities for this disease was 2.87 ‰. Similarly, as with the mortality from circulatory system diseases, the town of Vráble preserved a very favorable position with the value of 1.56 ‰ (fig. 4). The third main cause of mortality (external causes) dominates in the mortality of these three towns – Kolárovo, Štúrovo, Šaľa. In each of these towns, the value of mortality from this disease reached more than 1 ‰. This value is higher than the average value of towns/cities due to this cause of mortality (0.87 ‰). On the contrary, the situation in mortality from this cause of mortality is very favorable in the towns of Želiezovce, Šurany, and Šahy.

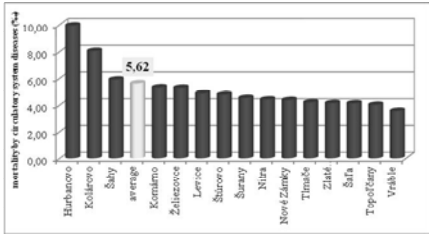


Figure 2: Number of deceased residents due to circulatory system diseases in the towns of the Nitra Self-governing Region (2011)

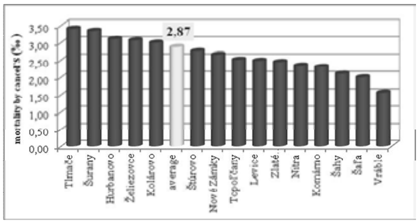


Figure 3: Number of deceased residents due to cancers in the towns of the Nitra Self-governing Region (2011)

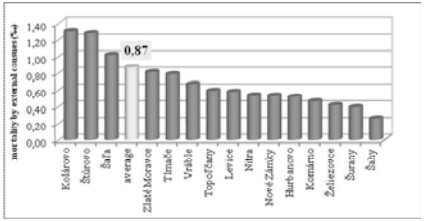


Figure 4: Number of deceased residents due to external causes in the towns of the Nitra Self-governing Region (2011)

The number of deceased from the respiratory system diseases is significantly lower compared to the previous three causes of mortality in towns/cities of the NSR. In towns/cities this disease is the fourth most common disease that causes mortality of the population. This cause of mortality was predominant in the town of Hurbanovo (1.2 ‰). It was followed by the towns of Želiezovce and Kolárovo (Fig. 5).

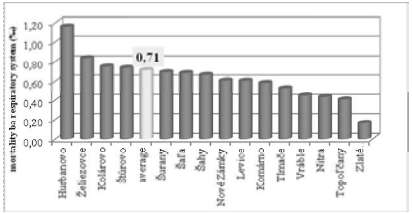


Figure 5: Number of deceased residents due to respiratory system diseases in the towns of the Nitra Self-governing Region (2011)

The fifth main cause of mortality observed in towns of the NSR was mortality from digestive system diseases. In the studied year, 199 inhabitants died due to this disease. The mortality rate of this disease is predominant in the towns of Šurany, Hurbanovo, and Tlmače. In these towns, mortality recorded a value of 0.79 ‰ in the Tlmače Town up to 0.98 ‰ in the town of Šurany. As we can see in fig. 6, the least inhabitants died because of digestive system diseases in the towns of Topoľčany, Kolárovo, and Vráble.

Mortality from the five most frequent causes of mortality varies in the towns of the NSR. Except from the towns of Komárno and Šaľa, only small towns dominated in the mortality of these most common causes. It is apparent also from Table 1.

A closer look at the different towns of the NSR says that three towns – Hurbanovo, Kolárovo, and Želiezovce have a very unfavorable position out of all towns. For example, the town of Hurbanovo maintained the first place in two causes of mortality (circulatory and respiratory system diseases). In the town of Kolárovo, external causes take the first place and the circulatory system diseases take the second position. The second group of towns consists of the towns of Šurany and Tlmače because these towns appeared three times in the studied period. In the town of Tlmače, residents died mostly because of cancers while in the town of Šurany, it was dominated by digestive system diseases. In addition to these towns, the forefront places in mortality for the most common causes of mortality were taken by these towns – Štúrovo, Šahy, Šaľa, and Zlaté Moravce.

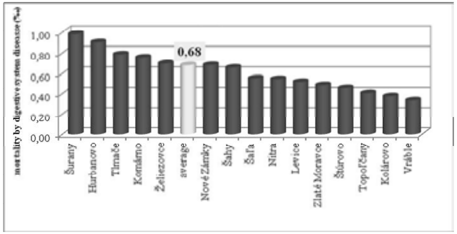


Figure 6: Number of deceased residents due to digestive system diseases in the towns of the Nitra Self-governing Region (2011)

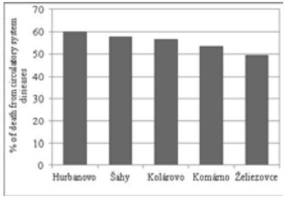
Table 1: The ranking of towns of the NSR in the five most common causes of mortality (2011)

Disease	Towns				
	1 position	2 position	3 position	4 position	5 position
Circulatory system diseases	Hurbanovo	Kolárovo	Šahy	Komárno	Želiezovce
Cancers	Tlmače	Šurany	Hurbanovo	Želiezovce	Kolárovo
External causes	Kolárovo	Štúrovo	Šaľa	Zlaté Moravce	Tlmače
Digestive system diseases	Šurany	Hurbanovo	Tlmače	Komárno	Želiezovce
Respiratory system diseases	Hurbanovo	Želiezovce	Kolárovo	Štúrovo	Šurany

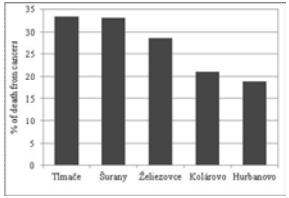
Source: Population Change in the Slovak Republic (2011), Statistical Office of the Slovak Republic, elaborated by Vilinova

In terms of percentage representation of mortality from circulatory system diseases, the highest proportion of mortality from this disease was recorded in the town of Hurbanovo with 60.1% (Fig. 7a). The town of Hurbanovo was followed by the town of Šahy (57.7%), Kolárovo (56.5%), Komárno (53.4%), and Želiezovce (49.4%). Cancers, as the second main cause of mortality, occurred mainly in the towns of Tlmače and Šurany with more than 30% share on the mortality of these towns (Fig. 7b). In addition to these towns of the NSR, high shares can be observed in the towns of Želiezovce (28.6%), Kolárovo (21.1%), but also Hurbanovo (18.8%). The highest proportion of mortality from external causes was reached in the town of Štúrovo with 12% (Fig. 7c). Among the first places in the range of 10-12% were the towns of Šaľa and Zlaté Moravce. The digestive system diseases were the most common cause of mortality in the towns of Šurany, Tlmače, Komárno, Želiezovce, and Hurbanovo (Fig. 7d). Mortality from digestive system diseases in the town of Šurany reached 9.7%. From this group of towns, the lowest level was recorded in the town of Hurbanovo – 5.5%. The group of the most common causes of mortality is concluded by the respiratory system diseases. Regarding this cause of mortality, the highest share was recorded in the town of Želiezovce which reached 7.8%. More than 7% share on mortality from respiratory system diseases was recorded in the town of Hurbanovo. The first five places are concluded by the towns of Šurany, Štúrovo, and Kolárovo (Fig. 7e).

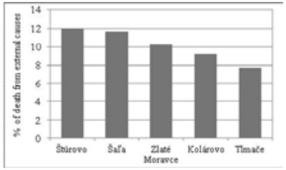
a) circulatory system diseases



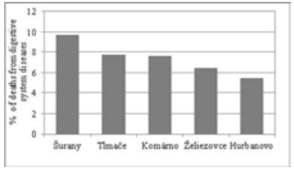
b) cancers



c) external causes



d) digestive system diseases



d) respiratory system diseases

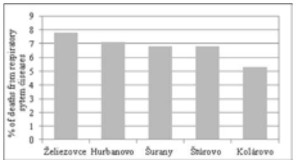


Figure 7: Percentage representation of the most common causes of mortality in selected towns of the Nitra Self-governing Region (2011)

In terms of percentage share of the most common causes of mortality, the towns of the NSR can be divided into two groups. The first group contains towns which gained above-average values in three causes of mortality and below average values in two causes of mortality. This group was, in terms of dominance of the percentage share of five causes, divided into four types (A, B, C, D).

Type A is dominated by high values of mortality from – circulatory system diseases, cancers, and external causes. The situation is more favorable in mortality from digestive system diseases and respiratory system diseases. This type is specific to the town of Zlaté Moravce. The towns of Vráble and Šahy were assigned type B. This type is characterized by the high mortality rate from circulatory system diseases, external causes, and respiratory system diseases. The positive fact may be considered below average values of mortality from cancers and digestive system diseases. The type C is characterized by high levels of mortality from cancers, external causes, and digestive system diseases. Regarding other causes of mortality such as circulatory system diseases and respiratory system diseases, we recorded below average values. This third type was assigned to the towns of

Tlmače, Šurany, Želiezovce, and Nové Zámky. This group is concluded by the type D which is specific by the dominance of mortality from external causes, digestive system diseases, and respiratory system diseases. In this type, we recorded favorable values of mortality from circulatory system diseases and cancers. Type D was characteristic for the town of Šaľa.

In terms of number, the first group is larger than the second group because eight towns of the region were assigned into this group. These are mostly small towns with the exception of the town of Nové Zámky. From all studied towns in the first group, the most unfavorable position is the town of Zlaté Moravce. Its particularity is an above average level in the three most common causes of mortality (circulatory system diseases – 50%, cancers – 29.4%, external causes – 9.8%). It is followed by the towns of Vráble, Šahy, Tlmače, Šurany, Želiezovce, Nové Zámky where the percentage share of mortality from the most common causes of mortality is different. The first group is concluded by the town of Šaľa which was significantly dominated by the mortality from external causes, digestive and respiratory system diseases.

The second group contains towns where the situation is more favorable in terms of mortality from the most common causes of mortality. In two causes of mortality in these towns, we recorded an above average level and below average level was recorded in three causes of mortality. Similarly, as in the previous group, we determined three types (A, B, C). In the town of Štúrovo, mortality from external causes and respiratory system diseases dominated. Conversely, mortality due to circulatory system diseases, cancers, and also digestive system diseases recorded more favorable levels and thus this town was assigned the type A. Type B is characterized by the dominance of mortality due to circulatory system diseases which is added by the second cause of mortality (respiratory system diseases, digestive system diseases, and external causes). Positive can be considered the fact that cancers maintained below average values of mortality in this type. This type was assigned to the towns of Levice, Hurbanovo, Komárno, and Kolárovo. Type C is specific for the high levels of mortality due to cancers, but also digestive system diseases and external causes. Below average values were recorded in the mortality from circulatory and digestive system diseases. Type C was typical for the Nitra City and Topoľčany Town.

4. CONCLUSION

Towns/cities of the Nitra Self-governing Region have, in terms of mortality from the five most frequent causes of mortality, different position which is based on their classification into two groups. The first group was characterized by four types and the second group was assigned 3 types. After we created the typology, the first group, which was dominated by above-average values of three causes of mortality, included rather small towns of the region such as Vráble, Šahy, Tlmače, Šurany, Želiezovce, and others. The town of Zlaté Moravce is a part of this group which was identified as the town with the worst status regarding the most common causes of mortality. This town is characterized by the dominance of mortality due to circulatory system diseases, cancers, and external causes. In terms of the created typology, the most favorable position retained in the town of Štúrovo. In this town, significantly below average values of mortality from circulatory system diseases, cancers as well as digestive system diseases were maintained. Besides this town, the created group included also the city of Nitra and towns of Topoľčany, Hurbanovo, Levice, Komárno, and Kolárovo.

ACKNOWLEDGEMENT

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POSTINDUSTRIAL LANDSCAPE IN CASE STUDY OF ROSICE-OSLAVANY MINING REGION

Libor Lněnička[1]

[1] Department of Geography, Faculty of Education, Masaryk University, Poříčí 7, 603 00 Brno, Czech Republic, e-mail: lnenicka@ped.muni.cz

ABSTRACT

The change of social, political and economic system in the Czech Republic after 1989 brought changes in national industry (structure in employment, ownership etc.). The subjective perception of the landscape from the perspective of local residents, environmental changes from the perspective of public administration and changes in quality of life presented by improving the technical infrastructure of cities from the perspective of the private sector are an important expression of change in post-industrial landscape. The aim of this paper is to present the results of survey, which took place in Rosice-Oslavany region. The main objective of the study was to determine how people perceive the closure of industrial activities and impacts on the surrounding landscape of Rosice-Oslavany region.

Key words*: Post-industrial landscape, Rosice-Oslavany region, coal, mining industry, environment, research, Czech Republic.*

1. INTRODUCTION

The landscape is a long-term stabilized set of natural and anthropological characteristics bound to a specific relief and having a common historical background (European Landscape Convention, 2004). Different approaches and historical developments in the landscape have also brought different perspectives on the landscape structure. The subsequent description and the landscape structures take place on three levels (Kučera, 2009) – landscape as an observed scenery, landscape as a territory and landscape as a specific unit. The last approach is the perception of the landscape as a complex with a certain internal structure. Localization elements often occur within the primary natural structure in the post-industrial landscape. Such elements predetermined the previous industrialization endeavors of the landscape in terms of its natural wealth – deposits of black, brown coal, iron ore non-ferrous ores, water resources etc.

Unused, devastated and reclaimed areas related to industrial or agricultural production or its residues are identified within the secondary structures (Cílek, 2002). In the tertiary structure, there are social restrictions but also the interests of developing countries. Within the quaternary structure of the landscape local residents mention certain feelings of sadness, nostalgia, loneliness and silence. But on the other hand, there is the perception of a beauty of the anthropogenically created shapes that belong to elements of an industrial nature (overgrown dumps, quarries, buried mining shafts). The view of the spiritual structure of the landscape is reflected in a different conception of the subjective perception of local residents who perceive daily changes in the landscape. This approach is very important for preserving the genius loci of each landscape. It is essential to perceive the landscape as a whole; therefore, a spiritual site has an important role. The spirit of the space is filled with approach and the deeds of those who manage, build, administer and use it (Marsh, 2010).

Industrial nature can be defined as nature which is being developed under a strong predominant influence of industrial activity and usually starts from the initial state of the colonization of bare areas, such as ponds, heaps and former industrial areas (Cílek, Mudra, Ložek et al., 2004). Thus defined, industrial nature is different from the nature of overgrown, neglected quarries, in that the quarries are often surrounded by more or less natural forests, while industrial areas are usually almost entirely cut off from surrounding systems by roads and buildings. Industrial nature is usually the most interesting during its early stages of succession which can change rapidly. It is a dynamic system, changing in many ways from a nasty dump into an interesting steppe, followed by uninteresting shrubby forest. The first experiments dealing with the perception of the landscape were undertaken by foreign authors, for example Bonaiuto (2002), Paasi (2002), Cosgrove (1998), Cosgrove, Daniels (1988) or Golledge, Stimson (1997). Czech authors dealing with the perception of landscape are represented by Hynek (1983).

“Industrial landscapes” which have been made by industry and now are abandoned may be characterized by a number of specific attributes describing relics of the past period known as the “post-industrial landscape”. Post-industrial landscape is characterized by the presence of the following elements (Kolejka, 2006):

- abandoned areas of industrial or agricultural activities, called brownfields,
- anthropogenic shapes created by the previous land use,
- devastated areas,
- reclaimed areas,
- land use type: built-up area, industrial area and agricultural area,
- higher unemployment, increased social exclusion as a result of the canceled production.

Changes in the perception of an industrial landscape in transition to a post-industrial landscape are also a reflection of the economic transformation of the late 20th century. A significant element of this transformation was to reduce heavy industrial production to a minimum (end of mining activities, recycling, etc.) and to focus on new kinds of industrial production (especially the electronics industry, industry of building materials, etc.). This had obvious impacts on the landscape and its character.

An example of the impact of structural changes on the fragmentation of the landscape is the post-industrial landscape. The Rosice-Oslavany region meets the definition of a post-industrial landscape: its industrial use began because of rich coal deposits from the perm-carbon age. Originally an agricultural landscape, it has undergone a dynamic change after the discovery of recoverable reserves. Within less than fifty years there has been a significant interference with the functioning of the existing system landscape. A distinctive feature of the industrialization of the landscape is the transformation that took place over a relatively short period of time. In the Rosice-Oslavany region the fundamental aspect of the transformation was the discovery of significant areas of coal (in 1760 at Padochov, in 1783 coal mining was launched in Oslavany and industrial exploitation north of Zbýšov occurred in the early 19th century). The transformation of the landscape was not purely industrial, but it was also in order to ensure amenities for the workers and employees of the mines, especially the construction of workers colonies and dormitories. This is evident in Oslavany, Zbýšov and even in the village of Zastávka, which was founded in 1840 on a Greenfield site as a center of mining and metallurgy. The gradual restructuring of the local economies, with obvious impacts on the landscape, has been evident in Western Europe since the 1970s (Plchová, 1999). Changes in the perception of the industrial landscape transition to a post-industrial landscape are also a reflection of the economic transformation of the late 20th century. An important element of the transformation was to reduce heavy industrial production to a minimum (end of mining activities, recycling, etc.) and to aim at new kinds of industrial production (especially the electronics industry, industry of building materials, etc.). Most of these changes occurred in large industrial areas where there was a decline of the heavy industry, and all of its subsequent activities (housing, transport, etc.), were phased out. Reduction and displacement of heavy industry led not only to changes in landscape spatial composition but especially to the vast social and economic changes in the territory. The Rosice-Oslavany region was not an exception. Consequently, during the 1990s this led to abandonment and deterioration of many of the buildings and, moreover, to the gradual disruption of mining, communications and industrial landforms (Kolektiv autorů, 2004).

2. LOCALIZATION OF RESEARCH AREA ROSICE-OSLAVANY

The area of interest in this example case study is the Rosice-Oslavany coal mine district. The Rosice-Oslavany region is situated about 18 km southwest of the city of Brno.

Its length extends approximately 10 km between the villages of Zastávka and Rosice in the North and Oslavany in the South (Fig. 1).

The Rosice-Oslavany region mine is the oldest coalfield in the Czech Republic. The mining of coal began in 1755 and it finished in 1992. It lasted almost 240 years. The mining area is situated in the Boskovice Graben, which is filled by a complex of Upper Carboniferous-Permian sediments. The Boskovice Graben unit is a limnic Permo-Carboniferous sedimentary basin. The intrabasinal complex is mostly represented by cyclically arranged fluvial to fluviolacustrine sediments (arkoses, sandstones, siltstones, claystones and micritic carbonates). The mining activities were concentrated along the western boundary of the graben, in a zone about 10 km in length and 2 km in width. Extensive mining activity caused significant changes in the groundwater flow condition (Oslava and Bobrava rivers). In the Rosice-Oslavany district the coal area contained three main seams and several minor seams. Only two seams were usually mineable throughout the whole extent of the district; the other seams were exploited only locally (Pešek, 2004).

The decision to stop mining coal in the Rosice-Oslavany district was made because of the great depths to which the mines had been excavated, coupled with consideration of negative climatic conditions, the complex geological constitution of the coal bed, the danger of possible methane leakage, and the danger of the coal self-igniting.

Figure 1: Rosice-Oslavany region on the map of the Czech Republic.
Source: J. Kolejka, 2006

3. METHODOLOGY OF RESEARCH

The basic premise of qualitative research was a need to determine the local people's perception of the changes in the landscape in the Rosice-Oslavany region. A questionnaire survey was chosen as the most effective method to obtain direct data. To answer the research questions an adequate deductive (explanatory) research method was chosen, as it was possible to gather a set of variables depicting changes in the post-industrial landscape – the Rosice-Oslavany region – and to indicate the variables mentioned above. Depending on the nature of the variables, with an emphasis on the generalizability of the results, a quantitative research strategy was deployed. As a research tool, a questionnaire was chosen because this technique enabled the survey to obtain data in the appropriate range and quality of questioning and could be done within one calendar month. Therefore, distortion of data collection over a longer period of time was avoided. The costs of collecting and processing data were found to be reasonable. The main objective of the research was to *find out how citizens perceive the closure of industrial activities and impacts on the surrounding landscape and their living conditions, to find out how citizens evaluate the consequences of the industry deviation.*

In the first step of research basic research question was defined:

What has changed the genius loci of post-industrial landscape in the Rosice-Oslavany region?

In next step the three hypotheses were defined:

- H1: The diversion of the Rosice-Oslavany region from industry has caused changes in the environment in this area.
- H2: Due to the diversion of the Rosice-Oslavany region from industry, changes have taken place in the techno-economic community amenities of this locality.
- H3: The diversion of the Rosice-Oslavany region from industry has caused changes in the socio-cultural life of the population in the surveyed localities.

This paper describes only the results of the environmental area; therefore, results and discussion in this paper are focused only on the first hypothesis. The results of the next two hypotheses might be described in another paper.

The unit of exploration was the territory covered by the cadastre of observed post-industrial municipalities in the Rosice-Oslavany region: Babice, Kratochvilka, Neslovice, Oslavany, Rosice, Tetčice, Zakřany, and Zastávka a Zbýšov. The territory of all the municipalities in the surveyed area was included in the selection of the units surveyed. The units of the survey were inhabitants (15 years old and older) of the aforementioned municipalities, as the researchers drew on the assumption that the inhabitants of a municipality are able to assess changes in the variables of interest.

Data were collected by trained interviewers – students from the Faculty of Social Studies at Masaryk University in Brno- in November 2009 in all nine municipalities of the post-industrial landscape Oslavansko-Rosicko. (Babice, Kratochvilka, Neslovice, Oslavany, Rosice, Tetčice, Zakřany, and Zastávka a Zbýšov). The sample only included respondents who indicated a place of the residence in one of the above mentioned municipalities. The sample consists of 495 respondents, about 2.5 % of the target population as of 1 January 2009. The percentage of respondents has been considered sufficiently representative because the population of the mentioned municipalities is 20,358 residents.

The sample of respondents included 49.4 % women and 50.6 % men, which corresponds to the distribution in the target population. Emphasis was also placed on the age composition of the sample; all four age groups (15–30 years old, 31–45 years old, 46–64 years old, 65 years and over) were equally represented. The selection of respondents cannot be considered purely random, as a list of all the monitored area residents older than 15 years old was available. The resulting sample was partly influenced by self-selection, since respondents had the opportunity to refuse participation in the survey. A possible distorting effect on the results of the research was minimized by placing the emphasis on the proportional representation of men and women in the sample by age and, moreover, by including all possible occurance sites of specific groups of respondents: in flats and houses, in shops, offices, the local traffic stops, in public places and other institutions. The research was conducted both on weekdays and during weekends, which ensured the inclusion in the sample of respondents who were in their place of residence (such as those who stay there only at weekendsas well as those who inhabit the individual municipalities only during the working week). In this way, the highest possible representativeness of the sample has been achieved. The survey was anonymous and participation of respondents was voluntary, therefore, research ethics were upheld. Completion of the questionnaire took about 15–25 minutes. The questionnaire contained information on socio-demographic characteristics of the respondents (independent variables: respondent's place of residence, gender, age, occupation, education and housing type). The questionnaire contained only closed questions. Investigated dependent variables were sorted into nine thematic areas according to the fundamental indicators of change in the post-industrial landscape (air cleanliness, water quality, condition of public areas and land sites in and outside the community, technical and economic community facilities, job opportunities in the community, availability of institutional services, availability of educational institutions and opportunities of cultural and sports activities). The indicators were divided into three sections of the questionnaire (environmental, techno-economic area and the socio-cultural area).

4. SELECTED RESULTS OF THE SURVEY OF ENVIRONMENT

The impacts of industrial activity in the Rosice-Oslavany region may be observed continuously. Without the intervention of people (the inhabitants of the region) and the initiative of local institutions (associations, municipalities, cities, microregions, voluntary associations, as well as businesses) subsequent regeneration of the landscape that is dealing so aggressively with the consequences of heavy industry would never have occurred. The first area concerning the environment that was explored was air cleanliness. Overall, respondents clearly noticed a positive change. 256 respondents (52.1 %) are convinced that air cleanliness has improved. This is associated with the termination of mining activities, therefore, the cleanliness around the mine shafts and mining pits is improving significantly. 159 respondents (32.4 %) are convinced that the air cleanliness around them has changed and 10.4 % think that it has deteriorated. Most people perceive deterioration of air cleanliness in the communities in which the strong industrial tradition has not been completely closed down. But in which activity has been reduced or transferred to another production area. In terms of air cleanliness in the various municipalities of the region, the views of the local population confirmed differentiation in access to the primary sources of pollution.

From the respondents' point of view, the greatest deterioration of air cleanliness is evident in the village of Tetčice, where the woodworking industry is currently located. Tetčice has not been significantly affected by the mining industry, however, the mining industry indirectly impacted its development. In 1852–1855 the railway from Brno was built and brought the village not only a few job opportunitiesand a convenient connection to the center of Brno, but also substantial changes in the appearance of the village. The rail link and the station position were the main elements in the establishment of the wood processing industry. The only major industrial company in the village with a tradition of more than 50 years is a sawmill. Its operator is the South Moravian Timber Plant based in Brno. According to the Czech Hydrometeorological Institute, Tetčice is classified among the areas with deteriorated air quality with regard to the limit values for health protection, although, according to the server Cenia there is not a stationary source of air pollution in the municipality. The problem is also caused by road transport. 25 % of the respondents reported a decline in air quality due to changes in the number of motor vehicles. Road Class II/394 passes through the village in the direction of Rosice – Tetčice – Neslovice – Ivančice. Other significant worsening of air cleanliness has been recorded in Rosice. Rosice is located approximately 20 km west of Brno in a convenient traffic location on the Třebíč – Brnoroad close to the D1 Prague – Brno – Vyškov – Hulín – Přerov – Lipník n. Bečvou (section D1 Mirošovice – Kývalka) motorway and the Brno – Jihlava railway. The main source of air pollution in the built-up area of Rosice currently involves just the main roads. A problem similar to that in Rosice may be the air recorded in the village of Zastávka (17.5 % rated it negatively) and also in the village of Neslovice (20.7 % rated it negatively). The source of pollution in Neslovice is also road transport (Road II/394 in the direction of Rosice – Tetčice – Neslovice – Ivančice). The solution for the affected communities would be the construction of bypasses; which are planned in case of Zastávka (consideration of a southern bypass) and Tetčice. Their realization, however, face many nature and landscape protection issues (stops at the local bio-corridor and undermined areas at location in Tetčice Bobrava Natural Park or the existence of a water source protection zone, the Neslovice agricultural land fund and property involvement). However, a positive impact of the changes in transport in Tetčice is seen by 16.7 % of the respondents.

If we evaluate the air cleanliness in municipalities located in the post-industrial landscape, we encounter many interesting observations made by local residents. The most crucial is regarding the termination of mining activities between 1980 and 1990 and of industrial production in the region and the subsequent emergence of entirely new industrial activities in the region. According to the respondents, a positive effect of the termination of mining and the subsequent processing of raw materials is evident in all municipalities that used to be mining centers. In Oslavany 83.3 % of the respondents evaluated the end of mining positively and only 5 % expressed their negative attitude. Adaptations of residents to new conditions in terms of job opportunities are presented in Oslavany not only by localization of major industrial enterprises in the industrial zone but also in the former Vaclav Nosek Mine. In terms of reestablishment of industrial complexes in Oslavany, the town's most used one is the northern industrial area (former Václav Nosek Mine), where a successful company, Strojírna Oslavany, has its headquarters. The company specializes in the manufacture and repair of hydraulic shock absorbers for rail vehicles. In 2010 it employed 150 workers. Even the industrial zone of southeastern Oslavany went through restructuring steps in the 1990's. An area of 7 739 square meters occupies only 1.2 % of the total area of the entire industrial zone; however, it is one of the most serious problems, which has no solution currently. The closure of a power plant in Oslavany meant the emergence of large abandoned areas as well as the loss of employment for 450 people from Oslavany and the surrounding area (Kyselák, 2002). 89 % of the entire southeastern industrial area is currently used by private entities, as well as the public administration. For example the town of Oslavany owns landwhich is used for water reservoirs and rented for breeding fish. Prefa Brno has its major business location in reused industrial buildings and land. The company built its plant on almost 5 hectares of land in 1960 and it is currently one of the most important employers in the town and region (approx. 300 employees). The production of the company is based on the gradual processing of the slag heap (3.09 ha), which served as storage space for loose slag from power plants. The heap is now the property of Prefa and the slag is gradually being used to produce concrete blocks, curbs and paving.

Another municipality in the region where the end of industrial production has brought an initial positive effect is the town of Zbýšov. The closure of the mines in the early 1990's had a significant impact on the life of the population. 1,000 local residents worked in the Henry II Mine and Samson. As a result of mining and development new amenities had been built in the village of St. Martin's Church (1893), a school, post office, Mining House (1924), residential buildings, health center, kindergarten and several new shops. With the end of mining, many people lost their jobs, but almost 70 % of the laid off inhabitants were hired by newly founded companies. The village of Zastávka belongs to the northern part of the district. As the only municipality of the region it was founded “on a Greenfield” mainly due to the discovery of coal in 1875. Zastávka Ironworks, which used local coke, contributed significantly to the development of the village. Three groups of apartment houses were built for the new workers and miners – Stará (1853), Hutní a Nová both (1862). Zastávka, therefore, became a center of mining life.

The building of the railway between Brno and Zastávka with the continuation to Jihlava (today's route No. 240 Brno – Jihlava) has contributed to the development of the community. It was one of the first Czech local railways. Coal mining was terminated in 1992. 60 % of the respondents confirmed a positive impact as a result of the mining termination, while only 1.8 % of the respondents reported a negative effect. Only 1.7 % of those surveyed evaluated positively the emergence of new industrial production in Zastávka, more respondents (10.2 %) evaluated the penetration of new industrial activities adversely. Barka Ltd., which is a major company located in Zastávka, focuses on buying raw materials and waste recycling (Fig. 2).

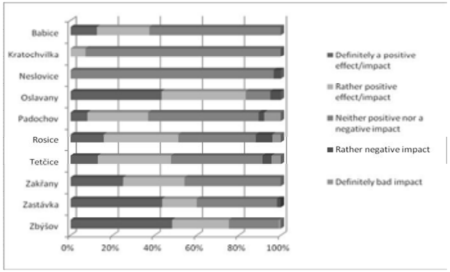

Figure 2: Termination of the original industrial production in the municipalities of Rosice-Oslavany.
Source: Interview Survey, 2009

At present, the company provides jobs for 25 employees. River and water management activities are an interesting indicator of environmental quality in the region. The Rosice-Oslavany region basin forms the western edge of the Boskovice furrows, about 15 km from the city of Brno. The Oslava River in the south and the Bobrava River in the north are the two major rivers within the region. The network is complemented by lower water flows (Balinka River, Říčany Stream, Neslovice Creek, Ketkovice Stream or Habřina Stream). The quality of water in the rivers in the region has been significantly influenced by the industrial mining activities. On the opinion of the quality of the watercourses in the region, 121 respondents (30.3 %) perceive the change positively, while 70 respondents (17.5 %) perceived a negative deterioration. 51.9 % think that the quality of the watercourses has not changed (Fig. 3).

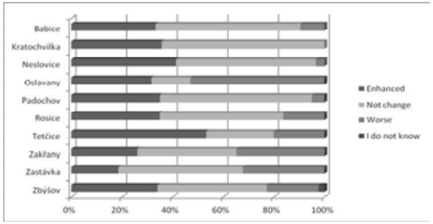

Figure 3: The quality of water in rivers in the municipalities of the Rosice-Oslavany region.
Source: Interview Survey, 2009.

By changing the socio-political processes after 1989, municipalities took advantage of the possibility for successive reconstruction of public spaces. The above survey shows that 341 respondents (71.3 %) clearly evaluate these changes positively.

Making public space open to citizens has required the introduction of separated waste collection, and especially larger cities have invested considerable funds in the building of waste disposal services or introduced container waste collection. In all municipalities of the region there is a system of waste sorting. Containers for paper, plastics, glass (white and colored) and other mixed waste are the essential collection containers placed in all municipalities. The biggest changes are seen in smaller municipalities where a waste sorting system has not been introduced. In Padochov (82.5 %), Zakřany (100 %) and Neslovice (87.1 %) of the respondents perceive the changes positively. On the contrary, Oslavany (33.3 %), Rosice (23.6 %), Tetčice (19.4 %) or Zastávka (12.7 %) show a neutral approach to this place (apart from Tetčice, where residents use the collecting yard in Rosice) (Fig. 4).

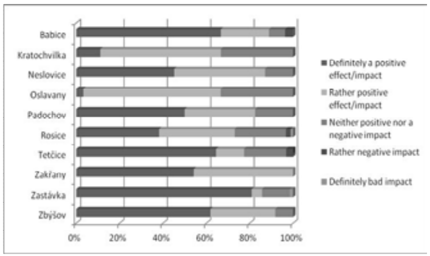

Figure 4: The introduction of collection points (containers) for separate waste in municipalities of the Rosice-Oslavany region.
Source: Interview Survey, 2009.

5. DISCUSSION AND CONCLUSION

Without the intervention of people (the inhabitants of the region) and the initiative of local institutions (associations, municipalities, cities, micro, voluntary associations, as well as businesses) subsequent regeneration of the landscape that is dealing so aggressively with the consequences of heavy industry would never have occurred. The major areas where changes in industrialization can be observed concern the environment. Air cleanliness, the condition of the rivers, the State of the land fund, etc. signify the main areas where most people perceive the changes. The landscape of the region has experienced a significant transformation in the last 57 years. The original industrial landscape, with a strong dominance of extractive industries, has turned into a post-industrial landscape. The closure of the strategic industrial companies and the termination of the exploitation and processing of coal and other related materials has meant for many people not only attenuation economic action (job loss), but also a change in the perception of the landscape. The characteristic features of the industrial landscape disappeared from 1993 to 1996 and, therefore, only memories remained for many of the residents. The transformation of the landscape was amplified with an open view to west into the valley of the Oslava River from Oslavany Old Mountain. From the top of this landmark, the residents of Oslavany may observe changes in the industrial complex which alter gradually every day. Not only long-term changes (state buildings and other properties – decay, reconstruction, etc.), but also short-term changes (reducing the bulk slag heap) mean daily change in the perception of the landscape. Genius regionis historical memory is enhanced by the very country where the natural landscape transformation in the industrial landscape represented a major intervention in the 18th century (Vencálek, 2007). Despite all the synergies that have been achieved during industrialization, persist in people's memories until today. The current use of industrial areas by private companies (the industrial complex in southeast Oslavany, industrial zone in Zbýšov, industrial area in Zastávka) demonstrates an excellent ability to adapt to new business conditions. The only factor that is endangered in the future is the railway infrastructure. The railway in the northern part of the region (line No. 240 Brno – Jihlava) and the link which connects the region through the southern route No. 244 Brno – Oslavany are crucial not because of personal transportation, but mainly due to freight transportation. Loss or restriction of this operation would increase freight trucking, which may again have a negative impact on the environment. Based on analysis of the results of the research, hypothesis Nr. H1 was confirmed.

ACKNOWLEDGEMENT

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POPULARITY OF GEOGRAPHY BY STUDENTS OF THE FACULTY OF NATURAL SCIENCES CONSTANTINE THE PHILOSOPHER UNIVERSITY IN NITRA AND THEIR KNOWLEDGE ABOUT EMPLACEMENT AT THE LABOUR MARKET

Hilda Kramáreková[1] and Ján Morvic[1]

[1] Department of Geography and Regional Development, Faculty of Natural Sciences, Constantine the Philosopher University in Nitra, Trieda Andreja Hlinku 1, 949 74 Nitra, Slovak Republic,
e-mail: hkramarekova@ukf.sk

ABSTRACT

The paper deals with the results of selected questions from the questionnaire survey reflecting a perception of the Faculty of Natural Sciences, Constantine the Philosopher University in Nitra (hereinafter referred to as "FNS") by students attending the 1st year of various study programmes, which was realized in September during academic years 2011/12 and 2012/13. The first issue is popularity of geography by FNS students and also by students attending only geographical study programmes. The second part is focused on the students' knowledge about emplacement at the labour market, respectively knowledge about experts from the field they study. At the end, there is presented a relation of acquired information to the process of education and labour market.

***Key words**: geography, popularity, labour market*

1. INTRODUCTION

Each of scientific fields is currently in the process of competitive struggle for financial and human resources. Science that is perceived as a relevant element within the society has much better outlooks for obtaining them. Therefore, every scientific community face questions how to present its contribution for society and population in a comprehensible way and how to attract an interest of young and talented people for studying them [5]. The same, of course, is connected with Geography, which perception is very specific because of insufficient publicity in media and propagation of its results. These facts have had a significant impact on the interest to study Geography and emplacement of its graduates at the labour market.

Communication among science, its results and relation to society is paid a long-term attention at the Faculty of Natural Sciences, Constantine the Philosopher University in Nitra, Slovakia (hereinafter referred to as "FNS").

The part of Marketing strategy of FNS development lies in surveys focused on the perception of FNS by its students [6], places where they commute from in order to reach education at FNS or emplacement of graduates at the labour market. They are realized with the support of FNS management and staff of the Department of Geography and Regional Development in cooperation with other faculty employees.

The aim of the paper is to show the results of the two-year long survey that was concentrated on opinions of students attending the 1st year study programmes at FNS with an accent put on the view of students of the Department of Geography and Regional Development and their attitudes to the popularity of Geography, knowledge, respectively visions about an emplacement of graduates of particular study field at the labour market.

2. THEORETICAL AND METHODOLOGICAL FRAMEWORK

The issues of popularity of particular subject at primary or secondary school, respectively chosen study programme at university, are directly connected with the personality of a teacher. A man, who mediates to pupils or students not only knowledge, skills and abilities, but also creates an image of the particular subject as well. Therefore teacher may influence their future personal lives.

We agree with Tremboš [7], who stated that an obstacle of wider employment of geographers lies in not very flattering reflection of Geography across the society and its negative image. Among others, it is the result of insufficient propagation of Geography in mass media, which can influence an opinion of the majority. Matlovič and Matlovičová [5] claim that under the term of "Image of Geography" can be considered a set of subjective opinions, ideas and feelings that people have in relation to Geography. The image of Geography is a significant simplification of large quantities of associations and pieces of information connected with Geography. There is also a comprehensive view on the social relevance and building the brand of Geography. The topic of image of Geography was the matter of studies by Kuldová [4], who analyzed it within the various educational documents.

Balážová and Kramáreková [1] published the results from survey focused on the various types of respondents (the 9th grade pupils at elementary school, students in the 4th year of study at secondary grammar school with four year-long study, students attending the 1st year of geographical study field at FNS, teachers at elementary school and secondary grammar school, the public – human resource officers in companies).

The complex view on Geography; from the light of application of its knowledge in other features of human life (such as regional development, spatial planning, environmental science, sustainable development, geographical education) as well as from the aspect of its image and emplacement of geographers at the labour market; was presented by Kramáreková et al. [3] within the publication Principles of Applied Geography ("Základy aplikovanej geografie" in Slovak).

The paper shows a presentation of findings collected within two questionnaire surveys realized in September of academic years 2011/12 and 2012/13 after the enrolment of students to the 1st year of particular study programmes. The questionnaire consisted of 18 questions (open, semi-open, closed) that were related to the perception of FNS by the selected group of students. The first section dealt with the personal information about respondents, respectively with the procedures and types of information they chose in the process of study programme selection. The following questions were connected with the importance of their study field in praxis and knowledge of personalities and experts. The fulfilment of questionnaires was provided by tutorial teachers of particular departments at FNS. In the academic year 2011/12 was obtained completed 469 questionnaires of 555 enrolled students (84.5%). The share decreased a bit (83.6%) in following academic year, due to the fact that 327 fulfilled questionnaires were gained from 391 students. The information has been processed into tables and graphs and then presented through comparative analysis.

3. POPULARITY OF GEOGRAPHY

The popularity of geography was researched at the level of FNS and at the level of the Department of Geography and Regional Development.

Fig. 1a and Fig. 1b display popularity of Geography within the FNS. There is apparent that Geography is attractive within the group of students, who have chosen it as one-major non-teacher training study programme (Geography in Regional Development – abbr. GRBC and Social Geography – abbr. SGBC) or as one subject within the two-major teacher training study programmes. The interesting fact is that Geography was liked by students of Environmentalistics (abbr. ENBC), Chemistry of the Environment (abbr. CHBC) and students of two-major teacher training study programme of Biology in combination with Physical Education, too.

The same trend is evident also in the case of particular study programmes realized by the Department of Geography and Regional Development. There is a strong predominance of students attending the one-major non-teacher training study programme Geography in Regional Development (Fig. 2a, Fig.2b).

The analysis of popularity of Geography through a questionnaire and consequent communication with students at the Introduction to Geography subject did show a long-term image of Geography as an "easy" science, in which the successfulness is relatively easily achievable based on the mainly verbal expression as a science of "travelling". This is the reflection of current state of geographical education that is not satisfactory either in terms of number of lessons or terms of content and personality of the particular teacher of Geography.

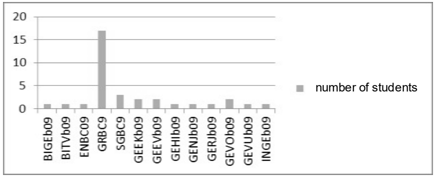

Figure 1a: Popularity of Geography among 1st year students at FNS in acad. year 2012/13

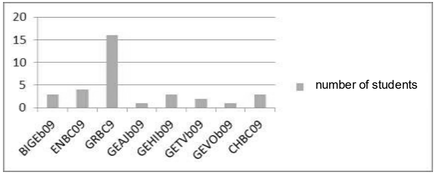

Figure 1b: Popularity of Geography among 1st year students at FNS in acad. year 2011/12

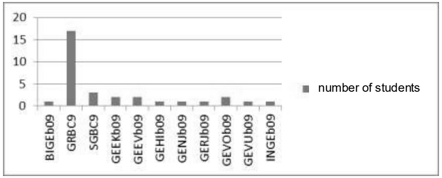

Figure 2a: Popularity of Geography among its 1st year students at FNS in acad. year 2012/13

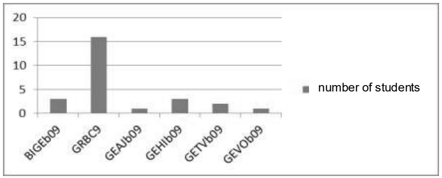

Figure 2b: Popularity of Geography among its 1st year students at FNS in acad. year 2011/12

Explanatory notes of the study programmes abbreviations: BIGE (Biology-Geography), BITV (Biology-Physical Education), GEEK (Geography-Ecology), GEEV (Geography-Ethic Education), GEHI (Geography-History), GENJ (Geography-German Language and Literature), GERJ (Geography-Russian Language and Literature), GEVO(Geography-Civics Education), GEVV (Geography-Art Education), INGE (Informatics-Geography), GEAJ (Geography-English Language and Literature), GETV (Geography-Physical Education), ENBC (Environmentalistics), GRBC (Geography in Regional Development), SGBC (Social Geography), CHBC (Chemistry of the Environment).

4. STUDENTS' KNOWLEDGE ABOUT EMPLACEMENT AT THE LABOUR MARKET

The consequences of financial and economic crisis are still visible also in the current period, what is reflected in the lack of job opportunities at the labour market. However, the possibility of employment grows with increasing level of finished university education.

Also, the students' knowledge of emplacement at the labour market was researched at two levels – FNS and Department of Geography and Regional Development.

The knowledge about importance of own study programme in praxis were assessed based on the reactions of respondents, who had to concretize their answer, if they ticked “yes”. In the case of students of teacher training study programmes, their responses were completely identified with the job of teacher at primary, secondary school or university, although there were found some reactions showing potential to work outside the field of education. On the other hand, in the case of students of non-teacher training study programmes, there were recorded much worse reactions. The results of questionnaire survey focused on the 1st year students at FNS in academic years 2012/13 and 2011/12 point out that those students know about the importance of their field of study at share about the two-thirds in each year (Fig. 3).

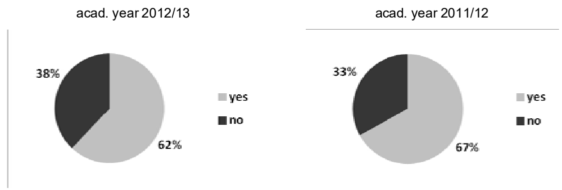

Figure 3: Answers of the 1st year students at FNS to the question: Do you know the importance of your study programme in praxis?

The analysis of the 1st year students' knowledge studying at the Department of Geography and Regional Development in academic years 2012/13 and 2011/12 follows the results of the foregoing question. From the total number of 372 answers in academic year 2012/13 up to 60% of participants did not know about the importance of their study programme in praxis. In academic year 2011/12 did not have any idea about personality related to study programme 315 of 469 respondents. There prevailed unspecified answers like “work with maps, work at office or fieldwork”.

The knowledge about experts in the particular field of study (Figure 4) reached in the both years just about one-fourth representation. From the view of educational process can be summarized that the results display a long-term and persistent disinterest of teachers to show their pupils or students an expert in the particular field – a professional model in terms of preparation for a future career.

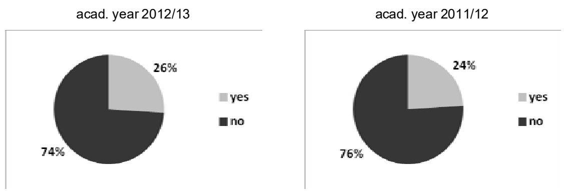

Figure 4: Answers of the 1st year students at FNS to the question: Do you know the expert(s) with the same level of education (as you want to reach) in your neighbourhood?

In the case of students of teacher training study programmes were presented examples of teachers or known experts at primary, secondary schools as well as universities (1st year students). The analysis of the 1st year students' knowledge studying at the Department of Geography and Regional Development in academic years 2012/13 and 2011/12 follows the results of the foregoing question. From the total number of 372 answers in academic year 2012/13 up to 75% of participants did not know any expert. In academic year 2011/12, even 425 of 469 respondents (91%) did not have any idea about expert related to their study programme. There predominated general answers like “office worker, project manager, employee in the field of environment, geodesist, etc.).

The following question concentrated on the students' knowledge of personality related to the study programme outside the staff of the particular department pointing out that the teacher was identified as an expert (personality). Due to the mentioned fact, the share of knowledge of an expert outside the staff decreased at the level about 10% within the both academic years (Fig. 5). The knowledge of personalities and professionals – symbolizing models identified with students and approximating to them – is therefore just minimal.

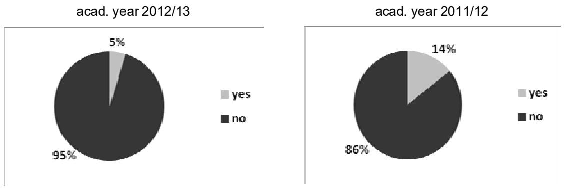

Figure 5: Answers of the 1st year students at FNS to the question: Do you know any expert of the study programme you study, except of the members of the department staff?

The analysis of the 1st year students' knowledge studying at the Department of Geography and Regional Development in academic years 2012/13 and 2011/12 follows the results of the foregoing question. From the total number of 372 answers in academic year 2012/13 up to 95% of participants did not know any personality. In academic year 2011/12 did not have any idea about personality related to study programme 250 of 469 respondents.

5. CONCLUSION

The popularity of school subject at primary or secondary school creates an optimal motivation for pupils or students in their following study. At the same time it can bring motivated students to universities, as well. We made a research focused on the popularity of geography at FNS, also at the Department of Geography and Regional Development of FNS. Geography is a favourite subject for students, who are studying it as the one-major non-teacher training study programme (Geography in Regional Development, Social Geography), or as two-major teacher training study programme. Geography is also popular for students of Environmentalistics, Chemistry of the Environment and also for students of two-major teacher training study programme (Biology in combination with Physical Education).

Our research included the student knowledge about the labour market emplacement based on the two levels. The results show that students know about importance of their study programme at 62% in academic year 2012/13 and at 67% in academic year 2011/12. The students’ knowledge about the experts in relation to study programmes was at the level of 26% (2012/13), or 24% (2011/12). The knowledge about experts within the study program but outside the staff led to the fact, that students identify their teacher as an expert (personality). This explains a decrease of knowledge in specific expert (personality) to 5% or 14%, except of teacher at the workplace. When it goes to getting to know the personalities, professional idols as the best personalities to identify with students, the knowledge about it is at minimal level. The subject Applied geography and its specific connection with the labour market emplacement of students, or even the lessons of geographers working out of academia, improves this link among geographic study programs at FNS.

The knowledge about everyday reality employment related to the course in study programme, improves also the introduction of system of practice for students (department practice – for students with the one-major non-teacher training study programme and pedagogical practice – for students of two-major teacher training study programme), which is required for every student. The popularization of each natural science through different forms and activities is the positive example of creating its image and brand – more information is available on the website of FNS, section Faculty in Media [2].

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REGIONAL GEOGRAPHICAL ANALYSIS OF LAND CONSOLIDATION REFORMS IN CZECH REPUBLIC

Jan Vachuda[1] and Antonín Věžník[1]

[1] Department of Geography, Faculty of Science, Masaryk University in Brno, Kotlářská 2, 602 00 Brno, Czech Republic, e-mails: pelco@mail.muni.cz, veznik@sci.muni.cz

ABSTRACT

Paper analyses land consolidation process in Czech Republic. Land consolidation reforms is planning tool for improving conditions for sustainable development of landscape and for optimazing relations between owners and farmers. Paper starts with basic introduction of goals of land consolidation and then analyse types, number and size of land consolidation in regions of Czech Republic. Land consolidation reforms were terminated in 16.6 % of agricultural land of Czech Republic (1990 to 31. 12. 2010), but in 27.2 % of agricultural land were land consolidation already in progress or terminated. In 2012 costs for land consolidation reforms were 1.6 billion CZK (63 million EUR). There are regional deferences in land consolidation in Czech Republic, in regions (NUTS 3) of Karlovy Vary and South Moravia are terminated or in progress of land consolidation more than 53 % of agricultural land, but in Vysocina region only 18 %, NUTS III of Liberec, Ústí nad Labem and Moravskoslezsko (20 %). In other regions is this index 21-31 %. Speed of LC is low. Average of completely managed LC since 1990 is 32,000 ha of agr. land / year.

***Key words**: Land consolidation, agriculture, land use, regional analyse, Czech Republic*

1. INTRODUCTION

The aim of the paper is to make regional analyse of land consolidation reforms (after 1990 in Czech Republic). Partial goals are:

- Analyze the area of completed and unfinished land consolidation.
- Analyse the regions where is the highest number of completed LC in terms of the number, proportion and regional differentiation.
- Provide a broader context (LC goals, fragmentation, financial context).
- Evaluate the analyzed data.

Land consolidation is complex set of activities for improving the conditions of areas for agriculture, for improving the ecological stability of the landscape and for clarification and correcting ownership. The main goals of land consolidation are (Vlasák, 2007; Pozemkové úpravy, 2012):

- organization and clarification of property rights (renewal of the cadastral documentation),
- the consolidation of fragmented land, spatial and functional organization of land,
- aligning the boundaries of lots (new lots have preferable shape for farming),
- ensuring access to land (net of field access roads),
- creating the conditions for owners for rational management,
- protecting and reclaiming land resources (reducing erosion), protection of landscape,
- increase the ecological stability,
- support increased retention of landscape, flood protection.

Experts and scientific publications, who deal with land consolidation, come from a variety of different research fields. Comprehensive publication on land consolidation is Burian, Z.(ed.) 2011. Technically land consolidation shall be governed by the Methodical guidance on the land consolidation (Dumbrovský et al. 2004). A simple informative publication is Land consolidation – a tool for sustainable development of rural areas (the Ministry of Agriculture, 2010, updated edition 2012). From the perspective of landscape ecology, landscape planning and landscape are important general publications Sklenička 2002 or Löw, Michal, 2003; Forman, Godron, 1993). LC are joint with land use changes, which are geographicaly studied with complex metodology (Bičík, 2010; Skáloš et al. 2011).

Sklenička et al. (2009) quantitatively analyze the basic driving forces in land consolidation (1990-2005), refers to the reduction in the number of parcels per owner, which still remains relatively high (average of 3 parcels per owner after the completion of land consolidation). Sklenička et al. (2009) also analyze the dependence of the number of plots before and after LC on location in the historical regions of the country, administrative regions of the country and production areas.

Pedological aspects (soil characteristics by BPEJ and mapping methods) examines Research Institute of Soil and Water Conservation in publication Soil and its evaluation in the Czech Republic (Vopravil et al., 2011), legal and owners aspects are also important (Pekárek et al. 2010).

Land consolidation can also be included in the broader context of rural development and general regional development (Van Dijk, 2003). Land consolidation should serve as one of the synergistic rural development (Svobodová et al., 2011). Key is also binding of land consolidation to landscape and urban planning. (Van Lier, 2000). “Many years of search for effective ways of preserving and creating multifunctional harmonious and sustainable cultural landscape of our country most often leads to two main tools that fundamentally affect its appearance. These governance tools are local development plans and land consolidation.” Their coordination, continuity and cooperation are very important. (Kyselka, Hurníková, Rozmanová, 2010).

The most serious problems of agricultural landscape of CR (Burian et al., 2011):

- extremely large soil blocks (200-300 ha and more) cause increased erosion and monotony of the landscape, the landscape is degraded to aesthetically worthless production environment,
- lack of ecostability elements (hedgerows, wetlands, alley), poor condition of small reservoirs and watercourses,
- lack of access to land, inappropriate forms of property, obstruction / difficult passability of landscape, fragmentation of ownership (more than 75 % of agricultural land is leased, Situční zpráva půda – Soil Report, 2012),
- reduction of natural fertility due to pollution and erosion (currently estimated that water erosion is increased to 42 % and wind at 7.5 % of agricultural land in the CR. (Němec et al. 2011) Soil Report (2012) indicates the vulnerability of water erosion on 50 % of agricultural land and wind at 14 %).

2. METODOLOGY AND DATA

Work deals with basic characteristics of land consolidation (LC), sizes of completed and in progress land consolidation projects, numbers and types of LC and then make a regional comparison with areas of agricultural land. Basic source of data was Czech Ministry of Agriculture, time period was 31. 12. 2010. (Data about LC, 2010).

Therea are two types of land consolidation: Elementary land consolidation (ELC) and Complex land consolidation (CLC). Complex land consolidation projects are made generally in the whole of the cadastral unit in its unbuilt parts, extravilan parts with more difficult reorganization of net of field access roads, construction of water management facilities measures, elements to increase the ecological stability, new lot blocs and other aims. ELC are used in smaller areas (usually only part of cadastral unit) or for accelerated solution (local erosion or flood control facilities, accelerated unification of the land) and for more easy, faster and cheaper solutions. Land consolidation is legislatively defined mainly by the Land consolidation act: No. 139 / 2002 Coll., on land consolidation and land administration and by act No. 229 / 1992 Coll., on ownership of land.

Land concolidation number analyses can be perfromed with more possibilities. First is count only finished areas after land consolidation or finished and in progress together. It is also possible to count elementary land consolidation (ELC) and complex land consolidation (CLC) separately. Methodically, it is necessary to mention that the aggregate indicators presented below are not entirely accurate, because there are a number of areas where ELC was followed by a CLC. The index of area of land consolidation and agricultural land is index for better imagination but not totally accurate, because land consolidation often include smaller forest blocks, water areas, other areas, roads, etc.., therefore, LC are not only on agricultural land, but agricultural land is mostly more than 90 %.

3. RESULTS

Elementary and complex land consolidation was completed on 703 thousand hectares (16.6 % of agricultural land) were in progress for additional 451 thousand hectares (10.6 % of agricultural land), in total were in progress and completed to more than 1.1 mil. ha, or 27.2 % of agricultural land of the CR (31. 12.2010).

ELC was completed 2294 (projects) on 196 thousand ha of agricultural land. CLC was completed in 1144 on the territory of 507 thousand hectares.

Tab. 1 shows rank of regions with largest areas of total LC. Diference between regions are relatively high. Completed LC are in 16.6 % of agricultural land of Czech Republic, but in region Karlovy Vary is completed 47 % of agricultural land contra to region Liberec, where is completed only 7 % of agricultural land.

Completed plus in progress LC are in 27.2 % of agr. land of Czech Republic but regional defferences are significant. In South Moravia and Karlovy Vary region is in progress and completed more than 50 % of agricultural land, in contrast to minimum in region of Vysočina (18.6 %), Liberec (20.0 %), Ústí nad Labem (20.6 %). For other regions, the proportion of land consolidation (unfinished and finished together) is 21 to 31 %.

Highest number of finished ELC was in South Moravia region, where was completed 622 of all 2 294 ELC in Czech Republic (41%), in total area of 10 768 ha (32 % of all ELC in the country). Also in finished CLC was most significant South Moravia region with area almost 100 thousand hectares (20 % of all finished ELC in the country) in 156 finished land consolidation projects. More number of finished CLC was in Central Bohemia region (183) with area of 74 120 ha (2. rank in CR, 14.6 % finished CLC of CR). The last region in finished CLC was region of Liberec with 18 projects in area of 5688 ha.

Table 1: Areas of elementary and complex land consolidation in Czech Republic 31. 12. 2010

Czech regions NUTS III	Elementary + Complex LC		
	In progr.	Finished	Total LC
	area (ha), 31.12.2010		
Czech Republic	451370	703487	1154857
Jihomoravský kraj / South Moravia	65003	161037	226039
Středočeský kraj / Central Bohemia	53667	86094	139761
Jihočeský kraj /South Bohemia	58622	78054	136676
Plzeňský kraj / Pilsen region	49127	53181	102308
Pardubický kraj / Pardubice region	36747	48556	85303
Kraj Vysočina / Highland region	22245	54054	76299
Královéhr. / Hradec Králové region	26883	45596	72480
Karlovarský kraj / Kralovy Vary region	8848	57980	66828
Olomoucký kraj / Olomouc region	27274	38945	66219
Ústecký kraj / Ústí nad Labem region	27606	29057	56663
Moravskoslezský kraj / Ostrava region	34174	22088	56262
Zlínský kraj / Zlín region	23581	18508	42088
Liberecký kraj / Liberec region	17595	10335	27930

Source: Ministry of Agriculture

In South Moravia was completed and in progress together 226 039 ha of land consolidation which is 53.1 % of the agricultural land of the region (of which has been fully completed 161 036 ha.)

“The average size of area on one LC project is 400-450 ha, duration of LC is 4 to 5 years.” (Zelená zpráva, 2011). Source data shows that elementary land consolidation in progress and finished together have an average size of 100 ha, complex land consolidation of 470 ha. The average size all LC was 204 ha.

Figure 1: Terminated complex and elementary (simple) land consolidation in Czech Republic
Source: http://eagri.cz/public/app/eagriapp/PU/Prehled/, 31.12.2010

Regional diference was also significant on level of districts (76 districts of CR). Largest areas of ELC (finished and in progress together) were in district of Svitavy with 892 ha (Znojmo, Louny, more then 800 ha), the smallest area was in Beroun, Pelhřimov, Teplice, Jablonec, (all under 10 ha). Largest CLC was in agricultural landscape of Břeclav district (1158 ha), Vsetín, Bruntál (over 1000 ha), smallest (in high urbanized districts) of Karviná (68 ha), Ústí nad Labem (247 ha), Brno- město (273 ha), Sokolov, Jablonec nad Nisou (under 300 ha). Size of LC often depend on administrative definition (size) of cadastral unit, becouse CLC are performed in all cadastral unit.

Number of completed ELC and CLC together was highest in districts: Břeclav 277, Karlovy Vary 263, Hodonín 196, Cheb 163, Prachatice 124, minimum was in districts: Ostrava-city – 0, Prague 2, Opava 4, Rokycany 9, Pilsen – town 10.

Total area (in thousand ha) of completed both types of LC together was highest in South Moravia (161.1), Central Bohemia (86), South Bohemia (78). Minimum was in Prague (0,5 th. ha), Liberec (10), Zlín (18,5), Moravskoslezsko (22).

In level of districts was largest area of both types of LC (only completed) in Břeclav (61 800 ha, also the biggest number of LC projects – 277), second was district of Znojmo with 46711 ha, Cheb, České Budějovice, Ústí nad Orlicí, Rakovník. Minimum was (except of city regions Prague, Karvina), Děčín, Chomutov, Vsetín, Beroun, Liberec, Most, Ústí nad Labem.

Sklenička, Hladík, Střeleček (2009) analyse 487 cadastral units before and after LC, which were conducted between 1990 and 2005. Number of parcels in a cadastral area was in average 931 before and 456 after process of LC. Average number of owners during one LC was 147. One owner before LC had an average of 6.3 parcels with an average size of 0.43 ha plots, after LC 3.1 plots with an average size of 0.88 hectares. On average, therefore plots were doubled and one owner after reparcelling owned 2.42 hectares in three plots. The average price of land consolidation was 6 803 000 CZK (250 000 EUR), of which 42.1 % was on the design of projects work, to surveying and geodetic work 12.9 % and 44.2 % for realization (construction).

In realization costs was the most expensive construction of new roads (83. 4 % of the costs). The average price of land consolidation was 17 000 CZK / ha (620 EUR / ha). It should be noted that the arithmetic averages for the number and size of the parcels of owners have high standard deviation, because there are high differences in different projects and areas. Sklenička, Hladík, Střeleček (2009) examined the number of parcels per owner (fragmentation) before LC by four historic areas, the largest of which is the fragmentation of the Czech Sudetenland (11.6 parcel / owner), Moravian Sudetenland (8.1) Bohemia (7.7) and Moravia (5.2). According to districts are the biggest differences between the district Liberec (13.2) and Zlín (4.4). There are generally identified greater numbers of parcels per owner in Bohemia than in Moravia. Generally more fertile regions have smaller degree of fragmentation. The greatest effect of uniting of parcels (defragmentation) after LC was in NUTS III region of South Bohemia and the lowest in Zlin region. The amount of the cost is directly proportional to fertility. Generally, higher fertility means higher costs of land consolidation. This phenomenon is probably due to the greater range planning activities (new environmental construction), due to higher field blocks as well as the fact that more productive agriculture (corn, rape) has a greater erosion impact.

Even after LC process is still relatively high number of parcels per owner, which is due to many factors (different soil factors, traditional family heirlooms, the need to have more fields to reduce potential losses, restitution etc.) Even after LC, there will be a fragmented ownership, because it is not possible to reduce the number of owners. Number of leased plots is very high but in recent years decreasing (91.6 % of all agricultural land was leased in 2000, 76.5 % in 2010; Soil Review 2012) Number of parcels per owner may change with development of the land market (Sklenička 2002; Sklenička, Hladik, Střeleček 2009).

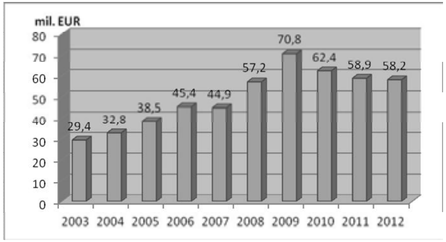

Figure 2: Land consolidation costs in Czech Republic
Source: Soil Report, 2012, Státní pozemkový úřad, 2012

Land conolidation annual costs rised to year 2009 and reached its maximum 70 mil EUR (1.95 bilion CZK). In 2010, 2011 and 2012, the cost was more than 1.6 billion CZK per year. "In 2012 was used 700 milion CZK to non-investment activity and 900 milion CZK on realization of roads, construction against erosion, flood etc." (Státní pozemkový úřad, 2013)

In 2012, there were finished 214 of land consolidation (68 elementary and 146 complex) in area of 94,127 ha. Most complex land consolidation was implemented in 2012 in the Central Bohemia Region (11 958 ha) and in the Pilsen Region (9,440 ha). Elementary land consolidation is most often carried out in the South Moravia Region (11,611 ha), the second in the South Bohemia region (4,329 ha). The financing of land consolidation in 2012 most influenced by the Ministry of Agriculture with the amount of more than 600 mil CZK and the institution for dealing with national land property (Pozemkový fond) which has contributed about 400 mil CZK. In 2013 was in progress 950 LC (State land office. 2013).

According to the current evaluation of the possibilities of land management institutions is desirable to yearly open and close about 180 to 200 projects of complex land consolidation (average number of 3 per district, it represents about 100,000 ha per year). Also open and close approximately 120 elementary land consolidation. (1-2 in district, ie. 40,000 ha per year).

4. CONCLUSION

Paper described the basic numbers about LC and can be summarized in three conclusions. The first conclusion is clearly visible regional differentiation in the number of completed land consolidation. This is mainly due to local factors:

- natural conditions (better in South Moravia, where is highest count of LC);
- historical context (expulsion of the German population, the effects of state agr. farms)
- number of parcels and farmers, bonity
- iniciative to make the LC based on the requirements of:
    - owners
    - farmers
    - foresters (especially for access to their forest land through agr. land)
    - State Administration (road construction, water works, protecting and improving the ecological stability of the landscape)
- specific conditions:
    - a preferred solution of LC in areas with problematic ownership
    - acceleration of process (lpriority constructions highways)
    - protecting the area of flooding and massive erosion
    - problems with drained soil (drainage is built on approximately 25 % agr. land of CR, which gradually grows older, clogging etc.)
    - coordination with the formation of the urban plan (etc.)

Second conclusion is the relatively slow speed of completing the land consolidation. In past 22 years since 1990 have been completely managed 16 % of the agricultural land (32,000 ha / year). Finishing of all area in current speed would take next 110 years. With slightly overvalued speed (which promises the State Land Office, 2013), around 150,000 hectares of LC per year would have managed to complete the remaining area 3 miles ha in 20.4 years. Even with a large overestimation is this number relatively high.

The third conclusion refers to the reduction of funds for LC, which continued in 2013. Funding of LC is relatively low, because there is no economical income of LC and environmental importance is not evaluated as very high. The medial discourse about the funding of LC is conducted that the owners (farmers) and environmental experts would have demanded higher subsidies for LC. Positive can be that fact that in fertile region, where LC are more expensive, is situation more in progress, and therefore future costs will be realtively less expensive.

In the discussion, there is necessary to mention that despite the relatively pessimistic conclusions about the length of managing of LC, there are strong effort to improve the situation in the implementation of land consolidation, which should be further promoted: There is grow of environmentally friendly mentality in society (sustaineble thinking) and environmental education, education about non-renewable land resources. Recently was improved monitoring erosion events on agricultural land (where the public can contribute http: ///me.vumop.cz) and improved coordination of land consolidation and land-use planing. There are also improvements in soil monitoring and legislation (eg. Law on soil protection). For more effective implementation of land consolidation is also positive the availability of data from the LPIS and other open data. Also positive is the pursuit of broader stakeholder participation in the land consolidation process, community planning (eg. LEADER), because mplementation of LC needs maximum involvement of local inhabitantes. Important is continual support for land consolidation within the Rural Development Program 2014-2020. In addition to these improvements is also very important to put more emphasis on technological and social innovation in agriculture.

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MUNI/A/0952/2013 Analysis, evaluation, and visualization of global environmental changes in the landscape sphere.

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Attachment 1: Land consolidation and agricultural land in Czech Republic *(Source: Ministry of Agriculture, Czech Statistical Office, Czech Office for Surveying, Maping and Cadastre)*

Czech regions NUTS III	**Elementary and Complex land consolidation together**			**Agricultural land**	**Proportion of LC on agricultural land**		
	In progr.	Finished	Total		In progr.	Finished	Total
	area (ha)				%		
	to 31.12.2010			to 31.12. 2012			
Czech Repulic	**451370**	**703487**	**1154857**	**4224389**	**10,68**	**16,65**	**27,34**
Karlovarský	8848	57980	66828	124027	7,13	46,75	53,88
Jihomoravský	65003	161037	226039	426041	15,26	37,80	53,06
Pardubický	36747	48556	85303	271564	13,53	17,88	31,41
Jihočeský	58622	78054	136676	490527	11,95	15,91	27,86
Plzeňský	49127	53181	102308	379335	12,95	14,02	26,97
Královéhradecký	26883	45596	72480	277690	9,68	16,42	26,10
Olomoucký	27274	38945	66219	279361	9,76	13,94	23,70
Zlínský	23581	18508	42088	193632	12,18	9,56	21,74
Středočeský	53667	86094	139761	662490	8,10	13,00	21,10
Ústecký	27606	29057	56663	275490	10,02	10,55	20,57
Moravskoslezský	34174	22088	56262	274802	12,44	8,04	20,47
Liberecký	17595	10335	27930	139826	12,58	7,39	19,97
Vysočina	22245	54054	76299	409470	5,43	13,20	18,63

DEVELOPMENT OF RESIDENTIAL SUBURBANIZATION IN URBAN PARTS OF THE NITRA CITY – ČERMÁŇ AND PÁROVSKÉ HÁJE

Gabriela Repaská[1], Katarína Vilinová[1] and Renáta Masárová[1]

[1] Department of Geography and Regional Development, Faculty of Natural Sciences, Constantine the Philosopher University in Nitra, Tr. A. Hlinku 1, 949 74 Nitra, Slovak Republic,
e-mails: grepaska@ukf.sk, kvilinova@ukf.sk

ABSTRACT

In recent years, we could see the gradual impact of suburbanization in Slovak towns and cities and their background. This phenomenon causes a change in the spatial structure of towns/cities but also a change in the social structure of the population. The aim of this paper is to highlight, based on the field research, the process of residential suburbanization in two different urban parts of the Nitra City – Čermáň and Párovské Háje.

Key words*: residential suburbanization, Nitra City, location factors*

1. INTRODUCTION

Currently, suburbanisation is considered one of the most powerful processes that significantly affect the face of today's cities in Slovakia. By the same force, it is involved also in the change of city surroundings, urban parts and surroundings of rural municipalities. Residents look for healthier, quieter, and more spacious environment for their housing and lives.

A part of the residential suburbanization is represented by the construction of luxury residential units in the suburban area (on the outskirts of towns/cities or in the countryside). Most often they are represented by family houses (individual construction, construction through developers) and housing constructions. In the countryside, in addition to these forms of construction, also the process of revitalization (renovation of old residential buildings by urban population) can be seen.

2. METHODOLOGY AND AIM OF THE PAPER

In geographical field the process of residential suburbanization is addressed by several Slovak geographers who evaluate its impact in different areas of larger cities. Problems of this process on the level of urban areas is not sufficiently developed in the Slovak geographical literature since it is solved primarily to the level of rural municipalities [1, 6, 7, 8, 10 et al.]. The manifestations of this process in urban parts were highlighted by authors [2, 9].

The aim of this paper is to highlight the process of residential suburbanisation in two different urban parts of the Nitra City – Čermáň and Párovské Háje. The development of suburbanization was evaluated also by the questionnaire survey and based on the respondents' answers, the manifestations of this process were confirmed. At the same time, the paper evaluates also specific reasons for the choice of the given site.

3. RESIDENTIAL CONSTRUCTION IN URBAN PART OF THE NITRA CITY

The Nitra City with an area of 100.48 km^2 and population of 81,733 inhabitants (2012) is internally divided into 13 urban parts: Dražovce, Zobor, Chrenová, Janíkovce, Dolné Krškany, Horné Krškany, Staré mesto, Čermáň, Klokočina, Diely, Mlynárce, Kynek, and Párovské Háje (Map 1).

The urban parts of Chrenová, Čermáň, Klokočina, and Staré mesto are typical mostly for housing estate buildings while other urban parts have retained the character of rural municipality.

Similarly, as in other towns/cities of Slovakia also in Nitra City there is currently being carried out a construction of family houses and housing buildings.

The strongest reflection of this construction can be seen in the urban part of Čermáň where are currently being carried out three developer projects. Namely, it is “Bytový dom Pohoda” (Pohoda Residential House), “Bytové domy Nitra – Čermáň” (Residential Houses Nitra – Čermáň), and “Čermánske námestie” (Čermáň Square). In the urban part of Chrenová, there are attractive double-storey houses called “Nová Chrenová” which construction began in 2009. In this urban part, there are 186 houses gradually being built called “Agria” having from one to four rooms. New residential areas are being built in the urban part of Klokočina mainly in its western and southwestern part at the end of the housing estate in a quiet locality and they are extending towards the urban part of Párovské Háje. In the cadastral area, there is a very attractive locality called “Šúdol” which is divided into “Šúdol – Východný prameň” (belongs to the Klokočina urban part) and “Šúdol – Západný prameň” (belongs to the Párovské Háje urban part). The urban part Nitra – Párovské Háje consists of individual family houses which are constructed on free parcels. Currently, there are 30 newly built houses and 10 houses under construction. Staré mesto “Old Town” will offer for housing 15 two- and four-room residential houses called “Triangolo” which are located in the site of the former Nitra brewery. “Zobor” urban part is the most attractive of all urban parts in the Nitra City. It offers free parcels for the construction of luxury residential units for higher class population. This locality gives residents a pleasant and safe living in a quiet environment with convenient transport connections and good access to the city center. Moreover, residential houses called “Dynamik” are also attractive in this urban part which construction began in 2005. They are represented by 3 residential houses with garage offering totally 120 apartments (2-3 rooms). In urban parts of rural nature such as Dražovce, Janíkovce, and Kynek, we can observe individual construction of family houses. Single family houses are unevenly built on streets and mainly they complement built-up area of the territory. In the urban part of Diely, a construction of 4 rental residential houses began. Every house will have four floors and 23 flats and it counts also with attic rooms. All apartments will have two rooms with an area from 47.65 to 52.40 m^2. Other urban parts (Mlynárce, Dolné Krškany, and Horné Krškany) are characterized mainly by commercial suburbanization while residential suburbanization takes place only to a minimal extent [9].

4. DELINEATION OF URBAN PARTS – ČERMÁŇ AND PÁROVSKÉ HÁJE

The urban parts of Čermáň and Párovské Háje are located in the western part of the Nitra City (Figure 1).

Figure 1: Delineation of urban areas – Čermáň and Párovské Háje in the Nitra City

The urban part of Čermáň has 5,735 inhabitants (status as of 12/31/2012) which is 7% of the population of Nitra City. With an area of 200 ha and population density of 2,867.5 inhabitants/km² it belongs to the largest urban parts of the Nitra City. The urban part is dominated by the residential function due to a complex housing construction accompanied by the growth of housing estates in the 1970s. The main transport route is the local Dolnočermánska Street which connects the urban parts of Klokočina and Staré mesto "Old Town" through the urban part of Čermáň. Dolnočermánska Street divides the urban part into 2 basic parts – Horný Čermáň (western part) and Dolný Čermáň (eastern part). Dolný Čermáň is bigger and older part with residential houses, businesses, schools, and family houses. Horný Čermáň has small and narrow streets and family houses. The whole Čermáň is bordered from the southwest by the Hornočermánska Street, from the east by Cabajská Street, from the north by Železničiarska Street, Hanulova Street, and partly by Hviezdoslavova Street, and from the west by Dolnočermánska Street and Golianova Street (Figure 2).

Figure 2: Street network in the urban part of Čermáň

The urban part of Párovské Háje with 411 inhabitants (status as of 12/31/2012) belongs to the smaller urban parts (0.5% of the population in the Nitra City). It has an area of 120 ha and population density is 342.5 inhabitants/km².

Residential structure of this urban part is formed only by family houses and the urban part retains a rural character. Compared to the urban part of Čermáň, the density of construction is lower in this urban part.

5. SIGNS OF RESIDENTIAL SUBURBANIZATION IN URBAN PARTS OF ČERMÁŇ AND PÁROVSKÉ HÁJE

Suburbanization has an impact on the population growth in surrounding suburban areas which has a direct impact on the construction of new family houses or flats that extend and thickens the built-up area in its territory. Therefore, we can find various forms of construction in these urban parts.

In the urban part of Čermáň, the residential units are being built in the northeastern part of the cadastral area, where they create new residential sites in which new residential and family houses are being built. Residential units complement also free areas between the already inhabited houses (Figure 3).

Figure 3: Residential suburban constructions in the urban part of Čermáň

The urban part of Nitra – Čermáň is predominantly made of construction of residential houses in the form of developer projects. It is represented by 3 unfinished buildings: "Bytový dom Pohoda" (Pohoda Residential House), "Čermánske námestie" (Čermáň Square), and "Bytové domy Nitra – Čermáň" (Residential Houses Nitra – Čermáň).

The most extensive complex of apartments is Čermánske námestie (Čermáň Square) (Fig. 1) where the developer is the company called Martinák, s.r.o. The complex contains 35 low-storey apartment houses on the Čermánske námestie Street (Fig. 3). The square shaped in the form of ellipse is a relaxing place with a plenty of greenery, functioning services (hairdressing, nail design, repair appliances, cafe...) which are bounded around by poly-functional four-storey residential houses. Currently, apartment complexes D and E are built and each of them is divided into 3 sections. These sections include 1-room, 2-room and 3-room apartments. The size of 1-room apartment is 40.45 m², size of 2-room apartment is 56 m² – 70 m², and size of 3-room apartment is 73 m² – 103 m². The apartment complex D includes 5 free and 27 sold apartments and in the complex C there is one free and 29 sold apartments. The price for 3-room apartments ranges from 87,000 to 107,000 €. The price per garage is uniform for all apartments which is 3,286.20 € [5].

"Bytový dom Pohoda" (Pohoda Residential House) (Fig. 4) will be located in a quiet area of the Čermáň urban part on the Hornočermánska Street in the Nitra City. The apartment house will include a total of 12 apartments in three floors. Apartments will have 2 and 3 rooms. Apartments on the first floor will have a garden with an area of 42.12 m², 52.17 m² or 56.19 m². Apartments on the second floor will have 1 or 2 balconies with an area of 7.38 m², 9.19 m², 1.44 m² and 2.38 m². On the third floor there will be an apartment with a terrace (34.2 m²). The size of apartments is in the range of 66.5 m² – 146.39 m² [4].

Figure 4: Apartments on the Čermánske námestie (Čermáň Square)

The project called "Bytové domy Nitra – Čermáň" (Residential House Nitra – Čermáň) (Fig. 5) is based on the three apartment buildings that are placed on the Potravinárska Street. There will be 20 housing units (one, two and three room) in each apartment building. Flats are identical to each other. The size of 1-room flat is 35.50 m², 2-room flat has 42 m²–46 m², and 3-room flat has 80.44 m² [3].

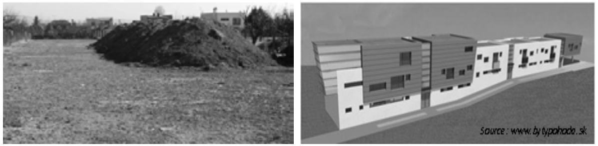


Figure 5: The location of Bytový dom Pohoda (Pohoda Residential House) and its animation

In the urban part of Nitra – Čermáň, there is a planned construction of more than 500 housing units. After completion of residential complexes not only housing complex will be built, but these areas will also offer a number of services such as cafes, restaurants, shops, etc.

In addition to residential complexes in this urban part, also the construction of family houses, that complement free parcels in the northeastern part of the built-up area, is being carried out. This is a construction carried out by the company or individual construction which is ordered by the customer himself/herself (Fig. 6). Predominant are low-storey family houses in the form of bungalows, but there are also double-storey and villa family houses (Fig. 7).

Figure 6: Residential Houses Nitra – Čermáň

Figure 7: Construction of family houses in the urban part of Nitra – Čermáň

The urban part of Párovské Háje is very attractive from the aspect of construction of family houses. Residential units create a new site in the northwestern part of the cadastral area which passes directly from the Šúdol site in the urban part of Klokočina. There are 6 newly built family houses in this area.

Directly in the built-up area there is a construction of family houses on the free parcels between the original buildings and also new streets are being created such as Veterná Street and Agátová Street (Fig. 8, 9).

Currently, there are 30 newly built houses and 10 houses under construction. Similarly, as in the urban part of Čermáň, it is dominated by low-storey family houses in the form of bungalows, one-storey, and villa family houses (Fig. 9).

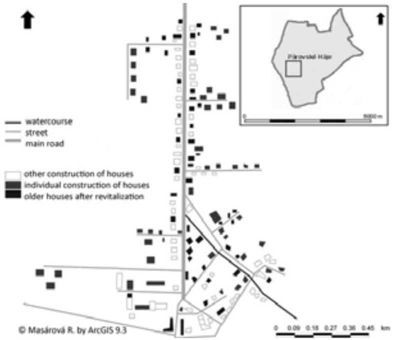


Figure 8: Street network in the urban part of Párovské Háje

Figure 9: Construction of family houses in the urban part of Párovské Háje

6. QUESTIIONNAIRE SURVEY OF IMMIGRANTS IN THE URBAN PARTS – ČERMÁŇ AND PÁROVSKÉ HÁJE

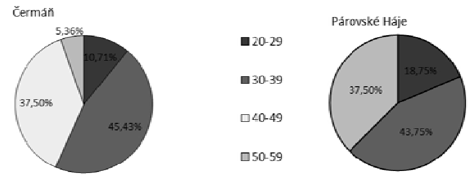
Signs of suburbanization in the urban areas of Čermáň and Párovské Háje were studied also by using field research which included questionnaire and interview.

Overall, 56 immigrated inhabitants of the urban part of Čermáň and 16 immigrants of the urban part of Párovské Háje participated in the survey. When residents were questioned, we tried to visit every flat in housing buildings; however, co-operation on the questionnaire was accepted by immigrants only from newly built family houses.

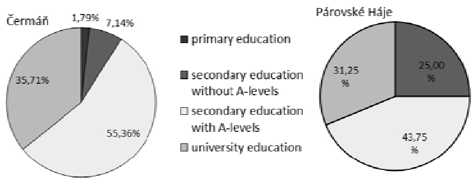
Questions from the survey were about the basic information on the respondent, housing, immigration reasons, and satisfaction with housing.

More than 50% of respondents, who immigrated to the suburban areas, were young population of 30 years old or older with university degree and secondary education. More than 50% of respondents were employed. In the urban part of Čermáň, the household income amounted to over 700 € while in the case of the urban part of Párovské Háje, it ranged from 500 to 600 € (Fig. 10).

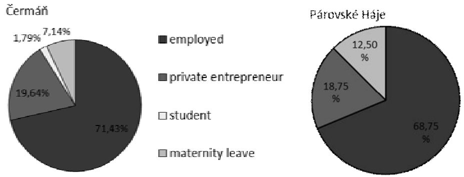
a) Age group of respondents in the urban parts of the Nitra City



b) Education of respondents in the urban parts of the Nitra City



c) Economic activity of respondents in the urban parts of the Nitra City



d) Gross monthly income of respondents in the urban parts of the Nitra City

Figure 10: Basic characteristics of respondents in the urban parts of Čermáň and Párovské Háje
Source: field research, 2012

Residents immigrated in the new residential area mostly from the Nitra City, particularly from urban parts of Chrenová and Klokočina. Smaller share of immigrants came from other municipalities. In the case of the urban part of Čermáň, 89.29% were from the Nitra City while in the case of the urban part of Párovské Háje it was 87.50% (Fig. 11).

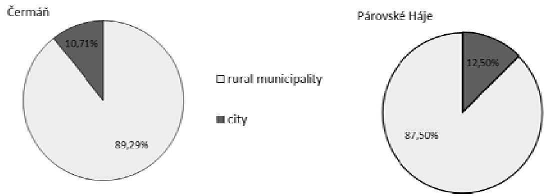


Figure 11: Previous residence of residents in the urban parts of Čermáň and Párovské Háje
Source: field research, 2012

The length of housing of residents varies. In the urban part of Čermáň, most of households live in the suburban area from 6 to 10 years while in the urban part of Párovské Háje it is from 1 to 5 years (Fig. 12).

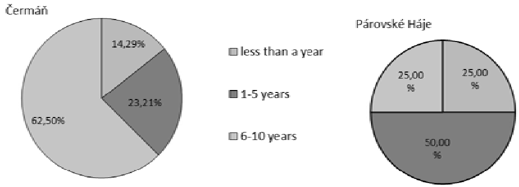


Figure 12: Length of housing of residents in the urban parts of Čermáň and Párovské Háje
Source: field research, 2012

Based on questions relating to the reasons for moving to urban parts, respondents could choose one of the 9 reasons: change of workplace; distance to work; education, study; health reasons; marriage; divorce; housing reasons; following a family member; other reasons. The most common reason for immigration into urban parts were housing reasons (Čermáň – 41.07%, Párovské Háje – 56.25%) as confirmed also by one of the attributes of suburbanization which is the opportunity to live in own family house with a garden and more privacy (Fig. 13).

Figure 13: Residents' reasons for moving into the urban parts of Čermáň and Párovské Háje following
Source: field research, 2012

To determine satisfaction of population with the living conditions in the urban parts, we chose 10 indicators which were assessed by respondents with marks from 1 to 5. Mark 1 expressed the most important factor and mark 5 stands for the least important factor. On the basis of such assessed localization factors we obtained an average mark which divided them into above-average important (more than average) and below-average important (less than average) indicators.

Respondents in the urban part of Čermáň received the average evaluation mark of 3.5. As above-average were evaluated only 3 living conditions in the urban part. Top rated was the personal and property security (1.70) followed by the housing conditions (1.72) and technical equipment and infrastructure were given the evaluation of 2.97. Other conditions were evaluated as below average.

Respondents in the urban part of Párovské Háje received the average evaluation mark of 3.4. As above-average were evaluated living conditions (1.32), personal and property security (1.47), and sporting facilities (2.33). Less positive, but still above average were evaluated these indicators: technical equipment and infrastructure (2.96) and transport connection (3.12).

As below average were evaluated the shopping facilities and services (3.97), opportunities for entrepreneurship (4.38), socio-cultural life (4.65), and job opportunities (4.87). Health and social services were also negatively rated with an average assessment of 5 (Fig. 14).

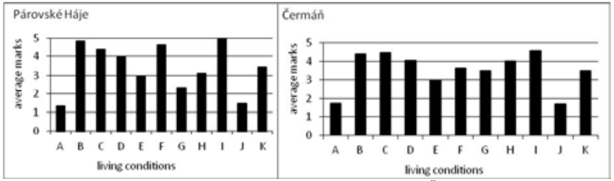


Figure 14: Satisfaction with living conditions in the urban parts of Čermáň and Párovské Háje
Legend: A – housing conditions; B – job opportunities; C – opportunities for entrepreneurship; D – shopping facilities and services; E – technical equipment and infrastructure; F – socio-cultural life; G – sporting facilities; H – transport connection; I – health and social services; J – personal and property security; K – average
Source: field research, 2012

7. CONSLUSION

The construction of new houses, which is associated with immigration of new residents, has the biggest impact on the expansion of the urban parts. That is why, currently, the construction of residential complexes through developer companies is widespread. Such residential complexes can also be found in the urban part of Nitra – Čermáň. In this urban part, they plan to build more than 500 housing units after the completion of two stages of various residential complexes. The urban part of Nitra – Párovské Háje is a typical example of the construction of individual family houses that complement the built-up area of this urban part. Speeches process of residential suburbanization was the example districts of Nitra – Čermáň and Kynek confirmed. The biggest impact on the expansion of urban parts has a new house construction, which is associated with the immigration of new residents. Therefore, there is a widespread construction of turnkey apartments i.e. construction of residential complexes by developer companies. These residential complexes can be also found in the Čermáň urban part in the Nitra City. More than 500 housing units are planned to be built in this urban part. The urban part of Párovské Háje is typical for individual family houses construction which complements the built-up area of this urban part.

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THE NEGLECTED POTENTIAL OF GEMERSKÉ HOREHRONIE AND PROPOSALS FOR ITS UTILIZATION

Ján Veselovský[1] and Jakub Bernadič[1]

[1] Department of Geography and Regional Development, Faculty of Natural Sciences, Constantine the Philosopher University in Nitra, Trieda Andreja Hlinku 1, 949 74 Nitra, Slovak Republic,
e-mail: jveselovsky@ukf.sk

ABSTRACT

We analyze main problems in the definition of tourism region of Horehronie. According to earlier researches and older works in this region is delimitated a subregion in the easternmost part of area with specific cultural and historical development. This territory has various cultural heritage: from the westernmost Ruthenians in Slovakia to German noble house of Saxen-Coburg-Ghota. We hope knowledge of its history can help to establish counterpart to Banská Bystrica in the eastern part of Horehronský region of tourism, which is well-known and often visited.

***Key words**: cultural and historical heritage, region of Horehronie, traditions, secular monuments, religious monuments, happenings, Cobourgs House*

1. INTRODUCTION

During a field survey in the tourism region of Horehronie we found out that its eastern part; as it was delimitated by the Department of Tourism at the Ministry of Economy of the Slovak Republic [1]; has a very good potential for tourism development. In terms of cultural and historical heritage is not the mentioned area very promoted, nor by Banská Bystrica Self-Governing Region neither on websites dedicated to the promotion of tourism in Slovakia abroad [4], [9].

Tourism is in current period a natural component of lifestyle as well as a way of demonstration of standard of living of inhabitants. Its recreational and medical function is very important. Its status proportionally increases with the attendance of population on tourism activities, but on the other hand it worsens the quality of natural environment. Besides the stated function, tourism is characterized also by cultural, cognitive, scientific and informative function [7].

Krogmann [5] describes tourism as a composite phenomenon that has to be; in terms of its complexity; researched by many various scientific disciplines such as Management studies, Sociology or Economy, which use own special approaches.

In the process of evaluation of tourism assumptions is used the system divided into three groups of assumptions: location, selective and realization [7]. For the assumptions of location are considered natural and cultural conditions for the emplacement of particular form of tourism, too. The selective assumptions speak about ability of inhabitants to participate at tourism events (or other activities) and the assumptions of realization talk about the way how is possible to realize tourism activities, because they show a real situation within the landscape, whereas they include a material and technical base for tourism. The first group of assumptions is further subdivided into natural (relief, waters, climate, fauna, flora and protected areas) and cultural and administrative which include cultural and historical heritage, central institutions and organized events.

Cultural monuments are subdivided into tangible and intangible. The tangible ones can be on the lower level again divided into movable and immovable. The mentioned subgroup of immovable monuments is bounded by the one place and therefore influence tourism flows.

The aim of this paper is to delimitate a subregion of Gemerské Horehronie, to describe its cultural and historical potential and to propose a thematic route that would use it.

2. GEMERSKÉ HOREHRONIE

Gemerské Horehronie consists of the municipalities of Polomka, Závadka nad Hronom, Heľpa, Pohorelá, Vaľkovňa, Šumiac and Telgárt and is located in the most eastern part of tourism region of

Horehronie. These villages belonged to the property of Muráň Castle [6], which last owners were nobles of the German lineage of SachsenCoburg-Gotha, shortened as Coburgs. Their stay probably led to creation of many interesting cultural sites that could have become core products of tourism in the Region of Horehronie. In accordance with the sufficient high-quality propagation especially abroad could be created a counterpoint to Banská Bystrica. It is located in the most western part of tourism region of Horehronie and as a seat of the Banská Bystrica Self-Governing Region attracts there many tourists, who usually visit just the city and its hinterland but do not explore the rest of the tourism region.

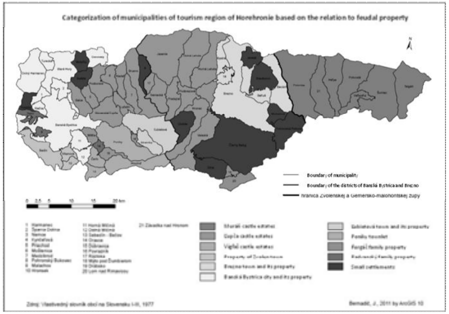

Figure 1: Categorization of municipalities of tourism region of Horehronie
Source: Ján Veselovský

3. TSAR FERDINAND I. BULGARIAN AND GEMERSKÉ HOREHRONIE

The oldest villages in this region are Telgárt, Šumiac and Polomka (Map 2) that existed just at the beginning of the Wallachian colonization in the 14th century. There lived Ruthenians from Romania and Carpathian Ruthenia. Those Vlachs founded in the 2nd part of 16th century villages of Heľpa, at the beginning of 17th century the villages of Závadka nad Hronom (1611) and Pohorelá (1612) [1]. Later, in the 2nd half of the 18th century were discovered deposits of iron ore in the territories of municipalities of Pohorelá and Šumiac. These natural resources led owners of Muráň Castle (Kohárys and later Coburgs) to the establishment of metallurgical factories and settlements called Pohorelá Masa, Vaľkovňa and Červená Skala. They had just a residential function for metallurgists who were mostly coming from Germany [2].

Just the monuments associated with the last owner of Muráň Castle as well as metallurgic complex, Tsar Ferdinand I. Bulgarian, has the biggest potential for the promotion of cultural and historical sites. Just this member of Coburgs family was instrumental in construction of many sacred and secular monuments in Gemerské Horehronie. In the second half of the 19th century the Tsar decided to build for himself and his brother – Prince Filip – a nouveau mansion with park in Pohorelská Maša. He was going right there from Vienna; where this family stem resided at this time; and later from Sofia with his other crowned relatives from Denmark (King Ernst Gunther), Brazil (Emperor Pedro II), Belgium (later King Leopold II and Albert I), Portugal (later Emperor Carlos and Manuel), the Great Britain (King Edward VI, Edward VII and George V), Russia (Tsar Alexander II and Mikuláš II) and, of course, from imperial court in Vienna (Grand Duke Jozef Karol) [3].

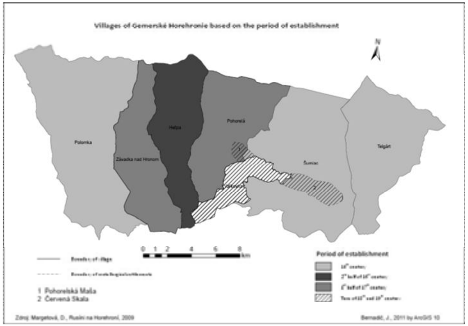

Figure 2: Villages of Horehronie based on the period of establishment
Source: Ján Veselovský

In Pohorelská Maša were later built other important sites. The Art nouveau villa of regent of ironworks was built there and a Roman Catholic church in 1907, where were his children confirmed, except of the later Tsar Boris III who had to be Orthodox according to the Bulgarian Constitution. The so-called Constitution of Tarnov from 1878 claimed the Orthodox religion as a state religion and the monarch was required to be its believer. The mentioned Constitution was the first one in the Bulgarian princedom [3]. In Valkovňa can be seen houses and church built for the community of Protestants of the Augsburg confession and in Červená Skala is Roman Catholic parish church with stained glass windows depicting Ferdinand with his family members. In the easternmost part of the region, at Pusté Pole, there is a hunting manor, which was as well as other buildings, built in Tsar Ferdinand's period for his purposes.

Figure 3: Tsar Ferdinand (sitting in the middle) and his family members
Source: [3]

These Coburgs buildings are considered to play a key-role in the proposed tourism product "In the Footsteps of Ferdinand in Horehronie." We propose a reconstruction of villa of regent of ironworks; where was a medical centre till the beginning of the 21st century; to the Tsar Ferdinand's Museum associated with the exposition of enamel products coming from the former ironworks from the 2nd part of the 20th century. There would be also an exhibition of life and work of academic painter Max Švabinský; who lived in the villa in the first part of that century [8]; and an information centre promoting other Coburgs and folk sites in Gemerské Horehronie. The proposal for Pohorelská Maša also includes a renovation of park with the restoration of waterfall where would be appropriate to install information boards focused on the visits of known monarchs in this village. This could be also the point for some means of transport (such as horse or microbus) on this thematic route [2].

Figure 4: Tsar Ferdinand during exile under Kráľová hoľa
Source: [3]

Figure 5: Villa in Pohorelská Maša **Figure 6: Coburgs manor in Pohorelská Maša**
Source: Bernadič, 2010

According to the proposal, route continues to the small settlement Nová Maša (part of the Valkovňa village) where are some of the former Cobourgs houses still inhabited and there are also ruins of the metallurgical factory. We recommend installing the board focused on the ferrous metallurgy in Gemerské Horehronie.

In the middle of village of Valkovňa is located an evangelical church built during the beginnings of the 20^{th} century. It was constructed for the needs of metallurgical foremen coming originally from Germany. Currently (March 2013) is the church administered by the Roman Catholic Parish in Červená Skala and once a month there is a mass. At this place would be appropriate to install the next board concentrated on nationalities, inhabitants of Swabia, Styria, Alsace etc., to which the indigenous people recognized, differences in religion, fashion and other habits and customs that were brought to this territory [2].

The easternmost settlement within the village of Vaľkovňa (Zlatno) liked Tsar Ferdinand the most of the whole Horehronie. Holec [3] claims that Ferdinand in his last will (in 1948) expressed a desire to be buried just in the cemetery at the settlement, what corresponds to the fact that Tsar's sarcophagus placed in the family tomb in Bavarian Coburg is still ready for transport. There should be another information board or monument dedicated to this fact.

The easternmost of the settlements, Červená Skala, is a transport hub and is important especially for tourism participants, who are interested in hiking in Muránska Planina, Slovenský Raj (Slovak Paradise) and Kráľová Hoľa in Nízke Tatry (Low Tatras). At the railway station at this settlement is recommended to emplace an information board about thematic route "In the Footsteps of Tsar Ferdinand" as well as another about Ferdinand's hobby in railways [3]. In Červená Skala is also located a Roman Catholic parish church of the Ascension of Jesus which stained windows depict likenesses of Ferdinand, even as a Bulgarian prince, and his family members [2].

Figure 7: Residential building "Šalanda" – view from dooryard
Source: Bernadič, 2010

The easternmost stop at the route is proposed a visit at the hunting manor at Pusté Pole which is rebuilt on the accommodation facility. In its proximity could be established a nature trail about Ferdinand's hobby in entomology, botany and forest protection. The interesting element could be the establishment of a small wildlife reserve, where would be animals those Ferdinand received as gifts. Among other species, it was a white deer from British Queen Victoria, who was Tsar's aunt [2].

If this tourism product realize, it will need a high-quality promotion especially abroad, because the group of tourists visiting places related to known personalities from past is in Slovakia less developed than in foreign countries. Gemerské Horehronie has also a very good potential in terms of organized events, tangible movable heritage and intangible cultural and historical sites.

4. ORGANIZED EVENTS AND CULTURAL HERITAGE

According to our information just one memorial room in Polomka operates in Gemerské Horehronie. It is used as a museum presenting traditional folk costumes and customs of inhabitants of village in the past. Another museum dealing with the local culture is located in Šumiaca and is called "Mikuláš Gigac museum of bells." The memorial room in Závadka nad Hronom was in the time of our field survey (autumn 2010) just in the process of construction. Given these facts, we recommend establishment of such a small museum in the each of the municipalities, because every of them have its own folk costume different from others in the region. Similarly, each "traditional" village is typical for its unique dialect, although that all of them have the origin in the Ruthenian Wallachian colonization [6]. The greatest peculiarity can be considered as a dialect in Pohorelá that can be labelled as Goral as well as dialect in Šumiac, which is very similar with the Ruthenian dialects in the Eastern Slovakia. We recommend for museum in Pohorelá the establishment of the part, which attention could be paid to Jozef Gregor Tajovský, Gejza Horák and Jozef Bahéri, who lived there [8].

In the framework of organized events is promoted outside the region a folk festival "Horehronské dni spevu a tanca" in Heľpa, which is usually held in the last week of June or the first week of July with the participation of folk artists from Slovakia and foreign countries, too. For tourists can be interesting to visit the World Championship in moving in Pohorelá held in the second weekend in June. In August is in Pohorelá organized also a folk night under Orlová. Regularly during June is held a rodeo in Polomka and in the last month of summer takes place at the church in Šumiac a festival of Greek Church Slavonic chants called "Ozveny staroslovienčiny" under Kráľová Hoľa [2]. An interesting event in Šumiac, which can attract many visitors, is "Fotodeň" (Photoday) that is organized many times a year, usually in January and May. It is a meeting of amateur and professional photographers, who take photos (focused on the one topic) in the village. At the evening is a session and the best pictures as well as their authors are awarded.

5. CONSLUSION

In this paper was defined the subregion of Gemerské Horehronie; in terms of delimitation by [11]; that had a different historical and cultural development in comparison to the rest of this region. This fact probably contributed to the preservation of specific traditions and construction of technical and cultural and historical monuments that could compete with the most visited sites in the western part of the region.

There were also indentified the main weaknesses in the development of tourism in the study area. In terms of selective assumptions it is mostly just an insufficient promotion. Webpages focused on promotion of Slovakia abroad do not deal with this part of Central Slovakia. Similarly, there was found no information about territory on the webpages of Banská Bystrica Region.

Another shortcoming in tourism development is a relatively large distance from urban centres and lack of accommodation and catering facilities.

We hope that presented proposals and ideas will be used as a location assumptions of tourism, decaying sites will be repaired and particularly better publicized. Knowledge of these conditions could help to the completion of network of accommodation facilities.

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RELIGIOUS TOURISM OF TOPOĽČIANKY MUNICIPALITY

Ján Veselovský[1]

[1] Department of Geography and Regional Development, Faculty of Natural Sciences, Constantine the Philosopher University in Nitra, Trieda Andreja Hlinku 1, 949 74 Nitra, Slovak Republic,
e-mail: jveselovsky@ukf.sk

ABSTRACT

Religious tourism is one of the oldest forms of tourism which inserts to the specific phenomenon of tourism. Tradition of religious tourism is firmly established in all religions. The most noticeable visual manifestation of religious tourism is pilgrimage tourism. In connection with the pilgrimage tourism there are demands on the quality of the environment, transportation, material-technical base, catering etc. The aim of this paper is to provide detailed information about pilgrimage tourism in the Topoľčianky municipality.

Key words*: religiosity, tourism, Topoľčianky, Church, pilgrimage*

1. INTRODUCTION

Religious tourism means each type of tourism, whose participants are during their journeys to the places of temporary residence motivated especially in religious way [18]. Pilgrimage is a movement to holy places because of religious objectives [1]. The basic motives of pilgrimage tourism; deep-routed from the first Christian centuries; are the possibilities to see, pray, fulfil a promise, achieve hear of prays, give thank and learn. [17] is inclined to the term of pilgrimage tourism and presents that participants at religious activities are perceived as pilgrims or tourists but never as religious tourists.

Pilgrimage tourism is a certain specific type of tourism. It belongs to the oldest forms of tourism and is as old as mankind and religion. It is characterized; as each type of tourism; by participants that are strongly religiously motivated [13].

The issues of tourism were contained in studies by [15], [10], [14], [20], [2], [5], [7], [8], [6], [16] and the topic of religious tourism at the study area was presented by [9], [11], [12], [21], [3], [4].

2. PILGRIMAGE TOURISM IN SLOVAKIA

The area of Slovakia has had especially rich sacred history. The Christianity has a long-term tradition in this way. The first diocese established in Slovakian territory was in Nitra. It was founded in 880 during the existence of the Great Moravian Empire and St. Methodius was at the head of this bishopric. The Christianity was spread among people just owing to influence of St. Constantine and Methodius. Believers began to worship the saints and by the time were created various cult objects and places of pilgrimage.

The essential elements of the Catholic spirituality are undoubtedly consisting of a Marian devotion as well as devotion to the saints, respectively to their relicts and hence it cannot be missing in lives of the faithful. A pilgrimage to shrines is associated with cult objects from the earliest times. Pilgrimages are long-term elements of history and it has had a long tradition also in our country [21].

The mentality of Slovak nation includes a sense of pilgrimage, although often without practical utility. Pilgrimage tourism can be therefore considered as an impulse for a renewal of extinct traditions and thus a way to achieve more positive economic indicators in this industry. Slovakia has excellent conditions for pilgrimage tourism development which are used just in a minor way. There are tombs of various saints and beatified, relics of the saints, Calvarias, The Way of the Cross, gracious paintings and rare statues of the Virgin Mary [1].

A tradition of pilgrimage is the oldest and most widespread within the Roman Catholic Church that registers places of pilgrimage from local to international importance in our country. The most importance pilgrimage destination is Levoča town with international importance and two centres – Šaštín and Nitra – with importance at the national level. In our country there are known relics of the saints, such as the relic of the Holy Cross at the Franciscan church in Bratislava, the relic of the holy

Christ's blood with a special chapel at the minster in Hronský Beňadik, the holy stairs in Malacky that are a copy of stairs after those Christ walked into Pilate's hall. Calvarias and The Way of the Cross are the places associated with the worship of wayside shrine that started to be built in the 16th century in order to commemorate the crucifixion of Jesus Christ. There are many known and favourite Calvaries and The Way of the Cross, such as Calvary in Nitra, Topoľčany or Topoľčianky. The most often preferred items for religious tourism in Slovakia are gracious paintings and statues of the Virgin Mary.

3. PILGRIMAGE IN TOPOĽČIANKY MUNICIPALITY

The municipality of Topoľčianky is located in the district of Zlaté Moravce and 3 km far from Zlaté Moravce town in the northern direction. The parish belongs to the Deanery of Zlaté Moravce and the Diocese of Nitra (Fig. 1, Fig. 2). It is recognized as a place of the Marian pilgrimage and declared as a place with importance at the regional level and dedicated to the “Karmelská-Škapuliarska” Virgin Mary.

Figure 1: Archbishoprics in Slovakia
Source: [27]

The transport accessibility is ensured by the Road 511 that connects the town of Zlaté Moravce on the south and the town of Partizánske on the north.

The origin of Marian pilgrimage comes from the period, when the decisive battle between Central-European Christian nations and Turkish occupiers occurred. It took place near Vienna in 1683 and Christian troops defeated their opponent on September 12, 1683. Consequently, Pope Innocent XI gave the following day as the Feast of the Sacred Name of Mary for the whole Church.

Elisabeth Rákoczyová-Erdódyová (coming from Topoľčianky municipality), influenced by previous events, conducted a thanksgiving pilgrimage to the Holy Land. She visited many holy places, such as the monastery on Mount Carmel, where she got in touch with the rules of that Order. She asked the superior for permission to establish the Brotherhood of St. Scapular within her dominion in Topoľčianky. She did send a request to the then Hungarian Primate Juraj Szelepcsényi [21].

His successor, Juraj Széchenyi, dealt with this matter too. It was him, who sent this request to Pope Innocent XI and he met Countess Elisabeth's wishes. He entrusted Szechényi to establish the Brotherhood of St. Scapular in Topoľčianky municipality. He also determined a date of pilgrimage on the following Sunday after the Feast of Our Lady Scapulary (July 16). The Pope Innocent XI sent Countess also a special personal present – reliquary painting of the Virgin Mary Scapulary (Fig. 3) made by Italian master which was set into the silver frame that included remains of saints. Elizabeth found for the painting a dignified place at the newly established chapel that was a part of the manor. Juraj Szechényi established the Brotherhood on July 16, 1686. A pilgrimage has been held annually since the mentioned date. In current period, the centre of respect to Virgin Mary is not the chapel located at the manor, but a parish church and spaces around it, such as the local churchyard and a

Calvary chapel built and consecrated in 1933 that is located there, Calvary consecrated on July 14, 1907 and a chapel of St. Anne built in 1871. The whole compound presents a dignified place for thousands of pilgrims – devotees of Our Lady of Mount Carmel [24].

Figure 2: The Diocese of Nitra
Source: [26]

Figure 3 Virgin Mary Scapulary
Source: [23]

Figure 4 Parish church of St. Catherine
Source: [22]

The parish church dedicated to the St. Catherine of Alexandria (Fig. 4) was built by Count Karol Keglevich and his brother Žigmund, who was a bishop. It is built in classicist-baroque style, whereas there is a painting of the Virgin Mary Scapulary on the side altar. The proposal was prepared by the then famous architect Melchior Hefele from Bratislava who planned a current Primate's Palace in Bratislava as a seat of the Archbishop of Esztergom. A construction of the church began in 1776 and was finished in 1784 [13].

The church was consecrated on October 26, 1779. Some rare parts from the older church were moved there, such as the marble parts of an old altar, very precious copper baptismal font on the marble pedestal, the relief of Ján Topoľčiansky-Turkobijec made of a red marble and some valuable paintings. It is dedicated to the St. Catherine of Alexandria, whose painting is hung above the main altar. The mentioned painting is the work of painter Karol Keglevich (in 1784) and was based on the model of Hubert Alexander Mauer painted at the old gothic minster. Subsequently were from the older church transferred both bells (each of 50 kg weight) from the belfry and one bell (of 150 kg weight) right from the church. The church has a solid foundations and the Keglevich Family had a family tomb built under it [25].

New bells, made by Fischer Brothers Co. from Trnava, were placed on the belfry in 1925. Altogether, five bells were fixed and after two years (in 1927) also the tower clock [19].

Mikuláš of Topoľčianky, coming from the important lineage, had the chapel of St. Anne built (Fig. 5). Its ground plan was created in Italian town Gandria in 1342. These all plans are currently stored in the military archive in Haimstadtdorf town. The process of church's construction was finished in 1351. During the same year, after the harvest, was the church consecrated by Father Juraj, the monk from Abbey in Svätý Beňadik. The first priest was the bilingual Father Kazimír from Hont [13].

Outside the pilgrimage compound there is a chapel at the manor related to the holding of pilgrimages in the past. It was built by the Countess Rákocziová-Erdódyová's order on the occasion of the Brotherhood of Carmelite foundation. On July 16, 1686, the chapel was ready to receive a painting of the Virgin Mary of Carmel (gift of Pope Innocent XI) and welcome the Archbishop Juraj Szechényi, who founded the Brotherhood of St. Scapular in Topoľčianky. The chapel had been the target place for many pilgrims from its foundation till the Fifties of the last century when these kinds of activities started to be limited [21].

The chapel contains many works of art. On the altar there is a copy of Raphael's Madonna which replaces the former painting of Mother Scapulary that was relocated to the church and later stolen. In the niche behind the altar is situated the copy of Murillo's Madonna and next to her is the painting of four evangelists. In the front part, there is located the painting called “Mourning of Christ” by his mother after the removing from the cross, made by Eduard Bulla originally coming from Liptov. Above the chapel's entrance is painted Elisabeth Rákoczyová. This painting was made by Benedictine monk Basilio in 1663 [13].

Nowadays, during the pilgrimage, usually about 10,000 tourists come to Topoľčianky. The pilgrimage starts at Saturday evening by The Way of the Cross followed by church mass, candlelight procession into the castle chapel. At midnight there is a church mass for youth. From Sunday morning there are church masses in Slovak and also Hungarian. The highlight event of the pilgrimage lies in the church mass at Calvary in the presence of three bishops and about ten priests (Fig. 6).

Pilgrims have in the compound the possibility to confess at improvised confession booths, where are just some chairs and prayer desks brought from the church. In the territory of churchyard, above the Calvary made in 1907, is situated the Chapel of the Holy Sepulchre (1933), chapel of St. Anne (1871), missionary rood, statue of Our Lady of Sorrows and the cross under lime tree. In front of the church there are the statues of St. Cyril and Methodius. The whole mentioned compound (church, chapels, churchyard, Calvary) creates a dignified place of respect, reverence and the final rest [25].

A drinking water as well as walled toilets is available for pilgrims. Parking of a car or bus is possible at the nearby square located in front of the “Národný dom” hotel or adjacent streets. Local accommodation facilities offer also the overnight stay. There is also available medical service for pilgrims too. At the time of pilgrimage there are many stall keepers offering Christian literature and devotional commodities. Souvenirs and sweets can pilgrims buy on the main street of the municipality. From the organizational point of view is the pilgrimage realized by parish in Topoľčianky with an active help of many volunteers [13].

Figure 5: Chapel of St. Anne **Figure 6: Pilgrims in front of the church of St. Catherine**

Source: [21], Veselovský, archive

During the pilgrimage is also organized “Karmelfest” (Fig. 7), what is a meeting of youth pilgrims in the municipality of Topoľčianky.

Figure 7: “Karmelfest”
Source: [24]

4. RESULTS OF QUESTIONNAIRE SURVEY

Pilgrims meet every year at the church mass in Topoľčianky, they pray together and walk by Calvary alongside the The Way of the Cross. The same happened also in 2012, when pilgrims met on July 15 in prayers to Virgin Mary Scapulary for the 326th time.

We took part at this event and acquired much important information about pilgrims, their relation to the pilgrimage, possibilities for participation and others. The questionnaire survey was realized at the time of pilgrimage (July 15, 2012) on the sample consisting of 63 respondents.

In terms of **gender,** mostly women participated at the survey. We questioned 41 (65.1%) women and just 22 (34.9%) men.

Within the frame of **age** structure, was found out that there dominated people from 41 to 60 years old who reached proportion at the level of 39.7% (25 persons). The lowest share (14.3%) was registered by the group up to 20 years. Representations of particular age classes are shown in the Fig. 8.

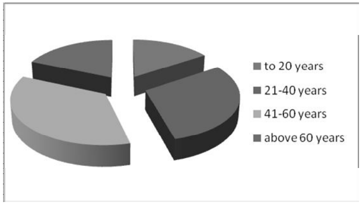

Figure 8: Age structure of respondents
Source: Veselovský, field survey

The next question was focused on the **place of permanent residence** of pilgrimage's visitors. The most of them came from the district of Zlaté Moravce, where Topoľčianky municipality belongs to. There were 12 (19%) pilgrims from the district of Nitra, 8 (12.7%) persons coming from the district of Topoľčany, 6 (9.5%) believers travelled from the district of Nové Zámky and the same number came from the district of Levice. Their participation can be caused due to the “Karmelfest” organization (Fig. 9).

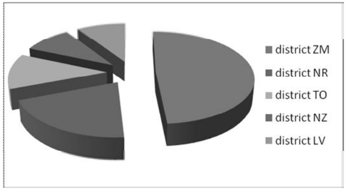

Figure 9: Structure of respondents by the place of permanent residence
Source: Veselovský, field survey

In light of the **level of education** (Fig. 10) were mostly registered believers who reached the secondary level of education – 29 persons presenting the 46% share. The second most often group of visitors (27%) had just an apprentice education (17 pilgrims). They were followed by those with university education (lower than 25%). Only an insignificant number (4.8%) of questioned participants reached just a primary level of education (3 people).

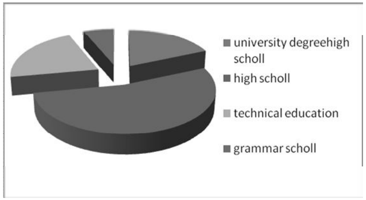

Figure 10: Structure of respondents by the level of education
Source: Veselovský, field survey

The aim of the following question was to find out the **means of transport** that pilgrims used in order to come to Topoľčianky. The most frequent answer was "other" (almost one half of all respondents) what reflects a high number of pilgrims from the district of Zlaté Moravce who could use a bicycle or came on foot (Fig. 11). More than the one third (36.5%) of visitors travelled by car (23 persons), on the other hand, a train was used just by 2 (3.2%) believers.

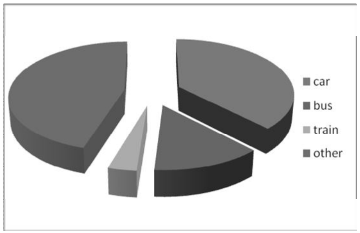

Figure 11: Means of transport used by pilgrims
Source: Veselovský, field survey

The next question found out a **manner of visitors' arrival**, so if visitors came to the pilgrimage just alone or with some friends, family members etc. The most of them, represented by 53 (84.1%) pilgrims, came with other people. The rest (lower than one-sixth) consisted of individuals (Fig. 12).

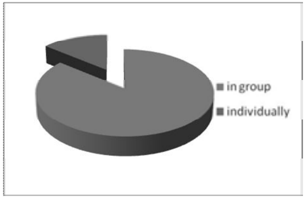

Figure 12: Manner of visitors' arrival
Source: Veselovský, field survey

The **source of information** was the matter of another question of the survey. The biggest group of participants (41.3%) answered "other source" (26 persons). This category consists especially of a long-term tradition of pilgrimage organization, announcement at church as well as various forms of invitations or posters for the forthcoming pilgrimage, respectively Catholic Youth Meeting. The second most frequent answer was "at church" presented by 17 (27%) visitors, probably during a church mass. Just the one-fifth of the sample acquired information from friends, newspapers were a source for 9.5% of the pilgrims and the Internet was used only by two respondents (Fig. 13).

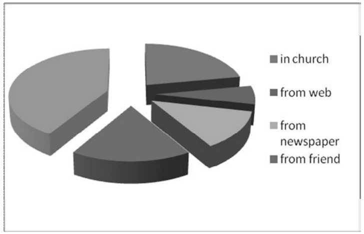

Figure 13: Sources of information about pilgrimage
Source: Veselovský, field survey

The **length of stay** at the pilgrimage was explored within the subsequent question. The overwhelming majority (60 visitors) answered only one day who represented the share at the level of 95.2%. Just 4.8% of respondents (3 of total 63 questioned people) were there more than one day and they were mostly the participants of the "Karmelfest".

The question concentrated on the **frequency of visits** offered 4 possible answers. The most often registered response was "up to 5 times" (36.5% share) and "up to 10 times" by 27% of respondents. The number of visits of particular pilgrimage centre depends on the length of tradition of pilgrimage organization. The older pilgrimage place is, the longer is tradition and the faithful visit such place for longer time and the number of their visits increases. It is reflected in the answer "up to 15 times" that was chosen by more than one-sixth of the questioned participants. Even 12 (19%) believers took part at the event more than 15 times (Fig. 14).

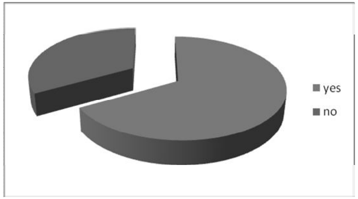

Figure 14: Attendance of other pilgrimages
Source: Veselovský, field survey

Many pilgrims do not attend only pilgrimage in Topoľčianky municipality but also visit other important places related to pilgrimages. The goal of the following question was to find out whether pilgrims visit other similar events. Two-thirds (66.6%) of the respondents answered that they visited various pilgrimages and just one-third decided to visit just pilgrimage organized in Topoľčianky.

The last question of the survey is hard to categorize. Respondents did write their own **motive** for pilgrimage visit. The most frequent motives were such as church mass, strengthening of the faith, prayer, closeness to God, give a thank but also a plea for help, Christian beliefs, obtaining energy and power for the next life. Among motives were also found various responses such as invitation of friends, visit of friends, curiousness, etc.

5. CONSLUSION

The Diocese of Nitra is situated in the western part of Slovakia. It is divided into the 17 deaneries and 197 parishes. Within this territory can be found 16 places of pilgrimage of various level of importance and belong to the particular deanery. Topoľčianky municipality is one of the most important places of pilgrimage in this diocese, because it is visited by 10,000 visitors at the time of pilgrimage. The Virgin Mary Scapulary has become the main cult object. A compound for pilgrimage is located right in the municipality, in the neighbourhood of church, churchyard and Calvary. During the main pilgrimage is also organized the Catholic Youth Meeting called "Karmelfest". Based on the questionnaire survey was found out that in terms of age was the most dominant a group of people from 41 to 60 years. In general, more women than men participated. In light of the level of education was the most frequent category of visitors who reached a secondary education. Believers preferred to come there in groups with friends or family members. Participants used mostly a car to travel to the event, but they chose very often "other way of transport," what could be bike or just they came on foot. The questioned visitors found information about the pilgrimage in various sources of information but lightly preferred was an announcement at church or invitation from friends. The visitors used to stay at the pilgrimage only for the length of one day. Some of the believers took part at other pilgrimages, mostly because of the proximity of their permanent residence to pilgrimage centres or just due to "Karmelfest" organization.

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RATE OF UNEMPLOYMENT IN THE PERIOD BEFORE CRISIS AS ONE OF THE INDICATORS OF POVERTY ON THE EXAMPLE OF THE NITRA REGION

Ján Veselovský[1], Lucia Šolcová[1] and Alfred Krogmann[1]

[1] Department of Geography and Regional Development, Faculty of Natural Sciences, Constantine the Philosopher University in Nitra, Trieda Andreja Hlinku 1, 94974 Nitra, Slovak Republic,
e-mails: jveselovsky@ukf.sk, lsolcova@ukf.sk, akrogmann@ukf.sk

ABSTRACT

Poverty in developed countries, but also in Slovakia is increasingly affected by the labour market or by unemployment. High rate of unemployment often becomes the poverty of entire social categories and individual that did not get a job in the labour market. It is an important indicator which also indicates the social situation in addition to the economic situation in a particular region. The aim of this paper is to point out and evaluate the level of unemployment in the Nitra Region as one of the indicators of poverty.

***Key words**: poverty, indicator, region, rate of unemployment*

1. INTRODUCTION

Since the end of 70s, the creation of massive unemployment has occurred not only in developed countries (since 1991 in Slovakia, too), what is related to the new type of poverty [10]. The mentioned poverty has dealt with individuals and whole social classes that have not found emplacement at the labour market. The noticeable proportion of the poor in Slovakia is connected just with the insufficient number of job opportunities and consequently with the unemployment [8], [9]. The growth in job insecurity and possible unemployment causes that a peril of poverty and poverty in general does not avoid even persons with low income [12].

Unemployment as a traumatizing element in our society was described by [14]. Not only did it show its economic or social dimension but regional, ethnological, cultural and generational specifics as well.

Unemployment causes an extrusion of individuals to the margins of society, rupture of social ties, loss of financial sources, reduction of quality of life (transformation to surviving), deterioration of health, (physical and mental, too – depression) and an increase of unhealthy forms of behaviour (such as alcoholism and others). The issues of unemployment and poverty were the matter of study of following authors [5], [11], [13], [1], [2], [3], [15], [8], [4], [6], [9], [7]. In addition to expressions of unemployment and poverty in rural communities of Nitra region also addressed other demographic indicators, eg. health status [20], [21], [22] and change the quality of residence [16], [17], [18].

2. RATE OF UNEMPLOYMENT – INDICATOR OF POVERTY

We consider the rate of unemployment as a basic and the most used indicator of unemployment reflecting the proportion of registered unemployed (hereinafter referred to as “RN”) of the total number of economically active population (hereinafter referred to as “EAP”) in %.

The average rate of unemployment for the period from 2001 to 2007 was at the level of 12.84%. This information describes that one in eight economically active people did not have a job. The mentioned value is quite high, whereas the Nitra Region sounds in boldly negative way. The only positive feature is that the rate of unemployment in Region has had a decreasing trend. While its level reached 19.33% in 2001, after six years (in 2007) it was lower by 12.98% that meant proportion at the level of 6.35% (Table 1, Table 2). This decline is connected with the reforms of government, higher number of international investors in Region and consequent increase of employment. Overall, the number of unemployed fell from 85,433 people in 2001 to 28,229 persons in 2007 (decrease of total 57,204 people) what was a very positive feature in terms of poverty. The highest values of unemployment rate (above the Region's average) were registered in the districts of Levice (16.59%), Zlaté Moravce (14.38%), Nové Zámky (13.77%) and Komárno (13.15%). On the other hand, the values below the average (positive from the perspective of poverty) were evident in the districts of Nitra (9.29%), Topoľčany (10.39%) and Šaľa (12.32%).

Table 1: Rate of unemployment (%) in districts of the Nitra Region (2001–2007)

District / Region	2001	2002	2003	2004	2005	2006	2007	2001–2007
Nitra	14.04	13.14	11.64	9.89	7.64	5.02	3.66	**9.29**
Zlaté Moravce	22.65	22.61	19.30	13.87	9.94	6.80	5.54	**14.38**
Topoľčany	15.36	13.57	11.48	10.27	9.23	6.95	5.93	**10.39**
Šaľa	17.60	17.51	13.99	11.25	10.68	8.35	6.86	**12.32**
Nové Zámky	21.25	19.79	16.92	13.42	10.24	8.37	6.38	**13.77**
Komárno	22.17	21.42	17.37	11.09	7.80	6.45	5.75	**13.15**
Levice	22.27	21.97	19.86	16.24	13.72	11.79	10.30	**16.59**
The Nitra Region	**19.33**	**18.57**	**15.79**	**12.29**	**9.89**	**7.68**	**6.35**	**12.84**

Source: Internal materials of the Statistical Office of the Slovak Republic, department in Nitra, 2008

Table 2: Number of registered unemployed in districts of the Nitra Region (2001 – 2007)

District / Region	2001	2002	2003	2004	2005	2006	2007	2001–2007
Nitra	14,383	13,733	12,201	10,405	8,062	5,313	3,869	9,709
Zlaté Moravce	6,038	6,028	5,163	3,836	2,683	1,837	1,486	3,867
Topoľčany	7,234	6,435	5,462	4,908	4,410	3,316	2,826	4,942
Šaľa	6,069	6,048	4,885	3,942	3,753	2,932	2,406	4,310
Nové Zámky	19,874	18,513	15,861	12,595	9,609	7,845	5,954	12,893
Komárno	15,186	14,675	11,906	7,593	5,344	4,412	3,923	9,006
Levice	16,649	16,479	14,950	12,247	10,351	8,887	7,765	12,475
The Nitra Region	**85,433**	**81,911**	**70,428**	**55,526**	**44,212**	**34,542**	**28,229**	**57,199**

Source: Internal materials of the Statistical Office of the Slovak Republic, department in Nitra, 2008

The highest value of unemployment rate within seven districts was registered in the district of Zlaté Moravce (22.65%) in 2001. This district reached for the surveyed period the highest decline of unemployment to the level of 5.54% in 2007 that meant the fell by 17.11%. Contrary to presented information, the lowest rate of unemployment was found out in the district of Nitra due to the construction of the industrial park which reduced unemployment in significant way.

From the spatial point of view (Fig. 1) are the highest values of unemployment concentrated on the south-eastern (the district of Levice) and south (the district of Nové Zámky – Štúrovo ward and Komárno ward) parts of the Region. On the other hand, low levels of unemployment are registered in the northern (the district of Topoľčany) and central (the district of Nitra) parts of the Region. There can be found higher and also lower values of the selected indicator in various fragmented parts of the Region.

Unemployment can be assessed also in terms of spatial distribution within five intervals. Positive values of unemployed persons (below average) are contained in the first interval consisting of 55 (15.6%) municipalities of the Region. It is the most widespread especially in the northern (the district of Topoľčany; 20 municipalities) and central (the district of Nitra; 22 municipalities) parts of the Region (Table 3). There are not more than 5 municipalities in other districts, whereas there is not any in the district of Zlaté Moravce. From the district of Zlaté Moravce belong to this interval various municipalities, such as Tovarníky (7.98%), Radošina (8.77%), Hrušovany (9.29%), Preseľany (9.46%), Chrabrany (9.16%), Solčany (9.86%), Veľké Ripňany (9.79%), Nemčice (9.47%), etc. They are larger municipalities with developing economic activities or they are located in the hinterland of town.

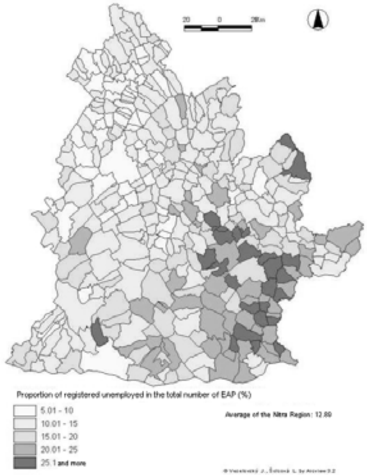

Figure 1: Registered unemployment rate in the municipalities in the Nitra Region

For example municipalities of Solčany, Tovarníky, Chrabrany and Nemčice – population is working usually in town, or it is concentrated towards the main transport route (Nitra – Topoľčany), such as Preseľany or Hrušovany that are typical for a good transport accessibility to Topoľčany as well as industrial park in Nitra. From the district of Nitra belong to the first interval different municipalities, such as Nitra (7.87%), Jarok (8.2%), Ivanka pri Nitre (8.43%), Zbehy (8.57%), Výčapy-Opatovce (8.6%), Veľké Zálužie (8.65%), Branč (9.26%), Bádice (9.29%), Cabaj-Čápor (9.55%) and many others. There are mainly large municipalities (f. e. mmunicipalities of Branč, Veľké Zálužie, Výčapy-Opatovce, Zbehy) or those ones located in town's hinterland (f. e. municipalities of Cabaj-Čápor, Ivanka pri Nitre). The low values of unemployment were also registered within the municipalities located on the important transport routes such as Šaľa – Nitra (municipality of Cabaj-Čápor), Nitra – Nové Zámky (municipalities of Ivanka pri Nitre, Branč), Nitra – Topoľčany (municipalities of Zbehy, Výčapy-Opatovce). Very positive results were registered in case of Nitra city, which is an industrial centre of the Region and all the municipalities with good transport accessibility towards it (such as municipality of Bádice; 7 km far from industrial park in Nitra). The low levels of unemployment can be found also in other fragmented parts of the Region. The example is municipality of Dedina Mládeže (5.29%) located in hinterland of Kolárovo town (the lowest value within the Region), municipalities of Maňa (9.37%) and Michal nad Žitavou (8.12%) located on the transport route from Šurany to Vráble and urban industrial centres Šaľa (9.21%), Komárno (9.42%). To sum up, there are 13 municipalities that have not more than 499 inhabitants, 12 municipalities that have from 500 to 999 inhabitants and 18 ones, which population reached from 1,000 to 1,999 inhabitants. The lowest interval is registered within the three towns and seven large municipalities. Finally can be concluded that low values of unemployment are typical for urban settlements, larger municipalities, municipalities located in the proximity of important transport routes and these located in the hinterland of town.

The second interval (consisting of 158 (44.8%) municipalities of the Region) and the third interval (consisting of 69 (19%) municipalities of the Region) are widespread through the whole area of the Region. They represent slightly positive (2nd interval) or average (3rd interval) values of unemployment. Their core is located in northern, central and western parts of the Region in the districts of Zlaté Moravce, Nitra and Topoľčany. These values are typical for larger municipalities or towns (12 towns represent 80% of the Region).

Table 3: Interval distribution of unemployment in the Nitra Region

District / Region	Interval				
	I	II	III	IV	V
Nitra	21	33	4	2	0
Zlaté Moravce	0	20	10	3	0
Topoľčany	20	34	1	0	0
Šaľa	2	5	5	1	0
Nové Zámky	4	27	9	16	6
Komárno	5	17	14	4	1
Levice	3	22	26	20	18
The Nitra Region	**55**	**158**	**69**	**46**	**25**

Source: Veselovský, 2009 – own calculations

From the perspective of poverty is the fourth interval; consisting of 46 municipalities (13.2% of the Region); in the negative light. Its centre is definitely located in the districts of Levice (20 municipalities) and Nové Zámky (16 municipalities). From the district of Levice there especially municipalities located on the southern parts of the mentioned district, such as the municipalities of Jesenské, Kubáňovo, Tehla, Dolné Semerovce, Farná and Vyšné nad Hronom. From the district of Nové Zámky there are municipalities that can be found on the south-eastern parts of the territory, such as the municipalities of Bruty, Pavlová, Belá, Obid, Šarkan, Bajtan. The mentioned municipalities are distinguished by low rates of economic activities, such as the municipalities of Kubáňovo (38.49%), Jesenské (28.57%), Dolné Semerovce (34.67%); low intensity of housing stock renovation, such as the municipalities of Šarkan (0.48‰), Tehla, Jesenské, Dolné Semerovce (none intensity of housing stock renovation); low proportion of entrepreneurs, such as the municipalities of Pavlová (3.34%), Obid (3.08%); or the high share of population just with the elementary level of education, such as the municipalities of Bruty (56.41%), Jesenské (56.25%), Bajtava (53.33%), Dolné Semerovce (53.23%), Pavlová (52.84%). There are mostly small municipalities (17 municipalities) typical for their peripheral location towards towns in the particular district.

The high unemployment (more than 25%) is typical for the municipalities in the fifth interval (25 municipalities, 7.4% of the Region). This situation is, in terms of poverty, very unfavourable. Within the light of location it is mostly concentrated on the south-eastern (the district of Levice; 18 municipalities), southern (the district of Nové Zámky, Štúrovo ward; 6 municipalities) parts of the Region. The highest values of unemployment were registered in the municipalities of Lok (25.26%), Žemliare (26.11%), Uhliská (26.77%), Nýrovce (27.7%), Sazdice (27.86%), Lontov (27.78%), Leľa (26.39%), Ľubá (26.6%), Kukučínov (28.92%), Sikenica (33.64%), Sikenička (31.64%), Ondrejovce (31.77%), Bajka (37.23%), Malé Kosihy (31.45%), Šarovce (38.46%), Zalaba (41.43%), Šalov (45.24%). Some of the mentioned municipalities are distinguished by the high mortality, such as the municipalities of Leľa (46.02‰), Sikenička (20.71‰) and Nýrovce (18.38‰); high level of average age, such as the municipalities of Žemliare (44.75 y.), Leľa (46.04 y.). Especially negative situation is registered in the municipalities that are not typical only for high unemployment but a high proportion of single-parent families as well, such as the municipalities of Žemliare (8.57%), Bajka (9.16%). There is a low level of housing stock renovation, such as the municipalities of Uhliská, Sikenička and Bajka, where is not in progress any renovation of housing stock; and the low share of entrepreneurs, such as the municipalities of Šalov (2,14%), Ondrejovce (2.25%), Malé Kosihy (2.3%).

The negative level of unemployment is not typical for any town. On the other hand, very unfavourable situation is typical for small municipalities (15 municipalities) with bad transport accessibility (peripheral villages, located outside of main transport routes), high share of post-productive population with poor social and technical infrastructure (often not connected to water-supply system, sewer system and gas – hence the business activities are limited), [19].

3. CONSLUSION

The rate of unemployment is considered to be one of the most important indicators of poverty. The average value of the unemployment rate was 12.84%. This shows that about one in eight economically active people does not work. This rate is quite high and the situation in the region as a whole looks negative. While the value in 2001 was 19.33%, in 2007 it was lowered by 12.98% so it was 6.35%. The given drop of unemployment is related to the government reforms, the increase of the number of foreign investors in the region and consequently the increase in employment. The number of unemployed overall dropped from 85,433 in 2001 to 28,229 in 2007, which means that the number was decreased by 57,204 which is a significantly positive effect from the perspective of poverty. The highest values of unemployment (above the country average) were recorded in the regions of Levice (16.59%), Zlaté Moravce (14.38%), Nové Zámky (13.77%) and Komárno (13.15%). Below average values (positive in terms of poverty) are evident in the regions of Nitra (9.29%), Topoľčany (10.39%) and Šaľa (12.32%). In the past seven years the highest value of unemployment was reached in Zlaté Moravce (22.65%) in 2001. This given region also recorded the biggest drop in unemployment during the specified period and the value was (5.54%) in 2007 so it was lowered by 17.11%. The lowest level was recorded in the Nitra Region (3.66%) in 2007 (an industrial park was built here, which greatly reduced the unemployment). The spatial distribution of the highest unemployment rates is concentrated in the south-east (the district of Levice) and in the south (the district of Nové Zámky – Štúrovo ward and Komárno ward) part of the region. Low rates are evident in the northern (the district of Topoľčany) and central part (the district of Nitra) of the Region.

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PERCEPTION OF THE SELECTED TOURISM CENTRES IN THE JELENSKÉ VRCHY (MOUNTAINS)

Michal Zvalo[1], Alfred Krogmann[1], Lucia Šolcová[1] and Marek Civáň[1]

[1] Department of Geography and Regional Development, Faculty of Natural Sciences, Constantine the Philosopher University in Nitra, Trieda Andreja Hlinku 1, 94974 Nitra, Slovak Republic,
emails: akrogmann@ukf.sk, lsolcova@ukf.sk, marek.civan@ukf.sk

ABSTRACT

The paper is focused on visitors' perception of tourism in two tourism centres and three municipalities set in the Jelenské vrchy (mountains) through a questionnaire survey. The study is concentrated on burning issues that are typical for this area and affect also the environmental feature of the landscape. Finally are summarized findings and concluding remarks with a view to evaluate perceived phenomena and processes.

Key words*: tourism, conditions of tourism, Jelenské vrchy (mountains)*

1. INTRODUCTION

Tourism is a social activity that determines a movement of population to the parts of landscape characterized by interactions of landscape elements, which can cause a temporary change of the place of residence [7]. The real functioning of tourism in any territory needs interrelations among location, realization and selective assumptions. In some certain way, they design together the appropriateness of region for tourism activities and their successfulness. Just the mentioned selective assumptions have also a social feature, because they reflect subjective perception of tourism by incoming clientele and therefore mean a feedback in the way of tourism development. A questionnaire research is very suitable and useful method for analysis and consequent evaluation of selective assumptions.

The aim of the paper is to assess a perception of the area of interest by visitors with a focus on negative aspects of tourism, especially infrastructure and development of accommodation facilities.

2. LITERATURE REVIEW

The importance of perception and its utilization in geographical knowledge, especially in tourism, is documented by studies from various Slovak, Czech and foreign authors, who have concentrated their attention to different interactions arising within the connection of tourism and a mixture of indicators and characteristics.

Not only is the perception a psychological process, but social, as well, which is being created between man and destination [8]. In general, the perception is distinguished by acquiring of information reflecting attitudes of the selected sample to the questions of interest. During the process of evaluation is possible their diversification based on the chosen parameter, that is confirmed in the research of perception of tourism in the Nitra Region, within that respondents were divided according to the place of permanent residence [6]. The German study shows other relations and connections that have assertions in the process of perception. One of that displays the independence of entrance fee on offered exposition what was realized in various open air museums located in the Federal Land of Mecklenburg-Vorpommern [1]. A questionnaire survey can be fully used on the characteristics of recreants' regime at the tourism destinations. This method was confirmed on the example of the Federal Land of Salzburg, Austria [10]. A perception has its significant importance in tourism and different non-economic issues, which is presented within the special research concentrated on cultural and social impacts of tourism on the island of Samos [4]. The complex study focused on perception of tourism and wide variety of its effects was realized on the example of residents of mountainous region called Flogaria located in the northeast part of Italy [2]. Social and cultural features of perception were displayed within the survey in the municipalities of Josefův Důl, Horní Maršov and Harrachov, where inhabitants claimed their favourability towards tourists using the irritation index [5].

The opinion of customer or client is important not only for purposes of scientific community but also for enterprises operating in the industry of tourism. Hence there is an increase of accommodation facilities that offer their clients some polls or inquiry tickers focused on their attitudes, estimations and remarks towards services.

3. STUDY AREA

From the administrative point of view, the study area of Jelenské vrchy (mountains) is located within the District of Banská Bystrica (NUTS IV level) that belongs to the Banská Bystrica Region (NUTS III level) (Fig. 1, Fig. 2). There are located the municipalities of Špania Dolina, Staré Hory, Motyčky, Donovaly, Baláže and Jakub that is the city district of Banská Bystrica.

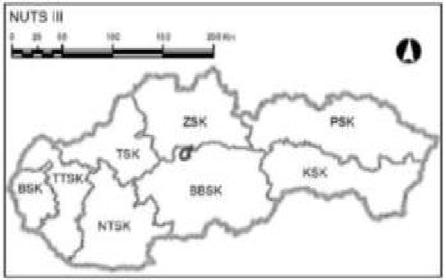

Figure 1: Administrative delimitation of Jelenské vrchy (mountains) at the NUTS III level
Source: [11]

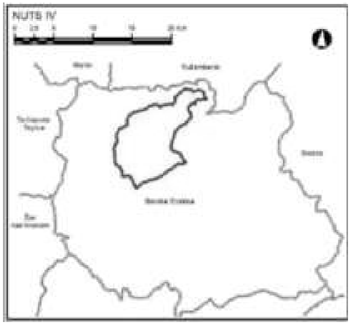

Figure 2: Administrative delimitation of Jelenské vrchy (mountains) at the NUTS IV level
Source: [11]

The point of physical geography can be based on the geomorphological conditions [3]. The Jelenské vrchy (mountains) are the subunit of Starohorské vrchy (mountains) unit. The mentioned Jelenské vrchy (mountains) reach area of 72.4 km^2 and they are divided into two internal parts. The first is called Jelenský chrbát ridge that covers 66.1 km^2 (91.3%) of the area and the rest (6.3 km^2) is covered by Donovalské sedlo (saddle).

Taking into account natural conditions for tourism, the study area has opportunities for a yearlong utilization reaching the highest rates in winter period. It is proved on the case of the municipality of Donovaly that is one of the most attractive winter sports centres in Slovakia, what is documented also by visitors coming not only from V4 countries.

Within the light of transport geography can be summarized that the most important motorway crossing the territory is the 1st class road No. 59 that is parallel with the E77 motorway from south-north direction which connects cities of Banská Bystrica and Ružomberok. This thoroughfare links Liptov region with the central part of Slovakia and hence it is frequently used traffic route.

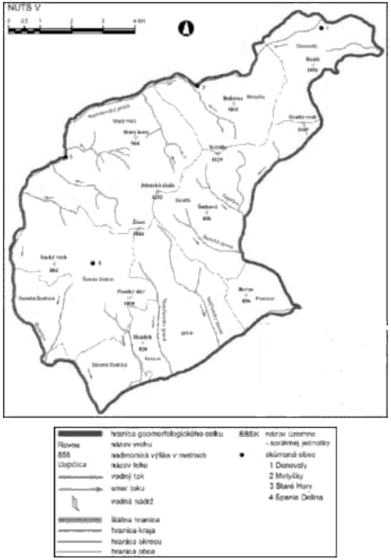

Figure 3: Administrative delimitation of Jelenské vrchy (mountains) at the NUTS V level
Source: [11]

The study area can be also evaluated within the current regionalisation of tourism in the Slovak Republic [9]. All of the mentioned municipalities belong to the Region of Horehronie which is evaluated from various points of view. It has a supranational character within the perspective of stay in mountainous or forest environment, even in the case of climbing. To sum up, climate and relief are two dominant conditions for realization of core forms of tourism that are presented by winter sports and associated accommodation and activities.

4. RESULTS

The final statistics about perception was acquired from the pilot on-line questionnaire survey. There participated 88 people and the most of them (55.7%) were women. In terms of age reached the highest share (46.6%) respondents who were from 20 to 29 years old, on the other hand, the lowest contribution (1.1%) was obtained from persons above 60 yrs, what declares that the Internet is favourable mostly among young people. The following question about the personal information was concentrated on the level of education. There were almost only university educated people (61.4%) or respondents that reached a secondary education (34.1%). The permanent place of residence confirmed that the study area is attractive especially for these ones who live in the Banská Bystrica Region (75.0%). Contrary to this fact, just one person came from the Prešov Region and the Košice Region.

Data focused on the visitors' frequency also show that the area of interest has pleasing conditions for tourism. Visitors who came to this territory 7 or more times got the highest share (68.2%). Approximately one-fourth representation of the respondents came there from one to three times and the participation at the level almost 8% was gained from tourists that visited the area four, five or six times.

Another question took interest in the length of stay. The highest representation (84.1%) showed people, who spent there from one to three days. Visitors, who stayed in the catchment area from 4 to 6 days, reached 11.4% share and the lowest participation (4.5%) was obtained from respondents that were accommodated there seven or more days.

The aim of the next question was to find out the most favourable season for visit. There was also a possibility of long-year attractiveness that acquired the highest (56.8%) favourability. People ticking winter as the answer reached the share at the level of 29.6%, what confirmed very good conditions for winter sports. Summer tourism was accepted by more than 10% of respondents. Spring and autumn are off-seasons for tourism, what declared only 1.1% share among the all obtained answers.

Above shows that the vast majority (63.6%) of respondents did not use any type of accommodation during their visit in the field area. These findings reflected that a significant share of visitors came from the Banská Bystrica Region and the distance between their place of permanent residence and the target destination is favourable within the time availability. Own house or chalet was used by 10.2% of the sample and other types of accommodation reached share less than 10 percent.

The important part of the survey lied in the mean of transport used to the transport to the final destination. Obtained responses confirmed current dominance of individual automobile transport that was ticked by 73.5% of asked people. The share less than one-fifth was registered among visitors travelling by bus and other means of transport (such as bicycle, cross-country skis, mountaineering skis etc.) were attractive only for 8% of respondents.

Another question was focused on the reasons of visit. The noticeable results were obtained just within three options. Almost the half (44.3%) of tourists came to the territory just because of holiday. The second most frequent reason was “other” that reflects the subjectivity of tourists and their travelling incentives. Due to the sightseeing tour visited the study area just 14.8% of respondents, whereas other possible answers (pilgrimage tour, language course, visit of friends, school trip) reached representation lower than 10% (Fig. 4).

The dominant factor of selection of the final destination was the goal of the following question. Respondents could choose among five possibilities and they could tick more than one answer. A welcomed outcome is that more than half (53.4%) of the sample liked beautiful natural environment which inherently belongs to the study area. The second most preferable reason lied in the favourable climatic conditions which reached the share at the level of 28.3%. In case of other possible reactions was not obtained representation above 10%.

Very important element in the industry of tourism are awareness between current and potential visitors. Another question investigated the source of information that helped tourists get information about the territory. Respondents could choose more than one of these answers – the Internet, TV, radio, newspapers, magazines, other. The most preferred source was the Internet (56.3% share) and the second one was television that reached the representation at the level of 21.9%. Other information sources were used in less than 10% cases.

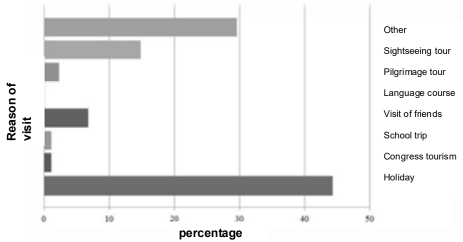

Figure 4: Reasons of visit of Donovaly and Šachtičky tourism destinations and the municipalities of Motyčky, Staré Hory and Špania Dolina by tourists
Source: [11]

Tourism infrastructure was the aim of the following two questions. The results of the first one was that the construction of tourism infrastructure is uncontrolled what confirmed almost two-thirds (64.8%) of the sample. The rest of them presented the opposite attitude. The goal of subsequent question was to find out whether tourists recorded a reflection of tourism infrastructure in the country in general. A clear majority (80.7%) presented that buildings disturb original natural landscape, while 19.3% of respondents perceived this phenomenon in the positive way.

Respondents evaluated an impact of rapid expansion of tourism activities on the character of landscape in the most favourable tourism destination Donovaly (Fig. 5).

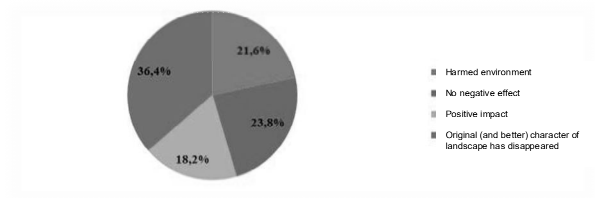

Figure 5: Perception of impact of massive expansion of tourism on the landscape character in the Donovaly tourism destination
Source: [11]

The highest share (36.4%) of respondents thought that the aggrandizement of tourism and related activities contributed to the loss of original and better character of landscape. Contrary to that, almost quarter (23.8%) of questioned people declared that tourism did not reflected in the negative features of natural environment. Very negative attitude was registered by 21.6% members of the sample, but on the other hand, a positive perception was ticked by 18.2% of respondents.

An increase of tourism causes other consequences, such as an increase of traffic. The questioned tourists perceived this feature differently. The most of them (42.1%) declared positive opinion, but on the other side, 35.2% of the sample presented a negative estimation. The rest (22.7%) of participants showed just a neutral attitude.

An aggrandizement of tourism can reflect in the increased production of municipal solid waste or waste in general what may have various negative environmental consequences. This hypothesis was confirmed by almost 60% of respondents, because they declared that the growth of waste affect on them in negative way. This feature was not considered as a problem by 12.5% of the sample and the rest (27.6%) presented a neutral opinion.

The last question of the survey has just a qualitative character. Respondents could add their own unwritten opinions, what would they change in the study area or just widen their comments on various questions. Among the recorded remarks were obtained negative reactions on the increase of construction especially in Donovaly tourism centre. This municipality is typical by the growth of apartment houses that are currently very dynamically increasing element within the accommodation facilities. Another view criticized high consumer prices in accommodation and catering establishments. In general, the members of our sample would prefer construction of attractions prior to mentioned facility of accommodation and catering. The other reactions were negative towards a quality of motorways and roads or an insufficient marketing presentation and propagation of the municipalities of Motyčky, Staré Hory and Špania Dolina.

5. CONSLUSION

Political, cultural and economic changes, which have occurred in 1989, have strongly affected also the tourism industry. A massive aggrandizement of tourism was mostly related to the naturally attractive areas and did not miss the Jelenské vrchy (mountains), where is the study area located. The realized questionnaire survey confirmed a hypothesis that a virtual communication is commonly preferred by younger population which was reflected in the surveyed sample. Among the respondents were dominating people coming from the Region of Banská Bystrica, what is a territorial unit where the study area belongs to. The mentioned fact was reflected in the average length of stay that ordinarily took from 1 to 3 days. In the scope of the transport, tourist favours mostly an individual automobile transport. A momentariness of the stay is affirmed by the fact that the most of respondents did not search an accommodation in the local capacities. An attractiveness and popularity of the region for winter sports are confirmed by the matter of fact that respondents are used to visiting the Jelenské vrchy (mountains) especially during winter season. The presented opinions are in agreement with that the region is enticing due to its natural beauties and propitious climatic conditions. We can state that tourists are aware of running processes in the area under the thumb of tourism. A surveyed sample strongly presented its negative attitudes towards increasing tourism infrastructure which was represented especially by accommodation facilities that unfavourably affect a natural character of the landscape. An environmental comprehension of questioned participants is confirmed by their perception towards burdens such as waste production or enhanced traffic frequency. Summarily, a questionnaire survey confirmed an actual position of surveyed region within the scope of tourism and the respondents simultaneously pointed out the pros and cons that are visible in the area.

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CZECH AGRICULTURE AFTER ACCESSION TO EU: CHANGES, REGIONAL DIFFERENCES

Antonín Věžník[1], Michal Navrátil[1] and Petr Skácel[1]

[1] Department of Geography, Faculty of Science, Masaryk University, Kotlářská 2, Brno, Czech Republic, e-mails: veznik@sci.muni.cz, 439880@mail.muni.cz, 323791@mail.muni.cz

ABSTRACT

The main objective of this paper is to analyse the major changes in the Czech agriculture after accession to the EU. Agriculture, as a fundamental human activity, very much depends on the socio-economic changes. Many changes had taken place since the second half of the 20th century and some of them are still under way. Currently, agriculture is mainly influenced by the Common Agricultural Policy (CAP) of the EU. As a result, changes are occurring in the agricultural production and in the use of agricultural land in the Czech Republic. Legal titles for funding serve for a more considerate and more ecological utilisation of land resources and thus they fundamentally change the whole structure of land resources of the Czech Republic. However, the changes do not affect the use of agricultural land and crops only. The animal production and livestock numbers are affected as well. Therefore, attention is given to the study of development of regional differences in selected crops and changes in number of selected livestock.

Key Words: *Agriculture, CAP, crop production, animal production.*

1. INTRODUCTION

As we have already mentioned, the Czech agriculture underwent several fundamental changes after 1989. In the 90's, it was the transformation of the national economy and the transition from a centrally planned economy to a market economy. It was the first major change which manifested itself in the Czech agriculture. Another important milestone was accession to the EU and adoption of the Common Agricultural Policy of the EU. The policy on subsidies has changed and in many cases, so did the soil management.

1.1 Materials and methods

Data for comparative analysis has been obtained from farm structure surveys from 2000 and 2010 (called "Agrocensus"). The data is publicly available up to the district level. These surveys are conducted using the FAO methodology. It is a quantitative analysis widely used in the Czech geography of agriculture.

For the evaluation of the obtained data, an index of change reflecting the year of 2000 was created (i.e. 2010/2000). The resulting index was processed cartographically for all of the districts in the Czech Republic in the application called ArcMap 10. This way, several well-arranged maps had been created which serve as a basis for the final analysis. The analysis is supplemented by a table that evaluates the development in livestock numbers in the Czech Republic.

1.2 Socioeconomic changes

The above mentioned events (the transformation and accession to the EU), were a significant step towards changes in the Czech agriculture. These changes can be divided into two groups: social and economic changes. The social changes were mostly related to the settlement of property relations in agriculture (restitutions, return of seized land). The economic changes comprised both of the transformation of existing farming entities (the end of collective farming and privatization of the state farms) as well as of the policy on subsidies in agriculture. The attitude towards supporting agriculture before 1990 and after joining the EU is manifested in the following table (table 1).

The table shows very clearly, that before 1990, the agricultural production was subsidized significantly. Emphasis was placed on quantitative aspects of the production which were also harsh on the environment. High employment rate in agriculture was supported and the regions capable of better production subsidized the ones with less favourable agricultural conditions.

With accession to the EU, numerous significant changes had taken place within the agricultural policy. The supporting subsidies are more focused on farmers and their farms than on the production itself. A more environment-friendly farming is being conducted (organic farming and animal welfare) and development of the countryside is taking place – as a complex of agricultural and non-agricultural part of the landscape. The land has been removed from the production and advisory activities have been introduced. Due to more agricultural production being more efficient, there has also been a very significant decline in employment in agriculture.

Table 1: Comparison of agricultural policies in the Czech Republic (1989 and 2004)

the main features of communist agriculture	tools of the common agriculture policy
great subsidies for the agro-food complex	cross compliance standards
incentives for a steady growth of the agricultural production (sales within the Comecon markets)	introduction of a single payment for each farm
high employment rate within the agri-food complex	decoupling of subsidies from the agricultural production
ecologically inconsiderate agricultural production	removal of land from production (set-asides)
socialist form of agriculture (collective farms, state farms)	introducing of modulation and support for the rural development
extensive subsidies that enable large-scale production, production specialization and increase of living standards in the countryside	introduction of an advisory system

Source: (HAMPL a kol. 1996, s. 239; EURACTIV [online])

2. CHANGES IN THE CZECH AGRICULTURE

Socioeconomic development during the 90's of the 20th century and later during the first decade of the 21st century caused changes in the Czech agriculture. The changes are most apparent in the composition of the land resources which, to a great extent, had been affected by the change in the governmental policy on subsidies. However, they were also influenced by the change in owners of the farming entities, when many of them stopped operating without any replacement (see 1.1).

Further, the changes affected mainly the structure of crop production and animal production. In case of crop and animal production, only the most important commodities within the Czech Republic are monitored in the study (mainly grain, potatoes, oilseed rape, cattle, pigs and poultry). Due to different environmental and agricultural conditions, there were considerable variations within the districts of the Czech Republic.

Already at the end of the period before accession to the EU and also after the first period of the Czech Republic as an EU member (2004 – 2006), various assessments of the success rate of Czech agriculture in the EU as well as of the impact of CAP on farms started to appear in expert literature, e.g. Střeleček, Lososová 2003; Jakobe, Trávníček, Vávra 2004 or Bečvářová et al. 2008.

With regards to geography, the impact of the CAP during the period of 2007 – 2013 was being evaluated e.g. by Németová (2009), Svobodová, Věžník (2011), Věžník, Konečný (2011).

2.1 Land resources

Land resources consist of three distinctive components: arable land, permanent grassland and permanent crops (e.g. vineyards, hop-gardens, orchards). Since the 1990, a significant decrease in agricultural and arable land has been recorded in the Czech Republic. The most considerable decrease occurred in the borderland (the Bohemian Forest, the Ore Mountains, the Jeseníky Mountains) and the urban districts (Prague, Brno). The border regions are locations with less favourable conditions for agriculture and this leads to the transformation of arable land into grassland and this way, pastures for organic farming originate. Increase in arable land can be registered in fertile areas of the Czech Republic (Polabí, Southern and Central Moravia).

The opposite trend is evident in permanent grassland where areas on the Czech territory are expanding. The greatest increase is taking place in the upland and highland districts of the Czech Republic. As we have already mentioned, permanent grassland is more economically advantageous in the less-favoured areas (LFA) and this also plays a significant ecological role. Conversely, the decrease of grassland occurs rather in more fertile areas of the Czech Republic.

2.2 Crop production

Despite the changes in the utilisation of land resources of the Czech Republic, no significant changes in crop production are taking place. Rather than that, a significant decrease per hectare is under way and the composition of crop areas is changing. The most represented crops are grain, with the dominant position of wheat and barley (mostly malting barley – for export). From Fig. 1 we can see that the increase, or the same number respectively, can be seen in the fertile regions of Polabí and in the Moravian basins. A decrease is particularly apparent in the mountainous and urban regions.

Conversely, a significant decrease in crop land occurred in our agricultural commodities which used to be typical until recently: in potatoes and sugar beet. In recent years, there has been a marked increase in the cultivation of oilseed rape (largely for the production of biofuels). Again a decrease in the cultivation of fodder plants on arable land and maize for silage was registered. In comparison with the above mentioned crops, industrial crops, fruits and vegetables are only of marginal importance and therefore, they will not be mentioned.

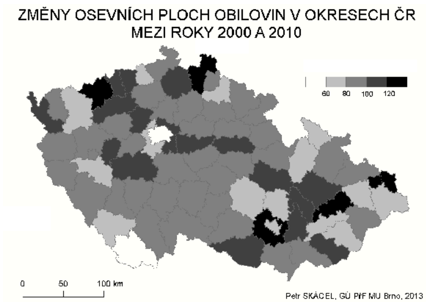

Figure 1: Changes in crop land for grain in the districts of the Czech Republic between 2000 and 2010
Source: (Agrocensus 2000; Agrocenzus 2010)

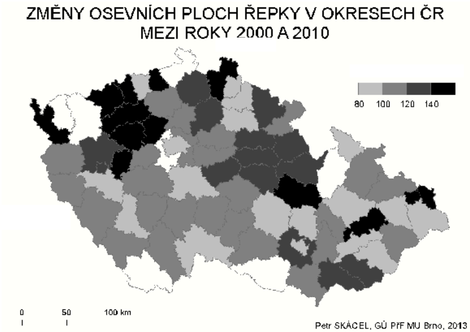

Figure 2: Changes in crop land for oilseed rape in the districts of the Czech Republic between 2000 and 2010

Source: (Agrocensus 2000; Agrocenzus 2010)

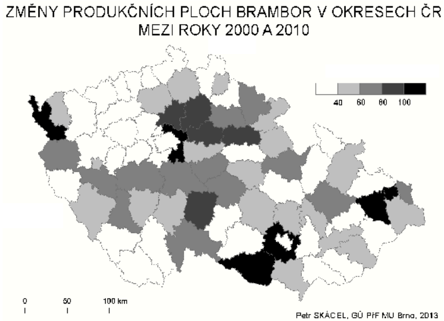

Figure 3: Changes in potato production areas in the districts of the Czech Republic between 2000 and 2010

Source: (Agrocensus 2000; Agrocenzus 2010)

2.2 Animal production

Changes in the structure of animal production were far more pronounced than in the case of crop production. In the 90's, a reverse trend in comparison with the socialist times took place which meant a decline in the animal production. Reduction in livestock numbers applied mainly to pigs and cattle. Reduction in number of cattle is a consequence of a decreased consumption of beef and dairy products. During the first years of the 21st century, the situation was affected by the incidence of the

BSE ("the mad cows' disease") as well. The decrease in the number of pigs is a result of the adoption of the CAP EU measures and pork import to the Czech Republic.

In the case of poultry breeding, no great decrease is taking place, but regional differences are apparent. Poultry (especially chicken and turkey) is becoming popular (as it is healthier in comparison with pork and beef) and also more affordable. Only 20% of poultry and eggs is covered by import. The following figure demonstrates the evolution of number of livestock animals in the Czech Republic between 1986 and 2013.

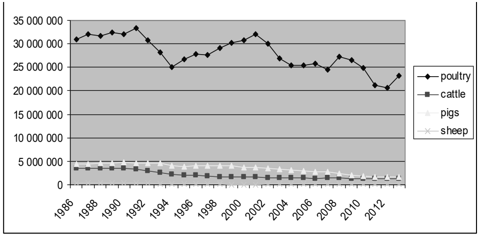

Figure 4: Livestock during the years 1986–2013
Source: (Czech statistical office, 2015)

Cattle breeding has a growing tendency in the mountainous regions of the North-Western Bohemia and also in the Karviná district and in the Břeclav region. Decrease has been registered in the fertile areas of Central Bohemia and Southern Moravia. In pig breeding, increase in numbers occurs only in some of the districts of the Czech Republic (namely Frýdek-Místek, Jihlava, Liberec, Semily and Most). Reduction in the number of pigs is evident in numerous districts mainly in North-Western Bohemia, Central Bohemia, Podbeskydsko and fertile areas of the Moravian basins.

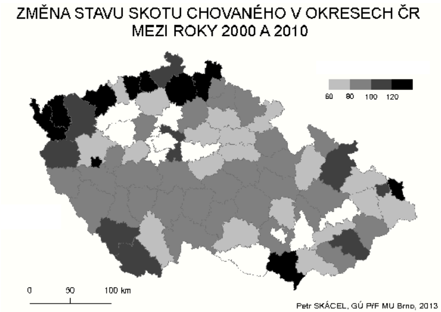

Figure 5: Changes in the number of cattle in the districts of the Czech Republic between 2000 and 2010.
Source: (Agrocensus 2000; Agrocenzus 2010)

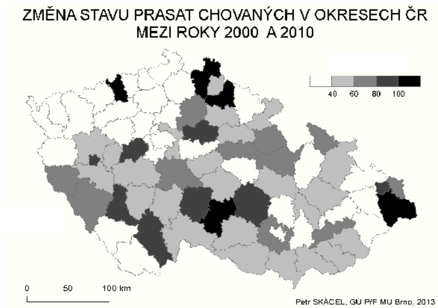

Figure 6: Changes in the number of pigs in the districts of the Czech Republic between 2000 and 2010
Source: (Agrocensus 2000; Agrocenzus 2010)

The regional analysis of poultry farming is interesting as well. As is apparent from the Fig. 7, regional differences are quite considerable. We can see an increase in the districts on the border of Central Bohemia and the Vysočina region and in selected districts of the Northern and Eastern Bohemia. Further in the districts of Blansko and Frýdek-Místek. However, there are plenty more districts with a noticeable decrease and they are spread across the whole country. Specifically, the Central and Eastern Moravia, the border of the South Moravian region and the region of Vysočina, and also in a considerable part of the Southern and Western Bohemia.

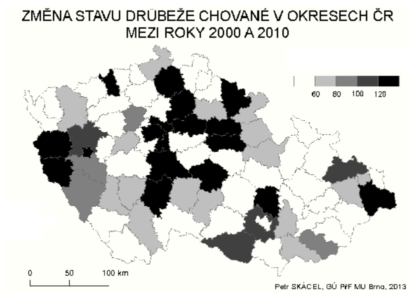

Figure 7: Changes in the number of poultry in the districts of the Czech Republic between 2000 and 2010
Source: (Agrocensus 2000; Agrocenzus 2010)

3. CONCLUSION

With the collapse of the socialist block and the transition to a democratic system, numerous substantial changes occurred in the Czech Republic, as did in other Central and Eastern European countries. Socioeconomic transformation has had a major impact on agriculture. The accession to the EU and the adoption of the Common Agriculture Policy of the EU became other significant elements that influenced the Czech agriculture. The changes were and are evident all over the Czech Republic, however, they do not advance in the same way everywhere.

Land resources

Decrease in arable land occurred mainly in the borderland mountainous area. These are mainly localities with less favourable environmental conditions for extensive farming. Grassland cultivation of these areas is supported by the EU grants. A similar situation is also in the urban regions (Prague, Brno). Here, the probable reason being the expansive development of the cities. By contrast, the greatest increase in arable land occurs chiefly in the most fertile areas of the Czech Republic with good agricultural conditions. In these areas, the farmers are also subsidized by European grants.

Crop production

Decrease in crop areas for grain has much to do with the decrease in arable land. Again, this mainly applies to the areas with less favourable conditions for agriculture. As is the case of arable land, the greatest increase occurs in the most fertile areas of the Czech Republic. Grain is still an important agricultural commodity for export.

The decrease in potato cultivation can be seen nationwide. The falling tendency has been under way since World War II. The greatest decrease is apparent in areas typical for their potato production. A decrease in consumption of potatoes per capita is taking place. In addition, cheaper potatoes are imported from abroad. In the areas where the potatoes had been cultivated, other resistant crops with a greater market demand are being cultivated (for example oilseed rape).

As we have mentioned already, the increase in the cultivation of the oilseed rape is evident in areas with less favourable conditions for agriculture. The oilseed rape is not as demanding for climatic conditions. Its significance is on the rise due to an increased interest in biofuels. Rapeseed oil is also being produced.

Animal production

The increase of cattle breeding in the borderland is connected with extensive breeding. The new grassland is being utilized for the breeding of cattle. The decrease applies rather to the more fertile areas where permanent grassland has been reduced.

Pig breeding is situated in the areas with factory farms and large fattening farms (South Moravia – areas of feed grain cultivation). The decrease in land for feed grain cultivation is one of the consequences of the decline in the number of pigs (the North-Western Bohemia, Central and North-Eastern Moravia, besides the Frýdek-Mistek district).

At the moment, the popularity of poultry (especially of chicken and turkey) and eggs is on the rise. Regions with an increase in poultry breeding are located in the areas with the greatest poultry consumption (Prague, Brno, Hradec Králové, Pardubice, České Budějovice, Pilsen, Most, Frýdek-Místek).

Only time will tell, how the new form of the CAP will turn out to be. The farmers hope for an improvement and easement of their activities. The new rules should be focused more on the support for farmers rather than on support for the individual products. Apart from increasing the ability of the European agriculture to compete, emphasis is being placed on quality and sustainability. New rules should be more fair, simpler and they should direct the farmers towards the field of environmentally sustainable agriculture.

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URBAN FIELD WORK – PROPOSAL OF MODEL ACTIVITIES ON THE CASE OF BRNO

Hana Svobodová[1] and Eduard Hofmann[1]

[1] Department of Geography, Faculty of Education, Masaryk University, Poříčí 7, 603 00 Brno, Czech Republic, e-mails: 67632@mail.muni.cz, 1@mail.muni.cz

ABSTRACT

Fieldwork is a strong teaching method which makes students learning by doing and it is an important way to develop geographical understanding of the World. Urban field work has been in Czech schools neglected for a long time. Although urban areas offer many opportunities to do interesting field work with students. Aim of this article is presentation of some ideas for urban field work on the model city Brno.

Key Words: *fieldwork, geography education, urban area, powerful knowledge*

1. INTRODUCTION

Field work is perceived as an important form of teaching. It teaches how to develop geographical knowledge of the world. During the past 50 years, teaching strategies in field work have developed from the traditional field excursion to field research based on hypothesis testing and geographical enquiry, reflecting different perspectives on teaching and learning. Thant to it Field work can turn geography into vivid, practical subject, in which students can link their knowledge (facts) with the reality. During the field work both cognitive and affective aspects of teaching are being mutually strengthened (Oost et al. 2011). These facts certify that the field work is a strong teaching method which makes students learning by doing. Foreign equivalent of this form of teaching is "powerful knowledge" or "powerful teaching" (Tejeda, Santamaría 2010; Hopkins 2000 etc.)

Field work can take place in urban or rural areas. While rural field work is quite common (in the Czech Republic it was traditionally connected with summer camps, environmental education and school field trips into mountains or other attractive areas) and is often connected with landscape ecology (e. g. Lipský 2006 Svozil, Hynek 2005), urban field work which is close connected with urban geography is according to Ocittl (1969) unfortunately not yet widely studied at the secondary school level. Although since the release of Ocittl's article has passed almost 50 years, the situation in many Czech schools is still the same.

That is why the main aim of the article is to present some ideas for urban field work on the model city Brno in the Czech Republic.

2. MATERIAL AND METHODS

Urban geography offers a wide field for experiment and research. The studied topics can concern physical and social conditions of model town. "The range of features which can be studied very largely depends on the size and status of the town in which the school is situated. Usually, the bigger the town the wider the scope for fieldwork" (Ocittl 1969)

In our case Brno city was chosen as a model city for urban field work. Brno is the second largest city in the Czech Republic by number of inhabitants and areas and topics for field work are numerous.

The following text is based on results of the project MUNI/FR/0014/2014 Field work in English. The aim of the project was to provide materials to students and teachers that can either be used directly for field work in Brno and its surroundings or to inspire them to prepare their own activities. Partial aims of this project were:

a) Preparation of field work activities which will interconnect the curriculum of partial geographical disciplines (physical and socioeconomic geography, cartography or GIS, didactics of geography and also urban planning) which is for understanding of geography importance as a complex necessary.

b) Strengthening the teaching in English language in geography lessons by the CLIL method (**Content and language integrated leasing;** It refers to teaching subjects such as science, history and geography to students through a foreign language. www.onestopenglish.com/clil/what-is-clil/**)**.

c) Enable foreign students study geography in English and thus strengthen relations between Department of Geography and foreign geographical departments. From the pedagogical-psychological point of view English methodological and study materials allow better adaptation and integration of foreign students into the team as field work require the cooperation of all concerned.

3. RESULTS

3.1 Field work phases

All activities done in frame of the project had four phases as presents Hofmann (2015): preparation, realisation, finalisation and evaluation (see Figure 1). All phases are divided into teacher and student activity.

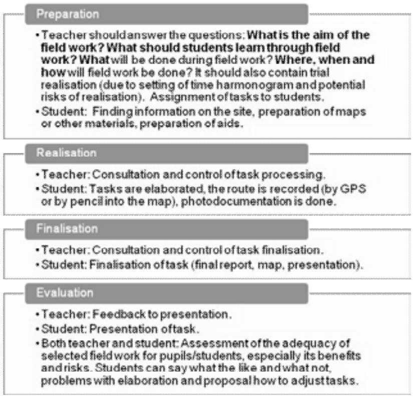

Figure 2: Phases of field work
Source: Hofmann 2015, adjusted by Svobodová

3.2 FINE website – suggestions for teaching

Preparation phase of field work was done while the activities for the project Field work in English (abbreviation is FINE) were thought up. Recently there are six activities prepared for Brno and they are presented in Czech and English language on the www.ped.muni.cz/fine website (Figure 2).

Figure 2: Sample of the website www.ped.muni.cz/fine
Source: www.ped.muni.cz/fine designed by authors

This website contents basic information about field work and CLIL method. Then there are six bookmarks with activities:

1) Panoramic sketch – Aim of the activity is that pupils/students can draw a panoramic sketch of landscape and interpret it with focus on landscape structure and processes going on in it (more in Hofmann, Svobodová 2013). Any evaluated point (hill, tower of church or other place) can be used as a place from which the sketch is drawn.

2) Suburbanisation – Aim of the activity is that pupils/students interpret the changes in the landscape and explain their causes and impacts.

3) Stránská rock – Stránská rock is former quarry and important refers to a Lower Palaeolithic to Upper Palaeolithic archaeological site, dating to approximately 600 000 BP. Aim of the activity is that pupils/students can evaluate uniqueness of the locality in terms of geological and geographical development, propose a panel of an educational trail for the Stránská rock etc.

4) Spielberk Office Centre – Spielberk Office Centre is a newly built administrative centre almost in the centre of Brno. Its location and relatively limited area makes it suitable for simple mapping and analysis processes, which take place in this area during the day. By mapping we capture the state of landscape in selected time. In several years, we can make further mapping and analysis, and compare the results easily.

Each activity is briefly introduced and it is possible to download a work sheet, print it and fill in in a paper form. More comfortable option is to fill in the work sheet on-line and download it later (Figure 3).

5) Orienteering – Orienteering is a sport based on the ability of orientation in the terrain with a map and compass. In Brno there are two areas of solid controls for orienteering (Soběšice and Rosnička in Wilson forest), where students can try out the basics of orienteering in practice.

6) Wherigo / whereyougo (in detail in next chapter).

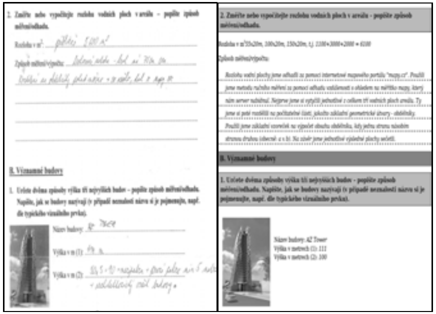

Figure 3: Example of off-line and on-line version of work sheet
Source: students' work in off/on-line version of work sheet

3.3 Where I go – Where you go

Nowadays all geographical field work activities can be supported by modern technologies (GPS, smart phone or tablet, interactive boards etc.).

GPS can be used in two basic ways. 1) Traditionally, student use GPS for finding of points, measuring of lengths, mapping and recording of the route.

2) Unusual way for GPS use is the "WHERE I GO" or "WHERE YOU GO" (variant for GPS on phone or tablet) application. This application belongs into so called geo location games (more details in Svobodová, Mrázková 2014). The name of application "WHERE I GO?" basically represents the principle of the whole game. At the beginning the players have no idea where the game will lead them. The GPS lead them to unknown places and if they find the place the GPS will show them a task. If they fulfil the task the can see another place to go. In this way they can go through prepared route. If they record the route of their movement, the teacher can later evaluate orientation of students in unknown area (GPS tracking, see figure 4).

The advantage of wherigo game is also that it can be easily created by anyone with a good idea and at least basic knowledge of programming. Then only the Urwigo programme is needed (download at: www.urwigo.cz).

Figure 4: Example of GPS tracking
Source: H. Svobodová on base of official orienteering map

4. CONCLUSION

The text introduced some suggestion for urban field work as we think that field work is a very strong education method. Fieldwork should inspire, enthuse and energise both students and teachers. The other positives of well-prepared fieldwork are that a) it is student-centred not teacher-led; b) learners take ownership of their fieldwork and thus learn more effectively by their own doing; c) field work combines partial geographical disciplines and methods of research (qualitative and quantitative) etc. However, from the view of geography teacher the most important thing is that students can apply theories gained during lessons into life and they start to understand the sense of geography and its usefulness.

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HOMELAND STUDIES AND GEOGRAPHY'S CONCEPTUAL BASIS CONTINUITY ACCORDING TO PRIMARY SCHOOL TEXTBOOKS

Rastislav Čief[1], Branislav Nižnanský[1], Ivana Tomčíková[1] and Ľubomíra Veselovská[1]

[1] Department of Geography, Faculty of Education, Catholic University in Ružomberok, Hrabovská cesta 1, 034 01 Ružomberok, Slovak Republic, e-mails: rastislav.cief@ku.sk, branislav.niznansky@ku.sk, ivana.tomcikova@ku.sk, l.brisakova@gmail.com

ABSTRACT

The aim of this paper is to highlight dominant concepts and continuity in the textbooks of Homeland studies and Geography which are currently being used at primary schools in Slovakia. The paper analyzes the conceptual bases of particular textbooks through concept maps, which were analyzed according to the frequency of occurrence of particular concepts. Thus we could generate the concepts which were emphasized in the textbooks the most. We also monitor, to what extent the conceptual basis proceeds to a higher grade and how it is further developed.

With this information, the teachers know what the basis of further building is, they are aware of what pupils already know from previous grades and they can focus rather on new knowledge, achieving thus a higher efficiency of education.

Keywords: *Geography, Homeland studies, conceptual basis*

1. INTRODUCTION

The subjects of Homeland Studies and Geography help students with basic orientation in their neighborhood and the world, with broadening their general knowledge and outlook. Concepts acceptance is an important element in the reflection of the landscape where students live, whether based on Piaget's assimilation of preconcepts (Piaget, 1999) or on Vygotsky's (1978) social acceptance through their communication within curriculum in given subjects. Concepts acceptance serves the construction of a standardized system of concepts, their names and relationships. Educational objective is set in accordance with the revised taxonomy (Anderson, Krathwohl, 2001) on the second level of the knowledge dimension – conceptual.

Several theoretical studies (Čief, Nižnanský 2012, Čief, Nižnanský, Tomčíková, 2013) and the analysis of performance and content standards in the National Educational Programme resulted in the need of the analysis of groups of the most important concepts in these subjects. These concepts, whose typical feature is the occurrence in teaching materials – especially in the textbooks, were discussed and debated in several students' final works. In a research context, we started using the term of conceptual basis. Conceptual basis of the subject has become an instrument of theoretical basis for the textbooks research. While the concept is understood in terms of Frege (1984) as a function above the subjects, the conceptual basis is a group of concepts allowing thematic construction, in this case the construction of geographical concepts.

The aim of this paper is to obtain a data basis for the analysis of succession and continuity of conceptual bases in the textbooks of Homeland studies and Geography, in accordance with which the subjects of Homeland studies and Geography are nowadays taught at primary schools in the Slovak Republic (Education system in Slovakia see: http://studyinslovakia.eu/education-in-slovakia/education-system-in-slovakia/). In theory, we start from the hypothesis that "the conceptual basis of the subject is a group of concepts chosen pragmatically, and is used in teaching materials of the subject, selected by an expert group with the internal structure further specified frequency analysis". The article explores the frequency of concepts in the concepts bases selected from the textbooks of Homeland studies and Geography, which has become a complementary criterion for selection of concepts of the basis. The resulting conceptual basis of the subjects of Homeland studies and Geography, designed according to the textbooks from the second to the ninth grade of primary school, contains the concepts with the frequency of occurrence of 5 or more within the given textbook (see chap. 2). We always use images generated by application Wordle, which represent the conceptual scheme and are a convenient addition to the frequency tables (Feinberg, J. 2014. Wordle. Dotupné na internete: www.wordle.net).

The obtained information on conceptual basis of the subjects is processed in the form of tables and diagrams in chapters 2.3 and 2.4. The analysis of succession and continuity of concepts is elaborated in Chapter 3.

2. THE CONCEPTUAL BASIS OF THE SUBJECTS OF HOMELAND STUDIES AND GEOGRAPHY

The subjects of Homeland Studies and Natural Science belong to “Nature and society” field of education on the first stage of primary schools. Homeland studies is contingent upon the National educational program for the first stage of primary school in the Slovak Republic – ISCED 1.

Geography, along with History and Civics, belongs to “Nature and society” field of education. The subject of Geography is contingent upon the National educational program for the second stage of primary school in the Slovak Republic – ISCED 2. Education of students from the first to fourth grade of eight-grade grammar schools is also contingent upon this document (ŠPÚ, 2011-2015).

The educational programme determines educational objectives and desired competencies, becoming thus the framework that can be fullfilled or achieved on the basis of a conceptual basis. While implementing and fullfilling this objective we are working with a conceptual basis. The concepts are being explained and associated. The source of the concepts, which we use to reach the learning objectives, is found in the given textbooks. (see Chap. 2.3 and 2.4).

2.1 Objectives and Competencies of the Subject of Homeland Studies

The subject of Homeland studies provides the pupils with all the necessary knowledge to discover nature and also human creations in an interesting way, whether in the near or distant surroundings. These findings are often presented through songs, stories, fairy tales and observations on the first stage, building thus a stronger attitude towards their home region.

Teaching of Homeland studies in grade 2 of primary school encourages pupils to talk about their region, to distinguish relationships and linkages in the region or municipality. Pupils can apply various findings from their own experience and own observations in different discussions. They learn how nature changes during the grade, how to work with a calendar, they make familiar with the orientation in the region either with the help of the compass or some significant objects. In grade 3, the subject of Homeland studies provides the pupils with knowledge that enables them to show significant mountain ranges, rivers, lakes and towns on picture maps and to learn to distinguish different or common features that are already visible. The knowledge gained in learning Homeland studies in grade 4 is focused on areas of Slovakia and experiential learning. Orientation on the map, reading maps with comprehension or work with images and photos are emphasized most.

The basic learning outcomes include:

- Knowledge of the area in which the pupil lives;
- Orientation in time and space;
- Map orientation, handling the historical sources that are age-appropriate;
- Developing attitudes to society and region through stories / fairy tales;
- Developing the ability of using the results and knowledge from their own experience, discoveries and observations;
- Using the sources of information to describe environmental characteristics and compare these characteristics;
- Perception of the relationships between nature and man and their interaction;
- Perception and acceptance of people from the areas, where culture is different from ours (ŠPÚ, 2011).

Competencies learned and acquired in the Homeland studies (ŠPÚ, 2011):

- Functional literacy;
- Communicative competence;
- Reading literacy;

- Cultural competence;
- Personal and interpersonal competence.

2.2 Objectives and Competencies of the Subject of Geography

The basic learning outcomes of the subject of Geography for grades 5–9 of primary schools include:

- Use and interpretation of different kinds of maps – Internet maps, thematic maps, road maps and others.
- Practically use and search for information about the country as a part of the Earth and as the whole in daily life, whether in print or digital form; subsequent systematization of knowledge acquired in the field of physical and human geography. Students can use physical geography knowledge for example in tourism or in protecting themselves against natural disasters. Human Geography aims to provide pupils with the knowledge about humans and their impact on the landscape and understand the transformations in the landscape, which are conditioned by man.
- From the literary point of view, teaching Geography is mediated not only in the form of textbooks, but also through professional publications and popular science magazines which are up to date. It provides the student with reading literacy, understanding, interpretation and comprehension of what has been read. The principal geographical means of expression include the need to develop reading and interpretation of pictures, photographs, tables, graphs, diagrams and other.
- Efforts to integrate and complexly look at the knowledge acquired in science or social disciplines and establishing of their relationships in such a way that the end result was the creation of a comprehensive picture of the regions in various parts of the world. The emphasis is also put on linking Geography to Arts and Music as the latest Geography focuses largely on culture and description of cultural expressions of people in different parts of the world.
- Creating projects which aim to develop the entrepreneurial skills of students. Students learn how to manage these projects in model situations, such as the situation in a travel agency etc.
- Expansion of cultural competences on the basis of exploring different cultures around the world.
- Learn how to use acquired knowledge, skills and abilities, which have been acquired in Geography lessons, with various other activities such as leisure, which also include travel, relax and others. (Nogová, 2010).

Geography develops core competencies mostly of spatial and integrative nature. These include a range of knowledge, skills and abilities which are reasonably combined by students. This way they come to understanding, interpretation and practical use of landscape features. Studying Geography deepens students' competencies which enable them to explore the landscape, understand landscape's arrangement and to find the best ways to optimally utilize and protect the landscape (Nogová, 2010).

The basic geographical competences of students on the second stage are map skills – map reading, analyzing its content, map interpretation, navigation, drawing sketch maps of the area etc. This competence is supported by students' interest, which includes not only their surrounding environment but also travel opportunities, work with the Internet etc. (Nogová, 2010).

2.3 The conceptual basis of Homeland Studies textbooks

The tables 1 to 3 represent the conceptual basis of Homeland studies and the frequency of its concepts. They are the basis for the analysis of succession and continuity of concepts of the conceptual basis of the subject Homeland studies on the first stage of primary school. The representation is accompanied with conceptual bases where the concepts of a higher frequency are depicted in a larger font size. The given images increase the clearness of the representation of conceptual basis.

Table 1: The frequency of concepts occurrence in Homeland studies textbooks for grade 2

school	42	classroom	11
municipality	37	health	9
road	37	family	9
weather	22	fire	8
surroundings	17	spring	8
home	17	nature	8
autumn	12	lessons	5
winter	12	summer	5
safety/the police	12	Christmas	5
holidays	11	break	5

Source: authors by textbook of Kožuchová, Šimunková 2008

Figure 1: The graphical interpretation of the frequency of concepts by table 1

Table 2: The frequency of concepts occurrence in Homeland studies textbooks for grade 3

map	88	timeline	21	Bratislava	9
Slovakia	85	caves	20	mountains	8
town	71	World Heritage Sites UNESCO	20	nature	8
castles	44	cardinal points	15	scale	7
landscape	39	standard Slovak	14	contour lines	5
rivers	34	mountain ranges	12	globe	5
plan	29	the European Union	12	dialect	5
forests	25	mansions	11	horizon	5

Source: authors by textbook of Kožuchová, Matušková, Šimunková 2009

Figure 2: The graphical interpretation of the frequency of concepts by table 2

Table 3: The frequency of concepts occurrence in Homeland studies textbooks for grade 4

town	167	region	25	mountain ranges	8
Slovakia	89	landscape	24	river banks	8
map	74	industry	19	mining	8
self-governing region	60	municipality	18	spring (of a river)	7
village	60	agriculture	18	nature	7
Košice	47	the Dunajec river	18	the capital of the region	6
rivers	47	the Danube river	17	cardinal points	5
Bratislava	46	timeline	12	plan	5
forests	28	mountains	12	castle	5
open air museum	27	surface	11	countryside	5
traffic	27	altitude	10	travelling	5
soil	26	lakes	9		

Source: authors by textbook of Kožuchová, Šimunková 2011

Figure 3: The graphical interpretation of the frequency of concepts by table 3

2.4 The Conceptual basis of Geography textbooks on the second stage of primary school

The tables 4 to 8 represent the conceptual basis of Geography and the frequency of its concepts. They are the basis for the analysis of succession and continuity of the concepts of the conceptual basis of the subject of Geography on the second stage of primary school. The representation is accompanied with conceptual bases where the concepts of a higher frequency are depicted in a larger font size. The given images increase the clearness of the representation of conceptual basis.

Table 4: The frequency of concepts occurrence in Geography textbook for grade 5

the Earth, planet	190	altitude	25	climate zones	12
map	130	the Poles	24	tide	11
the Sun	57	island	24	outflow	9
the Moon	56	mainland	21	eclipse	8
ocean	53	stars	20	plan	8
meridians	52	continent	20	galaxy	7
town	51	space	18	Polar circle	7
river	42	climate	17	lakes	7
volcanoes	41	atmosphere	16	bay	7
globe	38	weather	16	Bratislava	7
sea	35	satellite	14	comets	6
mountain range	32	village	14	GPS	6
parallels	30	earthquake	14	spring (of a river)	6
surface	27	continets	13	horizon	5
equator	26	canyon	13	new moon	5
Unesco	26	the Solar system	12	full moon	5
landscape	25	scale	12	steppes	5
Slovakia	25	magma/lava	12		

Source: authors by textbook of Ružek a kol. 2009

Figure 4: The graphical interpretation of the frequency of concepts by table 4

Table 5: The frequency of concepts occurrence in Geography textbook for grade 6

America	231	Slovakia	30	Antarctica	13
town	92	altitude	29	hurricane/tornado	13
Australia	77	climate zones	26	surface	11
ocean	57	map	25	weather	11
island	55	the Earth	25	the Poles	10
continent	48	steppes	25	parallel	10
climate	47	industry	25	ocean current	8
mountain range	46	sea	21	peninsula	7
rivers	42	agriculture	18	Oceania	7
landscape	31	bay	16	prairie	6
lake	31	the Equator	13	pampas	5
volcanoes	30	mainland	13	the Arctic	5
earthquakes	30	countryside	13		

Source: authors by textbook of Likavský a kol 2009

Figure 5: The graphical interpretation of the frequency of concepts by table 5

Table 6: The frequency of concepts occurrence in Geography textbook for grade 7

Asia	297	mountain range	52	population density	16
Africa	203	nations	48	altitude	16
rivers	115	peninsula	41	America	13
Slovakia	98	bay	28	earthquakes	9
the Earth	97	the Equator	27	volcano	8
landscape	96	monsoon	27	trade winds	8
town	80	tropic	22	ocean currents	7
ocean	77	surface	22	savannah	7
sea	71	races	21	meridian	6
continent	68	mainland	19	safari	6
climate	61	climate zone	19	Australia	5
map	59	industry	19	steppes	5

lakes	56	agriculture	18		
island	53	countryside	18		

Source: authors by textbook of Tolmáči a kol. 2012

Figure 6: The graphical interpretation of the frequency of concepts by table 6

Table 7: The frequency of concepts occurrence in Geography textbook for grade 8

Europe	440	the European Union	55	bay	17
sea	237	continent	54	climate zone	15
town	166	ocean	46	nation	15
industry	125	lake	42	America	13
river	121	peninsula	40	region	12
landscape	103	altitude	40	the Earth	11
mountain range	102	surface	31	Africa	10
map	87	Unesco	28	volcano	10
island	86	the Danube river	24	countryside	7
Slovakia	79	mainland	23	fjord	7
climate	73	population density	23	earthquake	5
agriculture	65	Asia	18	steppes	5

Source: authors by textbook of Ružek, Likavsky, 2011

Figure 7: The graphical interpretation of the frequency of concepts by table 7

Table 8: The frequency of concepts occurrence in Geography textbook for grade 9

self-governing region	335	sea	18	population density	10
town	265	climate	18	village	9
mountain range	155	Unesco	18	the Euquator	9
Bratislava	82	Europe	17	meridiam	9
region	73	protected landscape area	16	district	9
map	59	Košice	14	ocean	7
river	54	lake	13	inversion	6
nationality	41	the European Union	12	weather	6
the Danube river	39	surface	12	natality	6
industry	32	agriculture	12	mortality	6
landscape	25	the Earth	10	the Dunajec river	5
municipality	25	GPS	10	ordinate	5
altitude	19	mountain lake	10		

Source: authors by textbook of Tolmáči a kol. 2009

Figure 8: The graphical interpretation of the frequency of concepts by table 8

3. SUCCESSION AND CONTINUITY OF THE CONCEPTS IN THE SUBJECTS OF HOMELAND STUDIES AND GEOGRAPHY

Out of several approaches how to analyze the processed representations of conceptual bases, we have chosen two attributes that quantitatively describe the time series. The first one was gained by finding the number of concepts in a given grade and the other one gained by the shares of well-known concepts in the summary of concepts used in the textbook for the given grade.

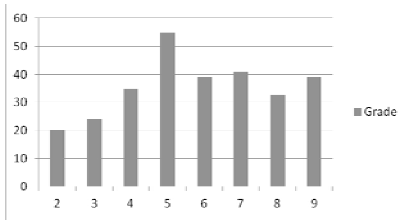

Figure 9: The number of concepts within a grade
Source: authors

Figure 9 shows the time series of the number of concepts with the occurrence of 5 or more concepts in the textbooks for the second up to the ninth grade of primary school. The succession of concepts according to their number can be divided into two groups. The number of concpects in grades 2-5 grows almost exponentially. The number of concepts in grades 6-9 is in fact stable.

To supplement the given characteristics of the succession, we have constructed Figure 10 which shows the percentage of repeated concepts for the given grade. This indicator shows the continuity of conceptual bases of given grades. We will instantly notice that the fifth grade shows the high number of concepts as well as a very low continuity of the concepts.

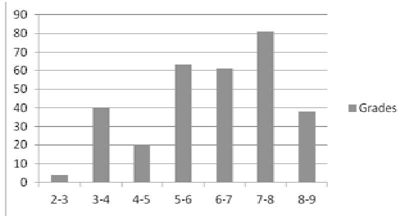

Figure 10: Continuity in the concepts between the grades
Source: authors

The comparison of each of two successive tables show that some concepts are used in the textbooks with a higher or lower frequency and some of the most frequently used concepts are new. We have evaluated the concepts' continuity in particular grades according to how many per cent of concepts were students already familiar with from the previous grade.

- The comparison of concepts occurrence in the textbook of Homeland studies for grades 2 and 3 show that selected concepts are repeated only in 4% (only one most frequently used concept – nature was used repeatedly).
- The comparison of concepts occurrence in the textbook of Homeland studies for grade 3 and 4 shows that selected concepts are used again in almost 40%. The geographical concepts are extended with new concepts such as lakes, springs, the capital of the region, countryside or the river bank.
- The most commonly used concepts in the fourth grade textbook are repeated in the textbook of Geography for the fifth grade only in 20%. Geography for the fifth grade processes a lot of new knowledge and the number, as well as the proportion, of new concepts is high. On the contrary, the frequency of selected concepts in Geography textbook for the sixth grade is up to 63%.
- The frequency of selected concepts in Geography textbooks for the sixth and the seventh grade has risen (61 %) due to a tighter curriculum continuity and also the use of already known concepts, not only the unknown.
- The concepts frequency (81%) in Geography textbooks for the seventh and the eighth grade keeps rising.
- Only 38 % of concepts from the eighth grade are repeated in Geography for the ninth grade.

The above mentioned results show that the selected concepts' continuity is highest between Geography textbook for grade 7 and grade 8. It is determined by the curriculum which is the regional geography of continents in both grades. On the contrary, very law continuity can be seen on the first stage and at the transition to the second stage, since the conceptual basis in students is still being built at this level and most of the concepts are new for them.

4. CONCLUSION

The analysis of the textbooks raised several topics for further thought. For example, we noticed that it is interesting to study whether the amount of the text gradually increases, as well as whether the font size in Homeland studies textbooks is larger than in Geography textbooks, or whether an increase in the amount of the text relates to the fact that we can observe a higher frequency of occurrence in particular concepts in higher grades.

Geography textbook for grade 5 has been designed differently to Homeland studies textbooks. There is also a lot of new knowledge which follows Homeland studies curriculum only a little. Demand for knowledge is very high and there is also a plenty of opportunities to create projects and presentations. Therefore it would be very useful to grant Geography in grade 5 two lessons a week, which has already been realized according to our findings from this school grade. The textbook for grade 6 is more specific than the textbook for grade 5 and it brings knowledge which students must know how to sort out or classify – which knowledge belongs to particular countries. The textbook for grade 7 is similar to the textbook for grade 6, but the knowledge is again more specific and requires the ability to sort it out as the content includes the knowledge of Africa and Asia. In the textbook for grade 8, there is knowledge applied to Europe and its particular countries while students have met more than one continent in previous textbooks. The continuity of the textbooks can be seen in the same or similar topics from the field of physical and human geography – climate, waters, economy, etc. The most specific curriculum can be found in the textbook for grade 9, which contains the main topic of Slovakia.

As a result, we have come to a recommendation for the fifth grade in particular. For example, a part of the fifth grade curriculum could be moved into the sixth and seventh grade curriculum, or the number of lessons could be increased. In the case-review proceedings of this article we learned that an increase in the number of lessons had already been made.

The conceptual basis is only one of a variety of tools for didactic analysis of educational practice. Its better understanding in the context of the factual, procedural and metacognitive knowledge dimension enables finding answers to the problem of stereotypes in education, such as education burdened by memorization.

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LINKING GEOGRAPHY OF RELIGION TOPICS WITH GLOBAL DEVELOPMENT EDUCATION AT PRIMARY SCHOOLS

Dagmar Popjaková[1], Petra Karvánková[1], Michal Vančura[1] and Denisa Vlažná[1]

[1] Department of Geography, Faculty of Education, University of South Bohemia, České Budějovice, Czech Republic, e-mails: dpopjakova@pf.jcu.cz, karvanko@pf.jcu.cz, vancura@pf.jcu.cz, denisa.vlazna@pf.jcu.cz

ABSTRACT

Raising children in a global dimension helps educate sensitive and tolerant individuals. The system at stage 2 of basic education in the Czech Republic provides a space for teaching global issues. They include knowledge of the spatial distribution of world religions and their influence on the character of the cultural and social life in different regions of the world. Topics concerning geography of religion and global development education can be combined in teaching. It is also suitable to use various forms of integrated education for their application. The presented educational material makes use of enquiry-based learning methods. The worksheets topics include the issue of the size and spatial differentiation of world religions, religious buildings and the relationship of religion and politics.

Key Words: *primary school, geography of religion, global development education, teaching material*

1. INTRODUCTION

In today's open world with complicated and turbulent social development in different countries, positively influencing the thinking and the development of the young generation forms a topical task. Today's children will be increasingly confronted with events in the world. The effort to guide them to properly identify and perceive global issues as well as navigate through these in the correct manner is one that schools play an important role in. The educational process in general and education of children in the school setting form a platform that allows educating the young generation towards understanding the world as well as its diversity and relationships. It is also important to guide children towards solidarity and tolerance as well as critical thinking. The primary curricula of the Czech Republic ("CR") do create some space for fulfilling the goals outlined above although in the real life of methodologists, authors of school documents and those implementing them, i.e. teachers, principles and configurations of learning schemes are not exploited enough in this regard.

The paper points to combining topics from geography of religion with global development education. The aim is to present geographic approaches to studying religions in a global context on the one hand and the principles of global development education ("GDE") on the other while highlighting the linking of religious geography and GDE to the Framework Educational Programme for Basic Education (FEP BE 2007) as a basic curriculum document for primary schools ("PS") in the country. The last section of the paper presents a part of the educational material dedicated to geography of religion and created at the Department of Geography Faculty of Education University of South Bohemia in České Budějovice as part of a thesis. The material presents tasks for pupils that allow presentation of the GDE principle in teaching geographical topics at stage 2 of basic education (or more precisely from the age of 11 to 15, i. e. for the 6th to 9th grades and also for the corresponding grades of six- or eight-year grammar schools). The mentioned material employed enquiry-based learning methods (Healey 2004, Brown, Douglas 2011, Perkins 2008).

2. THE PRINCIPLES OF CONTENT OF RELIGIOUS GEOGRAPHY AND GLOBAL DEVELOPMENT EDUCATION

Topics and methods to develop global thinking in PS stage 2 children in the CR are something that the concept of GDE generally offers. Educational fields expected to play a supporting role when implementing GDE into teaching at primary schools include Geography in addition to Civil Education and History. Features that confirm the multidisciplinary nature of geography include the fact that its content covers some global issues of GDE. In terms of topics, cultural geography and in its context geography of religion stand very close to GDE.

2.1 School geography: access to study religions

A concept that according to Matlovič (2001) entered scientific literature as early as the 17th century, geography of religion is one of the scientific disciplines of geography, and is close to religious studies, sociology of religion, sociology, ethnology, history, etc. (Henkel 2005, Skokan 2010). The global dimension is used by geography, for instance, in studying the spatial differentiation of religions (Kong 1990, Kong 2001, Holloway, Valins 2002, Proctor 2006, Johnston 2009) and outlining macro regions of the world. Attempts at the regionalisation of the world according to religions started to emerge in the 19th century according to Skokan (2010). The specification of world regions as such, in which type of religion acts as the main criterion or at least one of the main criteria, is based on the relationship between the religion and the geographical setting, i.e. the landscape.

In terms of educational transformation, the relationship of religion with the natural world can be used for primary school stage 2 along with its ties to the population, settlement structure, the economy and its industries, and politics. The relationship between religion and the natural environment is reflected in worshipping natural objects. Examples for this are given by Matlovič (2001) and refer to worshipping sacred mountains – Meru (Hinduism), Sion (Judaism) a Fudžijama (Shinto). Other such natural elements include rock formations and stones – al Kaba in Mecca (Islam) and the Sharagrama rock (Hinduism), plus water is of considerable importance for a number of religions, e.g. the Ganges (Hinduism) and Jordan (Judaism and Christianity) rivers.

The determinism of the natural environment can be seen not only in ancient religions and indigenous cultures, but also in world religions. This is undoubtedly due to the fact that it was contact with nature that served people from time immemorial when trying to find answers to unexplained phenomena. Indigenous nations used available natural formations (caves, cliffs) in practising religious life. It was only later that religions began to build their own structures, thereby influencing the character of the landscape and, especially, the settlements. Each religion is characterised by a certain type of structure. While sacred buildings in Hindu and Buddhist regions involve temples and stupas, respectively, immanent in other regions are synagogues to Judaism, churches and temples to Christianity and mosques to Islam (Kokaisl 2009).

Religion influences the dynamics, structure and distribution of the population. Islamic and Catholic societies are given by Matlovič (2001) to be examples of influencing population growth. Similarly, religion (Islam) can be a factor for a low education level (women). Examples of influencing the social structure of the population through religion include the Indian society divided into four castes. Although the system was officially cancelled in the country, attempts to remove it from Indian society failed according to Partridge (2005). Religion has been of great importance in terms of spatial mobility of the population since biblical times. Examples include the Spanish Reconquista, the Reformation Period, or the departure of members of the Unity of Brethren after the Battle of Bílá hora. The exchange of Hindu and Muslim populations when splitting former British India is presented by Park (2004) as one of the largest religious migrations.

Specific types of religion-driven spatial mobility include pilgrimages. Visiting places of pilgrimage is typical of all world religions. Since it also creates a specific religion-oriented field of tourism, religion can be considered to be one of the factors of tourism. In economies, religion is also a driver for the distribution of livestock production. In terms of politics, religion affects the domestic political situations of some countries and even international relations, with religious problems resulting, in extreme cases, in severe, open conflicts. Applications in teaching geography need to focus on identifying the nature and spatial distribution of religious conflicts in the world.

2.2 Global development education and its link with geography

The professional literature of pedagogical orientation frequently mentions the issue of global education or similarly global learning, development education, multicultural education, environmental education, peace education etc. GDE has settled in the terminology used in the CR. The process of gradual, broader introduction of the principles of global education, i.e. discovering problems of living in various parts of the world, has begun in the teaching settings at Czech schools as well. In terms of topics, GDE blends with the content of the subject matter of geography, and, as part of it, geography of religion.

2.2.1 The concept of Global Development Education

Initial efforts to implement global issues in education appeared in England in the 1920s. It involved activities of diverse educational associations, which, however, largely did not result in success. In fact, the application of so-called “world studies” did not start before the 1970s in the academic and school settings. This occurred as a result of a so-called World Study Project led by an English expert R. Richardson. These initiatives were followed by Canadian professors G. Pike a D. Selby later in the 1980s. It was they who began to coin the concept of “global education” (Hicks 2008, Bourn 2008a, 2008b). Spreading education in the field of global issues in Europe since the late 1980s is something to be credited to the Council of Europe. It initiated the creation of a dedicated independent agency North-South Centre. One of the Centre's scheme involves education in the global context (NSC 2005). Non-profit organisations played an important role in promoting global themes throughout the history of the development of these ideas and activities. For the CR, this currently involves the NGO People In Need and its international project entitled Teachers: Agents of Change. The activity is underway in the Czech Republic and Poland in 2013-2015 (Karvánková et al. 2015).

GDE is a life-long learning process that contributes to understanding the differences, similarities and links between the lives of people in developing and developed countries and facilitates the understanding of the economic, social, political, environmental and cultural processes these influence. It develops skills and promotes creating values and attitudes so that people are able and ready to actively participate in solving local and global issues (GRV 2015a, Karvánková et al. 2014).

2.2.2 Global development education in the context of geography

GDE themes (GRV 2015b in Table 1) are closely linked with a number of geographic disciplines. Almost all of the essential points falling within the GDE's key frameworks 1 and 3, i.e. issues of globalization and global challenges, are similar as the traditional objects of research in geography. The GDE topics of economic globalisation and world trade are intertwined with geography of industry because global industry is one of the main globalisation initiators and carriers (Vančura 2007, s. 225). Similarly, geography of trade is also concerned with and studies global trade flows. One can see a certain parallel between GDE and the geography of agriculture. Globalisation is also the factor for types and lines of agricultural production.

Table 1: Major topics of global development education

Globalization and mutual dependency of individual parts of the globe	Human rights		Humanitarian assistance and development cooperation
• Economic globalization, including world trade and ethical consumption • Cultural, social and political globalization • Global migration • International organizations	• Basic human rights • Children´s rights and senior citizen´s rights • Discrimination and xenophobia • Democracy and good governance • Equality of men and women	• Poverty and inequality • Poor education • Health issue • Malnutrition and famine • Lack of drinking water • Environment • Population growth • Conflicts and violence	• Development, its concepts and cultural aspect • Millennium development goals • History, motives and principles of humanitarian assistance and development cooperation • Actors in humanitarian aid and development cooperation • Activities pursued by the Czech Republic and the EU in the area of humanitarian assistance and development cooperation

Source: GRV (2015b) and MZV (2011) adjusted by Karvánková et al. (2015)

Evolution and normal movement of the population from the global, national and regional point of view forms the object of studying geography of population. It is the population growth which forms one of the topics of GDE's framework 3 (Table 1). Similarly, the mechanical movement of the population, including migration, as one of the main objects of research into geography of population, is among the major GDE topics as part of framework 1. The study of the social aspects of the population, which are also covered by Social Geography, is related to another GDE topic. Examples are poverty and inequality, low level of education, health issues, malnutrition and hunger of the population.

Geography's object of research involves environmental problems in a global dimension. This is related to GDE topics of lack of clean water and the environment. The remaining social topics of GDE (the key frameworks 1 and 3) – cultural, social and political globalisation and global conflicts – are the object of study for cultural geography and political geography, including geography of religion.

2.2.3 Global development education and geography of religion

Religion is among the defining aspects of the culture of any region of the world. Culture and the political and socio-economic situation in various parts of the world, i. e. the GDE's key framework 1 (Table 1), affect all other aspects of social life – the level of respect for human rights (key framework 2), social issues (key framework 3), the level of development and the dependence on the development and humanitarian assistance (key framework 4). The clash of different cultures and interaction between them form one of the fundamental features of globalisation. In addition to the challenges of globalisation in culture, geography of religion and global development education overlap in the area of human rights (human rights, discrimination). Freedom of religion forms a fundamental human right. No one should be discriminated against because of their faith. Similarly, global conflicts and violence are closely related with and originate from religion.

3. GEOGRAPHY OF RELIGION AND GLOBAL DEVELOPMENT EDUCATION VERSUS CURRICULUM

From 1 September 2005 onwards, a new system of curricular documents was introduced into the educational system of the Czech Republic. Aiming at learning of students from 3 to 19 years, the documents are developed at two levels – a national level and a school level. The national level comprises the National Education Programme defining the general principles of education in the country. Framework Educational Programmes (FEPs) for pre-school education, basic education and secondary education were simultaneously introduced at the national level. The FEPs define the binding frameworks of education for each stage of learning. The school level consists of school educational programmes.

The Framework Educational Programme for Basic Education (FEP BE) specifies the level of key competencies that the pupil should achieve when exiting the basic level of education. It defines the educational content (subject matter and expected outcomes), includes cross-cutting topics into the educational content, etc. The educational content is divided into nine educational areas as part of the FEP BE. As part of the primary school stage 2, two of them link to topics of religious geography and GDE: the Humans and Nature and Humans and Society educational areas. In general, geography of religion is included in the educational field of Geography. Geography, along with Physics, Chemistry and Biology, form part of the aforementioned educational area Humans and Nature. Global development education is the concept that may very well be applied to FEP BE, and therefore it can also be easily integrated into teaching. Involvement especially in the educational fields of Geography, Civil Education and, to some extent, History shows to be the best practice. Civil Education is included along with History in the educational area of Humans and Society.

Initial topics from religious geography and global education are anchored as early as at primary school stage 1 – they form part of the educational area of Humans and Their World. More specifically, it involves the education framework of People Around Us. It serves stage 1 pupils to become aware of the importance of mutual tolerance and to become familiar with issues related to the coexistence of people, society and the world (global issues). One of this area's target lines is discovering and understanding differences between people, inclusive of religious differences. The other education framework for teaching at stage 2 to connect to is one entitled The Place Where We Live. Here, expected outcomes include locating and formulating typical regional specialties, such as culture. The pupil can share their experiences, adventures and attractions of their own travelling with others, comparing the life in this country with that in other lands. All of these expected outcomes can be focused on comparing religions as well as used for elaborating other GDE topics (Vlažná 2015).

The educational content of the Geography educational field is for stage 2 of basic education into FEP BE (2007) divided into seven education frameworks. The issue of religious geography and GDE is contained in two education frameworks – Regions of the World and The Social and Economic Environment. Within the subject matter of the former, the pupil can acquire the characteristics of regions focused on natural, environmental and socio-economic relations, with an emphasis put on relationships and contexts (e.g. regions of religions). Expected outcomes of the framework include locating the world's macro region per selected criteria (e.g. religion); then there is comparison and adequate evaluation of peculiarities and similarities of selected macro regions and countries. The latter framework includes subject matters on world population (e.g. cultural characteristics) and regional social, political and economic formations (major world conflict outbreaks). Here, conflict areas of the world where instability is caused by religious reasons can be included from the religious geography aspect.

The educational content of the educational field of Civil Education splits into five education frameworks. Of these, as many as three are eligible for applying geography of religion & GDE topics. Appearing to be the most suitable for teaching topics of the Framework 3 of GDE – human rights and humanitarian aid and development cooperation – is the education framework of Humans, State and Law, one that includes the subject matter of human rights as well as the right to freedom of religion. International Relations, The Global World forms another framework that nears GDE. As the name suggests, subject matters applied here include globalisation, global issues and international cooperation.

History is important for understanding the historical circumstances and context of the cultural differences between different religions. In FEP BE (2013), the history of religions plays a role in three education frameworks of History: (a) The oldest civilisations, the roots of European culture highlighting the emergence of Christianity and the relationship with Judaism; (b) Christianity and medieval Europe, focusing on comparing the basic features of Western European, Byzantine-Slavic and Islamic cultural regions; and (c) The Modern Age, focused on the issue of anti-Semitism.

4. USE OF INTERDISCIPLINARY LINKS AND CROSS-CURRICULAR TOPICS IN TEACHING RELIGIOUS GEOGRAPHY AND GLOBAL EDUCATION

When geography of religion is applied in teaching geography at primary school stage 2, issues may arise regarding inadequate time allotment. Geography textbooks with the current endorsement of the Ministry for Education mostly allocate space for this topic as part of introduction to the population (basic characteristics of the religion) and within the regional geography, placing the emphasis mainly on Asia as a cradle of the world's major religions. However, room for religion is no longer given in the chapters on the world's macro regions and regions meaning that pupils gain only limited knowledge.

It is therefore appropriate to combine the teaching subject of religious geography with the above topics by making use of cross-curricular links between Geography, Civil Education and History. In the context of History, pupils should learn about the origin and development of each religion. As part of Civil Education, they should study the character and essential traits of religion. Finally, geography teachers should be addressing the geographical aspect, i.e. the distribution of the religions in the world and the context of their impact on societies. Although textbooks that cover the nature of the world's largest religions include that for Geography, this subject matter could be entirely omitted as part of geography lessons to address religious regions provided that the cross-curricular links are used properly.

The cross-curricular issues listed in FEP BE (2007) are such that they give the pupil an overview of the current issues of the contemporary world. Cross-curricular topics form a compulsory part of education. They can be used e.g. as part of individual subjects, as a separate subject or as a project. The issues of world religions and related global issues can be included into a number of cross-curricular topics. The closest to the issue of religious geography, combined with global education (GDE), is the cross-curricular theme of Multicultural Education. Along with the cross-curricular topic of Democratic Citizenship, Multicultural Education is to teach pupils to respecting cultural, ethnic and other differences while providing space for getting basic knowledge of different ethnic and cultural groups of the population living in the society in this country as well as in Europe. It develops the competence to recognise and tolerate the specialties of other religious groups and helps realise the incompatibility of religious intolerance with the principles of life in a democratic society.

The cross-curricular topic of Personal and Social Education is also designed to guide pupils towards an awareness of the diversity of people – including religion. In addition, it is leading to an awareness of the importance of cooperation and mutual assistance. This makes the topic close to one of GDE's humanitarian aid and development cooperation. Cross-curricular topics to help create a positive attitude towards cultural diversity include Education towards Thinking in European and Global Contexts. The topic provides pupils with basic knowledge of various ethnic and cultural groups living in the Czech society and in Europe, develops the ability to recognise and tolerate the differences of other religious groups, and helps realise the incompatibility of religious intolerance with the principles of life in a democratic society. Education towards Thinking in European and Global Contexts is to lead to deepening the understanding of emergence of and solutions to global issues. These include global conflicts, causes for which often lie in religious intolerance.

5. WORKSHEETS FOR TEACHING GEOGRAPHY OF RELIGION AND GDE

The presented worksheets form part of a teaching material that was developed in two versions using Microsoft Publisher. There is a student's version and a teacher's version, the latter featuring added solutions to issues, estimated times to complete tasks, cross-curricular links and more tips and tools.

A teaching guide was selected as the form of the teaching material; a combination of a textbook and diverse exercises that enables learner's autonomy and better absorbance of the issue, the handbook has two parts: while the first part covers the definition of religion as a term, distribution of selected religions in the world and the relationship between religion and the geographical sphere, the second one is rather a theory and outlines the selected religions. The entire teaching material is designed to encourage the pupils' independent thinking, looking for contexts and working with various sources (e.g. Internet, articles). In terms of time allocated for teaching geography at primary school, teachers should aim to consider the inclusion of appropriate sections/tasks rather than taking advantage of this learning material as a whole. As the name (Many Gods – Single Mankind) suggests, the teaching material aims to lead pupils to tolerance (Vlažná 2015).

The presented paper includes four samples. The first sample involves a worksheet entitled If the World Was a Village (Figure 1). The task assigned is imagining the world as a village with 100 inhabitants. The top of the sheet provides basic information on the relative number of followers of the world's largest religions. Pupils are instructed to differentiate the 100 people by colour at the bottom of the sheet guided by the text; the groups should be formed depending on the chosen religion. This simple task can enable the student to have an idea of the distribution of religions in the world. It is appropriate for including in the introduction to the population of the world, where the content of the subject matter includes religion. After some sort of adjustment, the task could also be applied in the context of regional geography – What would the distribution of religions in Asia (Europe, Africa, America, Australia) look like if the continent had 100 inhabitants? Such activities are best done when making use of various statistics (e.g. Factbook).

The second sample is called Religion and Politics (Figure 2). Here, the introductory text tells the student about the influence of religion on the arrangement of the political map of the world, e.g. an example of the split of British India and the disputed territory of Kashmir. The task is finding more information on the world's region where religion is the cause of conflict; in doing so, the pupil makes use of the Internet and atlas of the world. Part of the text is also a note of religious freedom being a fundamental human right. With the Czech Republic ranking among countries with the lowest level of religiosity in the world, Czech pupils may not be aware that religion can have a major influence on world events. Highlighting this is the very purpose of including this teaching material.

The third sample Spatial Distribution of Religions in the World (Figure 3) is designed to bring pupils closer to regions where the diverse religions prevail. At the beginning, there is a definition of religious geography. Then the pupils are assigned the task to work with a distribution map of religions. It is important that it is only a map without any captions. Discussion is used here to lead students to match colours and respective religions in the correct way. Mainly the typical features of the region such as religious buildings, local culture etc. should be highlighted. Using discussion, pupils are to recognise cultural differences and characteristics of each region.

Sample 4 Religion and Settlements (Figure 4) is to get pupils familiar with the influence of each religion on the world's architecture. This simple task shows seven buildings and seven pictures; the pupils are asked to create corresponding pairs and find the sites on the map. Subsequently, they search for more religious buildings via the Internet, trying to outline the architectural elements of individual religions. This topic is close to fine arts education, giving the possibility for making use of interdisciplinary links. This task is also appropriate for highlighting cultural globalisation.

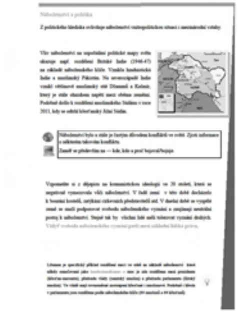

Figure 1: If the World Was a Village **Figure 2: Religion and Politics**

Source: Vlažná (2015)

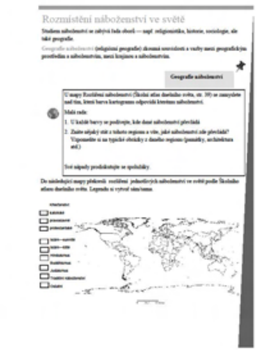

Figure 3: Spatial Distribution of Religions in the World **Figure 4: Religion and Settlements**

Source: Vlažná (2015)

6. CONSLUSION

Geography of religion is a sub-section of geography, which is included to some extent in the subject matters for stage 2 at basic education. Geography lessons, however, do not provide enough time for the teacher to dedicate to this subject matter. Religious geography shares a number of topics with the broadly conceived GDE. A comprehensive concept aimed at discovering and understanding the lifestyles in other parts of the world, GDE leads individuals to solidarity and tolerance on the one hand and critical thinking on the other. In particular, geography of religion and GDE share topics related to cultural aspects of globalisation.

Religion in various regions of the world affects the nature of the local culture. On the regional, micro regional or global scale, the confrontation of different cultures often brings extreme effects such as armed conflicts, violence, suppression of basic human rights, social instability, forced emigration, etc. Global threats stemming from intolerance towards other religions are particularly topical in recent years. It is therefore necessary that more attention is paid to such topics at school. Teaching children to understand others at an early age is essential.

In the real life of schools in the Czech Republic, global issues are rather infrequent despite the fact that the basic curriculum document for primary education creates space for including religious geography and GDE topics into teaching activities, which is especially true for teaching subjects such as geography, civil education or history. It is possible to look for space for implementing global topics in using interdisciplinary links, cross-curricular topics and forms of integrated education. In addition, the topicality and the attractiveness for the student make such topics applicable for use in the context of project development. This creates space for increasing lessons for geography and aforementioned closely-related education frameworks in the educational process at stage 2 of primary schools. Applying the specific teaching material on religious geography in teaching has a potential of inducing, encouraging and strengthening children's thinking in a global dimension.

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SELECTED ASPECTS OF THE TRAINING OF FUTURE GEOGRAPHY AND NATURE SCIENCES TEACHERS IN POLAND – ANALYSIS, EVALUATION, REFLECTION

Wiktor Osuch[1]

[1] Pedagogical University of Cracow, Institute of Geography, Department of Geography Education, Cracow, Poland; e-mails: wiktor_osuch@wp.pl; wikosuch@up.krakow.pl

ABSTRACT

This article presents an analysis of certain aspects and conditions of the learning process of students of geography teaching specialty in Poland. It is also an attempt to analyze and assess the changes that have occurred in recent years in the training of future geography teachers in connection with the introduced programmatic and organizational changes in the Polish higher education. The publication presents several opinions of various authors, mainly specialists in teaching geography and broadly understood geographical education, who every day take part in the preparation of theoretical and practical courses for geography students – candidates for teachers. Author also shows the results of some studies, particularly surveys, concerning the process of teacher training in Poland, including specific competencies and relating them to the results of studies from abroad to make any comparisons and ratings. This is a kind of discussion and reflection on further intentions and plans related to the education of future teachers, on the position of didactics in the geographical disciplines and on the capabilities of students and graduates of geography in a dynamic educational labor market. Closely related elements, including plans and programs of study, the selection of teaching staff, structure and organization of the educational process play an important role in the process of teachers' training. These and other elements have a significant influence on shaping future teachers' competencies and thus increase their competitiveness on the educational labor market.

Keywords*: geography teachers training in Poland, competence*

1. INTRODUCTION

Poland, as well as many European countries, for many years is looking for effective solutions that allow young people to find the right conditions to develop their interests, broaden their horizons and acquire attractive primarily education that will guarantee to get high competence and competitiveness in a dynamically changing European labor market. A very important task was put on education and teachers because they will create changes and introduce new solutions. These changes are noticeable for several years, also in the education of geography students. There have been a lot of attempts to reform the education system in Poland, ranging from changes in types of schools, changes in core curriculum, new textbooks, new educational content for particular subjects, but only a little has been done in order to develop a modern teacher, including geography teacher, in the XXI century.

The aim of this study is to analyze and attempt to assess some elements, which have a significant impact on the education of future geography teachers. The author of this paper analyzed the literature, mainly articles and publications on geography didactics, and he conducted diagnostic survey, where all kinds of survey questionnaires (containing closed questions, single and multiple choice questions) were used as research tools. Surveys were conducted among active geography teachers and geography students – candidates for the teachers. Some results of the research were confronted with the results of other authors, mainly for comparative purposes.

Poland (for the academic year 2014/2015) had fifteen geographical centers, including IGiPZ at the Polish Academy of Sciences and 14 higher education institutions, educating geographers, as well as future geography teachers. These were: University of Warsaw (UW), Jagiellonian University (UJ), University of Gdańsk (UG), University of Silesia (UŚ), University of Łódź (UŁ), Adam Mickiewicz University in Poznań (UAM), Nicolaus Copernicus University in Toruń (UMK), Maria Curie-Skłodowska University (UMCS) in Lublin, Kazimierz Wielki University in Bydgoszcz (UKW), University of Szczecin (USz), University of Wrocław (UWr), Jan Kochanowski University (UJK) in Kielce, Pedagogical University of Cracow (UP), Pomeranian University in Słupsk (AP). More broadly, the results of the survey on the current state of Polish geography during educational system transformation were presented in the publication by Kostrzewski, Roo-Zielińska, Krzemień and Lisowski (2015), which is not specific subject of this study.

2. TEACHING SPECIALIZATION AT GEOGRAPHICAL STUDIES

According to a detailed survey conducted by Osuch (2010) preparation to become geography teacher in most universities is voluntary and depends on specialty choice. However, considering the fact that in many universities, including those with large tradition of teacher training and large numbers of college graduates working in schools of various levels, the region move away from teachers' training to promote non-teaching courses. Enriching the educational offer with non-teaching specialties seems to be the answer of many geographical centers for a rapidly changing socio-economic situation in Poland. Currently, pedagogical universities, as well as other types of higher education institutions, can not ignore their graduates' possibility of future employment in the profession. It is believed that in an era of huge competitiveness on the educational labor market only students with a lot of proven field experience can become more attractive to a potential employer.

For example, for several years Institute of Geography (UP) in Krakow offers the following teachers' specializations: geography with nature sciences, geography with knowledge about society, geography with basics of entrepreneurship. Geography with nature sciences is one of the most popular geographical teachers' specialization in Poland. Few years ago we introduced and respected the principle of an equal number of teaching and non-teaching specializations. But it was abandoned and we did not take initiatives to broaden the offer of teaching specializations, like for example geography with the English language. The current offer at the Pedagogical University is much richer with non-teaching courses. Similar solutions are found in other academic centers in Poland, where the number of non-teaching specialization and courses is bigger than teachers' specializations. According to D. Piróg (2012), among all surveyed students of geography in Poland – 23% of students at UP, 18% of students at UMK and 16% of students at UWr were clearly determined to take up employment as a teacher of geography. Therefore, many graduates of geographical centers in Poland still see the school as the main place to seek for future employment.

In recent years, the number of hours of teaching specialization was determined by standards for teacher training, according to which the teacher training course was set at 390 hours, including 105 hours of main subject (geography) didactics and 60 hours of a second subject didactics (Osuch 2010). In the vast majority of programs and study plans, teacher training was provided on the first (bachelor's) degree of education. Currently, this situation has changed due to the implementation of the learning outcomes for individual courses and specialization effects – not due to the implementation of educational standards (Rozporządzenie MNiSW z dnia 17 stycznia 2012r.). Generally, items (courses) at teacher training were divided according to stages of school education. At the bachelor's "Geography with nature sciences" studies students pursue didactics of specialization course – nature sciences, because it is the subject, among others, taught in primary school. At Master's degree studies, students pursue didactics classes of the main subject – geography, which is taught in middle and secondary school, and other educational items for this stage of education. For example, subject "The concepts and practices of education" is provided in two versions: for primary school (bachelor's degree studies) and for middle high school level (master's degree studies). It is difficult to determine whether a newer solution is better because it is considered to be organizationally more difficult to achieve. At "Geography with nature sciences" and "Geography with knowledge about society" specialization, the vast majority of teachers' training classes and school practice is carried out during master's degree studies. Such a large accumulation of teacher training classes, other subjects and preparing the thesis is a heavy load for a student.

At many universities, for students wishing to acquire teachers' rights, a special organizational unit – the teacher training college – was set up. The purpose of this unit was to organize the teachers' training process, including teaching practice and their subsequent settlement, as well as the issuance of a certificate entitling to teach a specific subject in schools. UP additionally settled a special inter-faculty unit – Studium Kształcenia Nauczycieli (SKN) designed for students of extramural studies who did not decide to specialize in teaching, and they want to acquire the necessary capabilities in this regard.

So far, the opinion on the implementation of activities of psycho-didactic block were divided. Supporters of the university model believed that these items should be implemented within the framework of the teacher training college, due to lower costs of educating students and they more or less explicitly called for the creation of one common Chair of didactics. Recently, far more votes get the concept of didactics laboratories held in the structures of specific departments or institutes due to the possibility of allocating subjects from teachers training to “their” workers. However, it is not always possible. Especially in the implementation of psychology and pedagogical subjects at the stage of preschool or early school. You can put forward a thesis that the effectiveness of teaching will be higher, the more contact students will have with lecturers from their faculty. For the broader “quality of education,” it’s competence of teachers conducting the classes that should be relevant, not only administrative decisions held by university authorities. More and more often not only geographers, but representatives of other disciplines complete their education at pedagogical faculties, taking postgraduate courses, and even obtain degrees in pedagogical sciences to gain additional qualifications, and also to carry out new subjects and courses for students at their own units. According to the author of this study, academics thus become more competitive for their departments or institutes, which should result in entrusting more classes especially for employees of their units (Osuch, 2013). The issue of personnel selection requires broader analysis and undertaking specific research and findings in this regard.

Teaching practice and the concept of teachers’ training studies pedagogization

There shall be no doubt that teaching practice in schools is a very important step in educating future teachers of geography and nature sciences. Years of experience in the implementation of practices (Osuch and Osuch 2010) show that properly designed, organized and implemented apprenticeships contribute to increased motivation of geography students and their greater willingness to work as a teacher. Leading research for many years in different geographical centers in Poland, partly proven that geography students of selected universities in Poland showed larger (by about 20-25%) interest in employment as a geography teacher after completing their practice (Osuch, 1999).

The literature shows some interesting examples of innovation in the implementation of practices that cause the increased interest of students and pupils. Some of them are realized as projects. For example, J. Lampiselkä, and Z. Raykova (2008) present the model of cooperation of universities educating future teachers with exercise schools in Finland. This unique European cooperation involved 13 exercises schools in Finland, where teachers-mentors are not only specialists in the profession of school teaching, but also are prepared to work with students at the university. Legally and organizationally exercise schools are subject to universities. In Poland, despite the signing of agreements between universities and exercise schools, complicated regulations do not allow academics simultaneously employed in schools to accept students for the practice. Schools are separate institutions and not subject to universities.

J. Hercik, I Smolová, J. Frajer (2009) presented an interesting example of cooperation of the university with schools of exercise in the Czech Republic. They gave a non-traditional example of cooperation, involving tangible benefits for both sides by creating joint teaching materials for classes at the school, students also help the city of Zlin in conducting advice, mediation, and cultural events. For students, this practice is a great motivation to participate in public life in his own place of residence, and a good example of combining theory with teaching practice. It seems that properly achieved objectives of practice and formation of an emotional bond with the future profession results in students’ positive self-assessment of practices and arousing further interests in teaching.

It doesn’t seem beneficial that academics without any school practice should be employed in units responsible for teachers training (Osuch, 2013). Graduates of teacher training (including geography) directly employed after graduation at the university, gained their practical experience in the first years of parallel working as assistants in universities and teachers of geography in schools. In the past, prof. Jan Flis – an outstanding Polish geographer and educator obliged all academic staff to observe student during their school practice. Today, such a commitment would be a great surprise among academics and a great challenge because this obligation “is dedicated only for didactics”. Occasionally there were such situations, but only to avoid too many trainees under the supervision during the academic year.

According to M. Tracz and W. Osuch (2008) about 90% of the employees of geography didactics had experience working in different types of schools. In addition to the young assistants, outstanding teachers (who during the school work actively conducted research and have been involved in a number of interesting projects and ventures) were employed. For this group of teachers, this solution was kind of nobilitation, although in practice it only lasted a specified time (usually several years). It does not seem to be beneficial for modern teachers training to be led by teachers not understanding the reality of modern school, gaining knowledge about it and about wider didactics only thanks to information heard from friends or family members. A worrying phenomenon is the belief of some teachers, that subject didactics is only reduced to teach students to write the correct outline of the lesson. Additionally, their little experience with teaching, involving co-authored textbook, often, in their opinion, allows them to shallow the role of didactics in the educational process (Osuch, 2010).

The wide variation in bachelor's and master's thesis today is observed. It is difficult to say why the quality of thesis decreased, as is commonly believed, this issue of quality (not only among geographers) requires conducting thorough research (Osuch 2013). Accreditation Commission's inspection results are also inconclusive. Unfortunately, sometimes topic of the thesis and the thesis does not correspond and is even quite distant from the student's educational interests during teachers training. Frequently students choose a seminar in a random manner or are administratively directed to individual professors, having still available places. Such arrangements should not take place, and the student should have a free choice of the seminar. An interesting solution is used in the Department of Geography at the Palacký University in Olomouc. Master's degree students during teachers' training are obliged to choose precisely seminar – geography didactics, and consequently complete their MA thesis closely with the didactic of geography or issues related to the wider educational activities (Osuch, 2013). This is a good example teacher training pedagogization.

Scientific staff involved in didactic of geography in Poland is very small. The vast majority of geography didactics labs work inside institutes or departments of geography, and the employees themselves agree that such a solution is the most appropriate and should not be changed (Tracz, Osuch 2008; Osuch, 2013).

But now, as a result of the ongoing process of parameterization of units and departments, geography and other didactics (especially natural sciences didactics) are subjected to structural changes and switched to other units. Despite getting a difficult, but achievable scientific promotion, several academics of geography didactics' unit received habilitation. In practice, however, it did not translate into an increased rank of geography didactics in institutes.

3. MODEL SILHOUETTE OF GEOGRAPHY TEACHER ACCORDING TO LITERATURE – SILHOUETTE OF THE GRADUATE

In the pedagogical literature, there is a lot of information on teachers' profile, his desirable personality traits, predispositions to practice the profession, shaped competencies or qualifications obtained.

In surveys conducted by geography students and active teachers, creativity and responsibility are highly valued in the work of geography teachers (Osuch, Osuch 2005). Similar conclusions were presented by didactics at the University of Łódź (UŁ). According to surveys, creativity, and a wide knowledge is highly valued among graduates of geographical studies (Szkurłat, Adamczewska, Głowacz, Smętkiewicz 2011). Previously studies of A. Rowicka (2008) show that efficiency, creativity, sense of duty, diligence, responsibility, and tolerance are the most important traits that students believe the teacher should possess.

Currently, instead of a discussion on selected personal features of candidates for teachers more and more often the notion of competencies is used in literature. These competencies should be acquired by a student of teaching faculty – a candidate for a teacher, including a geography teacher.

Complete teaching of geography was defined by S. Piskorz (1996) as 'the effective dissemination of geographical knowledge, developing various factual and formal skills and getting accustomed to the specific system of values and developing the appropriate attitudes by a person with the adequate preparation to do that ' (university studies) (Piskorz 1996, p. 144).

Economics, engineering, technology, politics – these various sources of knowledge should be necessarily used by geographers according to A. Wahla (2000), a Czech geographer and educator. He also considered setting the whole process of education in worldwide social and economic transformations.

A Slovak geographer and educationalist J. Kancir (2000) described old, contemporary and future projects of geography textbooks as they are perceived by geography teachers. In addition, J. Kancir created the criteria of textbook assessment and carried out exemplary analyzes and assessment of those textbooks. In his next publication J. Kancir (2004) discussed the subject of a detailed didactics in the aspect of questionnaire students' surveys He made a number of remarks, mainly in the form of postulates concerning further education at geography faculty and training future teachers of geography.

A theoretical model of teaching geography and economic subjects at school was presented by an Austrian geography didactic Ch. Fridrich (2004). His whole perspective was connected with standards of teaching and assumptions included and resulting from curricula.

M. Kucharska (2004) indicated that initial teacher training does not end with graduation, and no specialist uses a finite resource of knowledge.

Along with describing Dutch graduates' profiles H. De Jong (2008) divided their competencies into various groups: pedagogical, communicative, teaching, organizational, in the field of cooperation with teachers and parents, and in the field of professional development. As he declared, teaching competencies include also competencies concerning the subject of geography, which are not emphasized or mentioned separately.

Poland, Czech Republic, Slovakia – these countries suffer from regression of school geography and its didactics. Many possibilities of its development were mentioned by E. Hoffman (2009), presenting also the position of geography as the subject taught at Czech schools with reference to the rank of geography didactics.

Presented examples certainly do not exhaust the literature in the field of teacher education in terms of geography teachers' training, but they are an interesting and valuable review for further consideration.

A description of the graduate profile plays an important role in the current programs and study plans. It is supposed to help high school graduates to choose adequate studies (to check if requested field of study will meet expectations and will give the opportunity to find an interesting job), and for future employers it facilitates the selection of competent employees.

In addition, Państwowa Komisja Akredytacyjna (State Accreditation Committee) analyze and evaluate (among others): the consistency of approaches to learning with the silhouette of a graduate, plans and programs of study and teaching methods. The graduate profile should contain study goals and a detailed description of the skills that the student should have acquired after completing the studies.

However, E. Szkurłat (2011) is critical of the foregoing. She believes that 'graduate profile description can not be replaced by generalities, but by clearly defined requirements, taking into account the key competencies acquired at a given stage of education' (p. 124.).

Z. Podgórski (1997) and J. Kop (2004), presented the silhouette of geography teacher to students right in their first classes to motivate students to discuss about positive and negative examples of teachers, as well as to analyze and reflect on the issue of liability in the teacher's work.

Introducing innovations, being motivated to take action, to plan, to reflect, to effectively cooperate – these competencies were mentioned by Ch. Vielhaber (2006) in his classification of competencies and the profile of a geography graduate of University of Vienna. These are key competencies shaping the silhouette of geography graduate in Vienna. Vielhalber gives only a little of attention to competencies connected with geography as a subject.

Z. Podgórski, S. Tyszkowski, R. Stańczyk (2008) presented students opinions about geographical studies. It was an analysis of UMK students' expectations, the realities of studying geography and future prospects. Conducted surveys had sounding nature and suggested changes in the educational profile of geographers in Toruń.

D. Piróg (2011) drew attention to the weak side of geographers education, which is the lack of broader research of the labor market needs for future graduates and the need for rapid updating and modifying the curriculum to increase employment in chosen specialization.

A specific ranking of key competencies was presented by E. Szkurłat (2011). Constantly changing labor market marked these as important: the skills of speaking and writing in foreign languages, ability to work with people from different cultural groups, capacity for analysis and synthesis, application of knowledge in practice, the use of computers and the Internet, innovation (p. 119). The publication of W. Osuch (2011) underlined the importance of competencies in the field of interpersonal communication both on teaching and non-teaching geographers' labor market. According to Z. Osiński (2010) "soft" competencies are often cited as the most frequently sought after by employers in advertisements, while sought-after features among the graduates were: creativity, responsibility self-reliance, to identify their strengths and weaknesses, high motivation, resistance to stress, innovation .

Such studies among geographers with various specializations have already been carried out and now they allow to complete reliable assessment of labor market needs and geography graduates' competencies expected by employers.

Presented several opinions on the silhouette of geography teacher can conclude that in the literature there is no single model of geography teachers' education. While each of the presented opinions draws attention to other elements forming a whole silhouette of geography teacher.

4. GEOGRAPHICAL STUDIES GRADUATE PROFILE AND COMPETENCIES

An important role of universities is to create specializations meeting the needs of the modern labor market and an accurate description of the graduates profiles (including competencies), because young people consciously choose fields of study thinking about their future career. However, despite competencies for future graduates of geography are specified in offers many academic centers, students admit they are not always sufficiently developed during studies.

Referring and analyzing geographical studies graduates profile, some surveys on self-selected competencies of teachers of geography and geography students – candidates for teachers were conducted. Surveys were fulfilled by 96 teachers of geography (2008-2009), geographical studies graduates (attending to teachers training) from five universities. Furthermore, for comparative purposes, the acquisition of competence by 136 geography students (from three different types of studies) at Pedagogical University of Cracow was analyzed. Full study results about competencies have been published in W. Osuch (2010) monograph.

For example, didactic competencies, with a high degree of education, included those in the following areas:

- the use of different sources of geographic information (70% very good marks, 25% good marks);
- multimedia presentations (66% very good marks), which means that students in this field are much better prepared than professionally active teachers (however, it is not fully established whether all teachers in surveyed schools have free access to multimedia projector).

By far the lowest results among the students of geography were obtained at the following competencies in the following areas:

- the use of foreign literature in teaching geography (up 35% failed to evolve this competence, 15% evolved very little, almost 28% evolved sufficiently and only less than 8% evolved very well. These are similar to the results obtained by geography teachers, both from middle schools and secondary schools, although the percentage of students not knowing the language is slightly smaller than among teachers. The results confirm the widespread opinion that the students of geography very rarely use foreign literature studying geography.
- planning and carrying out geographic field studies (almost 20% failed to evolve this competence, 17% did very poor, almost 30% evolved sufficiently and only less than 8% evolved very good). These are not very optimistic results, as among surveyed geography teachers surveyed. This shows a large group (both teachers and students of geography), for which fieldwork or conducting field activities is sometimes a serious obstacle, and they do not feel comfortable in this situation (Osuch, 2012).

Survey conducted two years later among geography students at University of Łódź (Szkurłat, Adamczewska, Głowacz, Smętkiewicz 2011) confirmed exactly coincide conclusions with those described for Pedagogical University of Cracow, especially in the field research planning and the use of foreign literature.

Comparing the descriptions of Polish geography graduates profile with the competencies test results, we can conclude that university profiles in a limited extent comply with the requirements of the labor market, the interests of students, and students do not always highly appreciate their competencies, which is confirmed by the results of the survey.

5. CONCLUSION

Research conducted in recent years and lively debate of didactics, educators and teachers around the place and role of geography teaching in geographical disciplines, institutes and geography chairs can contribute to the optimization of the process of teachers' education and the development of an effective and efficient model of education. I might also modernize the education of future teachers, to help them complete their tasks in a competent manner in constantly changing school environment.

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LOCAL LANDSCAPE USED IN TEXTBOOKS FOR PREPARATION OF GEOGRAPHY TEACHERS

Rastislav Čief[1] and Ivana Tomčíková[1]

[1] Department of Geography, Faculty of Education, Catholic University in Ružomberok, Hrabovská cesta 1, 034 01 Ružomberok, Slovak Republic, e-mails: rastislav.cief@ku.sk, ivana.tomcikova@ku.sk

ABSTRACT

Local landscape has a unique position not only within teaching Geography. Almost all subjects, studied on particular school stages, have been concerned with it. This knowledge is of extremely important educational and diverse significance within the educational process including its informative and formative impact. The teachers and their creative invention, based on quality training and perfect knowledge of a local landscape, play a crucial role in its practical implementation. Local landscape is often said to be a laboratory where it is possible to demonstrate geographical processes and phenomena. Here, the students move from an abstract level of knowledge to specific knowledge from a purely rational level to a ratio-sensual one. The aim of this paper is to characterize the concept of a local landscape, to evaluate the position of local landscape geography in Geography standards and textbooks for primary and secondary grammar schools and to analyze the position of local landscape geography within a university course for future Geography teachers.

***Key words**: local landscape, concept map, the National Educational Programme, Geography*

1. DEFINITION AND CHARACTERISTICS OF THE CONCEPT OF A LOCAL LANDSCAPE

Knowledge about nearby and distant surroundings has been used in school education for a long time. Even J. A. Comenius considered the approach from close up to distant to be one of the basic educational principles and in geography this principle has been elaborated into so-called regional principle. According to Kancír and Madziková (2003), an idea to use local and regional features and knowledge in education and teaching is not new. Many educators and thinkers – F. Rabelais, T. More, F. Bacon, J.J. Rousseau, I. Kant, J.H. Pestalozii or above mentioned Comenius, have already dealt with it.

We can find a diversity of interpretations of this concept in academic writing and teaching terminology. In Geography and especially in the didactics of this subject, in addition to the concept of a local landscape, we quite often find the concepts of a local landscape, local area, local region, a micro-region or a small area which are defined as synonyms and the authors characterize them from several aspects. Considering this inconsistency, it is very important to accept particular conditions of the school and children's experience in addition to experts' opinions (Madziková, 2003 In Tutokyová, 2012).

The spatial aspect of a local landscape is determined by the size of a regional geographic scale. In Homeland studies, Kancír and Madziková (2003) initially understand local landscape as a territory of municipality where the school is located, or the territory of other municipalities from which children commute to this school. Gradually, the explored region is getting larger while being studied, and we talk about wider surroundings of the municipality, often without a precise definition, sometimes using administrative (e.g. municipal boundary, several cadastres, district, region, area, state, a group of countries, continent) or natural boundaries (e.g. geomorphological unit, drainage basin, respectively sea drainage area, climatic zone, bioclimatic zone, continent). The basis for the area's definition is mostly the catchment area of local importance, the core of which is the seat of the primary school supplemented with parts of market chains. Students learn about the dominant elements of the landscape such as waters, forest, settlements, traffic system, they learn how to intuitively distinguish between different types of landscapes and speak about them.

Tolmáči (2007) characterizes local landscape as the seat where students live or go to school, with its surroundings. This landscape is somehow different from any other place in the world and thus it is unique. Natural laws are applied here and a man can perform various activities as anywhere else on the Earth.

Kandráčová and Michaeli (In Harčár, Nižňanský, 1997) define local landscape as an area of valid daily routine rhythm of a man in a setting, while according to its size it can be placed on the interface between local and regional dimension. It represents the part of human environment, which is a contact zone of immediate and continuous sensory cognition zone (e.g. house, local district, a village with basic amenities, with a zone which is perceived periodically, i.e. the municipality with more complex facilities).

Mičian (2008) allocates natural territorial complexes which can be compared with a local landscape according to their size. On this basis, we integrate it into spatial units of choric dimension whose surface varies from a few hectares up to several 1000 km2.

The most precise definition of a local landscape characterizes it as a human geographical region of lower order, i.e. a nodal region, whose centre with certain facilities (workstations, services) binds the municipalities in its hinterland (Fričová, Kühnlová, 1983). The definition of a local region as a physical geographical micro-region may not always be clear. A local area of major towns may consist of the town itself with its hinterland.

The time aspect is reflected in life experiences that an individual has acquired during their lifetime in a certain local landscape (evolutionary potential).

The socio-psychological aspect is reflected in certain emotional (mental) relationships between people living in a local landscape. For them, it means a sense of home, security and confidentiality. Local landscape perception by an individual and their behaviour within corresponds with it. Not only physical objects making up the place are meaningful for a man living in a particular place, but also events that they experienced in the past. This aspect is best expressed by a Latin term “genius loci”, which means “the spirit of the place” in Slovak language. It encompasses the unity of “genius regionis” (the spirit of the landscape) and “genius populi” (the spirit of people, society), which is very important in geography of a local landscape.

The didactic aspect of a local landscape is of great importance in Geography teaching. Deeper knowledge of a local landscape is not only objective but also a means of geographical education. Specific geographic phenomena and their relationships within a local landscape serve as a model for understanding general context and rules. A more detailed observation of a local landscape develops pupils' interests, it helps understand dynamic changes of a landscape, its specificities and relationships between a man and a landscape as well as permanent knowledge of natural and environment regularities more easily. A student, experienced in solving problems of a simpler and known local landscape (e.g. rural municipality) can solve problems of a more complicated and less known urban municipality or a larger region more easily and successfully.

From the aspect of educational needs, a local landscape (region) is a part of real space (world) in which a human lives, develops and forms, but at the same time also rationally and sensitively knows very well (Kancír, 2007). It is a part of a real world that has surrounded us since early childhood, offers us opportunities of cognitive development, stimuli for emotional development and formation of our opinions, it is a gateway for knowing distant countries in a time-space dimension which can be used in a cross-curricular approach.

2. GEOGRAPHY OF A LOCAL LANDSCAPE AND ITS POSITION IN GEOGRAPHICAL EDUCATION AND OBJECTIVES OF GEOGRAPHY OF A LOCAL LANDSCAPE IN SCHOOL PRACTICE

Geography of a local landscape (region) is an integral part of homeland regional Geography as one of the specific didactics of Geography which is, within the arrangement of thematic units in curriculum, the climax of geographical education at primary schools in the Slovak Republic. It is defined as geography of the area where a student lives, while in didactic terminology it is usually referred to as geography of a local area or micro-region. Since homeland geography has been considered to be the most important regional-geographic discipline, it was given an increased attention at all stages of development of education (Čižmárová, 2006).

Exploring the local landscape should be detailed according to the region’s dimension (upper-tier territorial unit, local region, municipality, municipal district, housing estate). Teaching should be influenced by familiarity with the environment, so that it is based on regional knowledge and understanding its history, the present and the future trends. Such an approach is considered to be modern and follows European trends of understanding of homeland geography.

The current position of geography of a local landscape corresponds to the traditional geographical characteristics, whose focus is on natural conditions, place names and economic situation. These components miss a general assessment and comparison, a problem approach in characterizing natural and socio-economic conditions, conditionality of individual phenomena and processes in the landscape sphere, and therefore they are not interconnected. The data collection prevails as well as description of the facts and discussing production activities without explaining their relation to the potential of the landscape and the wider economic relations (Čižmárová, 2001).

To maintain the continuity of local landscape exploring, however, presupposes the inclusion of regional knowledge into the whole system of teaching geography using specific examples from a local landscape. When evaluating the local landscape, it is necessary to clarify relationship between the natural elements and elements created by human activity.

According to Mydlová (2009), while speaking about a local landscape, we must put an emphasis on the affective objectives and thus we can strengthen and fulfil cognitive objectives. An important source for their development is a direct contact with reality and the use of observation, practical activities of students, for example their own terrain research during geographical walks and excursions.

Information about a local landscape must be adapted to psychological peculiarities of pupil's way of understanding in order to respect natural development of children and the teaching should be based on their experience. The difficulty of the tasks students should manage as well as the difficulty and amount of information about local landscape and intensifies with their age. They should be able to process the information and to pass it on in an engaging, instructive manner. The assessment of pupils' performance is aimed not only at memory performance but also at the quality of their work, commitment and originality. Thus, we assess a comprehensive personal development of pupils, not just their current knowledge. Geography of a local landscape thus enables intellectually weaker students with difficulty in learning memory to succeed.

The curriculum is often based on pupils' interests and their own decisions. It enables them to choose activities, make their own decisions and thus enrich the basic curriculum. The structure of curriculum of local landscape geography is fully the teachers' responsibility and they do not have to follow traditional scheme of the thematic units and their scope very strictly. They can organize them according to their own discretion, taking into account local peculiarities and conditions. It is necessary to pay special attention to geographical location in a wider sense, including its relative changes. It is advisable to use maps of different scales and compare different ways of local landscape mapping.

Description of natural conditions should be a comprehensive analysis of the landscape and not only detailed description of particular components, including the impact of human activity. It is inevitable to put emphasis on the protection of landscape's nature and its formation. Students are familiar with it and they can actively participate in it. The local landscape will serve as a model for understanding the vertical and horizontal relationships and geographic patterns, thus becoming the aim and the means of geographical education.

History and culture of a local landscape plays an important part in environmental education. Population can be characterized according to occupation in different economic sectors and the emphasis should be put on migration trends and development of natural movement. While exploring the settlements, it is recommended to ask questions about housing and lifestyle. Increased attention should be paid to the perspectives of the municipality and the landscape where students live. When characterizing the economic situation, it is not proper to enumerate all the activities in the landscape. We can apply the knowledge about natural resources to traditional manufacturing industries. It is necessary to describe transformation processes in economy and their impacts on changes in the structure of industry, agriculture, services and transport. In the end, attention is paid to the quality of environment and its preservation, disruption and usability for recreation and tourism (Čižmárová, 2001).

The topic of a local landscape is also discussed in Homeland studies. As homeland studies represent an elementary level of geographic education, it has a very close relationship with geography. But it cannot be completely identified with teaching Geography, because Homeland studies are meant to be a complex vision of the world in geographical and historical context, with a strong educational function. It is a propaedeutic subject for teaching Geography on the second stage of primary school. The correlation between these subjects provides several opportunities for cooperation between teachers of the first stage and geography teachers – for their communication about projected or achieved objectives in education, the building a continuous transition from the first to the second stage of primary school. However, it is questionable to what extent this relationship is really used in school practice.

Additional space for teaching local landscape is provided by a cross-curricular topic of Regional Education and traditional folk culture which can be, through the curricular reform of The National Educational Programme, incorporated into optional subjects such as Regional education, Regional history, Artistic processing of materials, Choir singing, Children's musical theatre, Literature and drama theatre. The aim of doing so is to create conditions for students to grow and develop their sense of beauty for their region, nature, architecture, folk art and learning about cultural heritage of our ancestors. Educational activity is aimed at students in regional education so that they know the history but also the present of their own village or town.

(http://www.statpedu.sk/files/documents/svp/prierezove_temy/regionalna_vychova.pdf [online 28 July 2013]).

The Didactic System of Local Landscape Geography and its Position in the Standards at Primary and Secondary Grammar Schools

Educational and psychological aspects, as well as other factors, such as difficulty of the curriculum, appropriate teaching methods, forms and means and expertise of teachers must be taken into account at didactic curriculum of local landscape geography at primary school. It has the traditional organisation and position within the system of geographical education which is determined by The National Educational Programme (the NEP).

The National Education Programme is a binding document that sets out general objectives of education and core competencies, towards which education should be directed. Educational objectives are set to ensure balanced development of students' personalities. The National Education Programme is also defined by curriculum framework. It is the basis for school educational programme, where the specific regional conditions and needs are taken into account. NEP for particular levels of education are issued and published by Ministry of Education, Science, Research and Sport of the Slovak Republic http://www.statpedu.sk/clanky/statny-vzdelavaci-program [online 28 July 2013]).

The topic of local landscape geography in the fifth year of primary school

Pupils of the fifth grade of primary school are initially taught geography in general, from the Earth's location in the universe. Pupils gradually acquire basic knowledge about physical and human geography through information interpreted in practical terms, which is presented in a motivational way. According to the curriculum, the learning content does not directly follow Homeland studies curriculum. However, the basic didactic principles of move from the known to the unknown and from near to more remote are not applied.

The topic of a local landscape is discussed in a thematic unit A Map and the Globe, which is included in a thematic area Space on the Earth and its display. There is an inspiration for a geography walk in the school's surroundings, namely Devínska Kobyla, which can be adapted and implemented to a local landscape. In this thematic unit, students should acquire these requirements and skills in relation to a local landscape: show the cardinal directions on a hiking or wall map, present different ways how to find cardinal directions in nature, draw a path with the help of cardinal directions, work with a map of local landscape, determine geographic location of the municipality or district seat, navigate themselves in the terrain, explore their surroundings and surroundings of the school.

The topic of a local landscape can also be used in a thematic unit Travelling and getting to know the Earth, which is included in a thematic area Relationships between landscape components. In a subunit The most beautiful places on Earth created by nature, students learn how to name components of a natural landscape in the school surroundings and determine the relationships between them, describe the weather in any day in the local landscape according to given characteristics, analyze the changes in the data of individual characteristics, use drawings and leaves to name the deciduous and coniferous trees in surrounding areas, indicate which climate zone Slovakia belongs to. With the topics of the fifth year such as Volcanoes – windows into the depths of the Earth, Water, glaciers and wind activities, Atmosphere – an air cover of the Earth, What is the weather going to be like?, Diverse countries of the Earth, it is appropriate to include project-based teaching and give examples of a local landscape, which enables pupils to learn how to apply acquired knowledge to Slovak territory.

For a clearer analysis of the local landscape terms used here, we have created a concept map on Geography walk into the surroundings based on Geography textbook for the fifth year of primary school, p. 35-37. (Ružek, 2009) The key concept with the highest frequency in occurrence is a geography walk (22), then there are concepts that branch out of it with a lower frequency as a route – a trail, surroundings, local landscape, terrain, nature, Devínska kobyla as a specific destination of the walk. The second most frequent concept is a map (16), which branches out into: orientation – location, borders, tourist, distance and altitude. GPS and geocaching represent quite modern concepts. Concepts which are difficult for fifth graders are an isobath and a trigonometric point, but they have occurred only in the map legend. (Fig. 1)

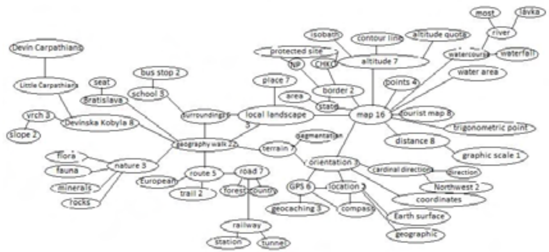

Figure 1: The concept map on Geography walk into the surroundings, based on Geography textbooks for the fifth year of primary school, p. 35-37

The topic of a local landscape geography in the sixth, seventh and eighth year of primary school

The curriculum of the sixth, seventh and eighth year of primary school is focused on the regional geography of the world. In the sixth year pupils get to know Australia and Oceania, America, the polar regions of the Earth, in the seventh year Africa and Asia, in the eighth year Europe – our continent. The National Educational Programme does not specify where to use the topic of a local landscape for specific reasons. It is a teacher's competence to decide. It is appropriate with the unit of Exploring the natural and man-made specificities of the region and comparison with Slovakia (local landscape), namely the topics of location, characteristics of the surface, climate, waters, flora and fauna, population and settlements, economy and areas of Australia and Oceania, America, Africa, Asia and Europe.

The topic of a local landscape can be used not only with physical and human characteristics of these continents, but also with thematic units Planet Earth (the sixth year), namely with the topic of Mountain formation, volcanic activity, earthquakes, Climate and climatic zones, Types of countries on Earth, then a thematic unit The world (seventh year), the topics of Human settlements and population and in the eighth year with the topics of Unification of Europe – the European Union or Europe's problems, which can be linked to the protection of environment in Slovakia. In addition, a local landscape may also be used with projects on various topics (the sixth and seventh year) or with the topic of Europe or the European Union under the title of The old world? (the eighth year).

The topic of local landscape geography in the ninth year of primary school

The topic of a local landscape can be most frequently found in the curriculum of the ninth year of primary school, which is focused on regional geography of Slovakia. (Tolmáči, 2012) It is discussed in a thematic unit Slovakia, which is included in the area of Regions of the Earth. In relation to a local landscape, pupils should meet the following requirements and skills: show the location of a local landscape on a tourist or topographic map by identifying locations, with the help of maps describe which part a local landscape belongs to (the Carpathian mountains, the Pannonian Basin), assign into geological zone (section), name its geomorphological units in the terrain and show them on the map, assign it to a climate area, observe weather and characterize climate, describe potential uses of groundwater in Slovakia and how it is actually used, propose precautions how to improve it, write the names of three spas and name therapeutic effects used there, name rivers and reservoirs, describe them and assign to drainage basins. Additional requirements and skills pupils should meet include: name interesting protected sites or objects in a nearby surroundings of their homes, name ethnic minorities and religions in the local area, name the seats of a district and neighbouring seats, talk about the history, present and future of the seat they live in, name factories located in a local landscape and the range of products they produce, draw a diagram representing your seat and the seats with the direct rail and road links, assess the state of traffic and tourism development in your seat and suggest improvements, according to the timetable, name seats where buses or trains go through on the way to the district, regional or capital city, introduce the country to potential tourists as an area suitable for tourism, describe interesting sites of the local area.

Educational standards do not define the teacher should address in this section. It is appropriate to follow Hettner scheme and use the project method in highest possible rate. The inspiration can be the project Slovakia and a local landscape, on which pupils can work gradually throughout the school year. Their task is to identify and complete the information about the place of residence or their school. Through GPS and Internet addresses given with each topic concerning Slovakia, the details about mountains, rivers, water reservoirs, fauna, flora and inhabitants, as well as economic activity in their municipality, should be recorded there. While working on the project, convenient tools are various resources such as books, atlases, the Internet, interviews with residents etc. In case they cannot find all the information, they can add their estimate. Finally, it is appropriate to illustrate it with a picture or a drawing of the local landscape.

Unlike the fifth year's concept map, the ninth year has no concept of a strong representation. The most frequent concept is an adjective geographic (9). The equality of particular concepts' frequency was caused by a project nature of the topic, where students were asked to make a project according to a Hettner scheme, which is caused by an equal representation of concepts dealing with individual components of the landscape. The concept of a local landscape (environment) can be considered for the central one. Then there are concepts as location, climate, water, rocks, soil, flora, fauna, people and the economy are branching out of it. The rarity is the total absence of the concept of a map, which is caused by using of recommended GPS for orienting. (Fig. 2)

Figure 2: The concept map on Project Slovakia and a local landscape, based on Geography textbooks for the ninth year of grammar school, p. 5

The topic of local landscape geography in the first year of grammar school

In the first year of a grammar school students learn about physical geography in the first semester. There is not a single chapter dealing with a local landscape, but we can find examples of a local landscape topic application in themes like: map content, the climate in a small area, weather, land waters, rocks in our surroundings, geomorphological processes and forms, or subdivisions of the biosphere in a small area. In the second semester, students study human geography. It is appropriate to teach population dynamics and structure on the example of a village, district and region in which the school is situated. Similarly, examples of the nearest surroundings that students know from their own experience can be used while learning about seats. Samples of the local landscape are desirable with teaching different types of agricultural landscape. A creative task using the local landscape is the task where students determine localization factors of local industry and local transport. Another task is aimed at potential of a local landscape assessment for various forms of tourism and services.

The topic of local landscape geography in the second year of grammar school

In the second year of grammar school, students learn about regional geography. In the first semester, it is regional geography of continents and oceans (Europe, Asia, Africa, America, Australia and Oceania, Polar Regions, Oceans), where they can make use of a local landscape at comparative tasks. For better visualization it is useful to compare known geographic phenomena in the local landscape with geographic phenomena from remote regions. There can be used examples of size comparison, altitude, temperatures, precipitation totals, population, towns, agriculture production, industry, non-renewable resources, the number of tourists.

The topic of local landscape geography in the third year of grammar school

Geography in the third year of grammar school is focused on regional geography of Slovakia, where we can find the largest part of curriculum dealing with a local landscape. At the end of an earlier version of the textbook of regional geography of Slovakia, there was a project on a local landscape (Fig. 3), which contained 23 tasks with the help of which students worked out comprehensive characteristics of the municipality and its surroundings. After creating a concept map, we found that the concept of a local landscape which is constantly emphasized in each task (it has been mentioned up to 40 times) is of a significant frequency. Other concepts are equally frequent, maximum three times, except for the concept of Slovakia, which is mentioned five times. As in the ninth year, the Hettner scheme is also respected and the central concept of a local landscape branches out into other concepts as: position (map, Slovakia), atmosphere, water, rocks, relief, soil, population and economy.

This project was eliminated in a new textbook's edition of 2011, but there were added the regions of Slovakia under the current administrative division. Examples of a local landscape there are also used with previous topics, where Slovakia is discussed in terms of various natural and human components.

Figure 3: The concept map on Local landscape project, based on Geography textbook for the second year of grammar schools. (2004), p. 60-61

In the third year of their studies, students can choose an optional subject Geography Seminar, where teachers create a lesson plan according to the needs of their students. However, the Ministry of Education recommends to make use of geography walks and excursions into the local landscape.

“The curriculum has presupposed the use of supplementary information. It is the teachers’ responsibility to decide how many lessons they will use for particular topics and how to organize the work. A seminar form of a lesson means independent work of students, studying literature which complements the teacher’s work, the solution of practical tasks, exercises, observations with the solution of particular tasks, geographical analysis and synthetic evaluation. The culmination of all of this is a seminar work in which the student demonstrates the ability to independently handle a topic based on the use of geographic information and geographic assessment. Geography walks and excursions are also recommended forms and the teacher decides whether to implement them.” (MŠVVaŠ, 1999: Grammar school curriculum. Geography Seminar.)

3. THE POSITION OF GEOGRAPHY OF A LOCAL LANDSCAPE AT UNIVERSITY

Learning objectives of didactics subjects is to prepare future geography teachers for their teaching practice.

According to the current programme of study, the Faculty of Education of the Catholic University in Ružomberok offers didactics studies at master’s degree in the field of Geography. In three semesters, the students are offered three compulsory courses and two optional courses. Compulsory courses are divided into Geography Didactics I., Geography Didactics II. and Geography Didactics III. (e-learning). Optional courses include The Use of Multimedia in Geographic Education and Regional Education.

The Course of Geography Didactics I. is taught two lessons a week: one lesson is a lecture and the other lesson is a seminar. The lectures emphasise the issue of Geography curriculum at primary and secondary school, the objectives, methods and organizational forms of teaching Geography, types of lessons, their contents, structure, an introduction to basic curriculum documents – curriculum plan and curriculum, educational standards, teacher’s books, textbooks, didactics tests. With the help of a teacher trainer, students apply in practice the knowledge from lectures.

The course of Geography Didactics II. is granted two seminar lessons a week. Students individually prepare and implement particular lesson stages, they evaluate them together and discuss them.

The course of Geography Didactics III., which is granted two seminars a week, aims to work out an e-learning model for lesson plans and selected Geography topics in LMS system environment. Another objective is to teach students how to work with an interactive whiteboard and options how to use PC at particular lessons.

The course entitled The Use of Multimedia in Geographic Education, familiarizes students with new forms of education supported with ICT (distance learning, e – learning, management of e -learning applications and their results), models simulations of natural phenomena through multimedia and enables them to work with computers.

The course of Regional Education aims to teach future teachers how to use elements of a local landscape regularly and continuously, i.e. regional principle, so that students learn how to detect and distinguish problems, get informed about different ways of their solution, or try to propose with them other solutions to problems that occur in the area where they live.

Future Geography teachers get in touch with a local landscape in the course of Physical and Human Geographical Mapping 1 and 2, where they examine individual components of a local landscape (geological outcrops, geomorphological forms, surface water, soil science outcrops, flora and fauna communities, humans and their activities impact on the landscape).

4. CONCLUSION

Local landscape teaching is the result of geographic education at primary and grammar school. Geography of a local landscape helps to develop analytical and synthetic thinking of students on the basis of regional documents of different dimensions. Specific geographic phenomena and their relationships in the local landscape serve as a model for understanding the general context and regularity. Students get to know the local landscape either directly on geography walks and excursions or indirectly in the classroom during the actual study.

It is inevitable to introduce the landscape in which students live in its global development (what appearance it used to have, what gradual human intervention has been done and what the current problems in the landscape are). It is appropriate to clarify the causes of activities deployment, their specialization in relation to the landscape conditions, their impact on the landscape appearance, the state of the environment and aesthetic value of the landscape. Future teachers must therefore know the terrain where they come to teach, be it from geographical, social or cultural aspect.

Through the process of getting some knowledge about a local landscape, teachers should try to educate their students, influence their life values, develop their knowledge and personality, form their solidarity and responsibility for the environment in the place of residence, municipality, region or country.

The local landscape has a unique position not only within teaching Geography. Almost all subjects, studied at particular stages, have been concerned with it. This knowledge is of extremely large educational and diverse significance within the educational process, including its informative and formative impact. The teacher and their creative invention, based on the quality training and the perfect knowledge of the local landscape, play a crucial role in its practical implementation. The local landscape is often said to be a laboratory in which it is possible to demonstrate geographical processes and phenomena. Here, the students pass from an abstract level of knowledge to specific knowledge, from a purely rational level to a ratio-sensual one.It is inevitable to adjust the information about a local landscape to psychological peculiarities of students, respect natural development of the child and rely on their experience in teaching. The difficulty of the tasks students should handle, as well as the difficulty and amount of the information about a local landscape, escalates in accordance with the students' age. They are supposed to process the information and pass it on in an attractive and instructive manner. The subject of the assessment of student's performance is not only the amount of curriculum in their memory, but also the quality of their work, commitment and originality. Thus, we evaluate a comprehensive personal development of the student and not only their actual knowledge. Geography of a local landscape thus enables intellectually weaker students with learning memory difficulties become more successful.

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INTEGRATED THEMATIC TEACHING OF THE REGIONAL GEOGRAPHY IN THE ELEMENTARY SCHOOL

Petra Karvánková[1], Dagmar Popjaková[1], Michal Vančura[1], Jana Krejčí[1] and Lucie Soukupová[1]

[1] Department of Geography, Faculty of Education, University of South Bohemia, České Budějovice, Czech Republic, e-mail: karvanko@pf.jcu.cz

ABSTRACT

The paper deals with the use of integrated teaching geography at the 2nd degree of the primary school. It focuses on the involvement of interdisciplinary links in education, specifically linking teaching English and geography. It presents various approaches (using the interactive whiteboard, workbooks, etc.) and integrated methods of teaching geography and English at an example of regional geography USA and Canada. In particular, presents a strategy for the use of CLIL (Content Language integrated Learning) in teaching at the 2nd degree of the primary school.

***Key words**: interdisciplinary links, integrated learning, CLIL, regional geography, English langure*

1. INTRODUCTION

Exploitation of linkages between subjects is an approach to instruction that is considered one of the key methods of developing and widening competences of pupils. In the main curricular documents in the Czech Republic it appears within the cross-curricular topics (Hudecová 2005, RVP ZŠ 2013). It is widely adopted by educational programs of particular elementary schools (SEP), where inter-subject linkages are also accentuated. The main purpose of exploiting inter-subject linkages is to support shaping of pupils' personalities based on contiguous general topics of several subjects (RVP ZŠ, p. 107). The advantage of exploiting inter-subject linkages within school courses is to use the topics of one subject to deepen topics and knowledge of pupils in other subjects. A parallel objective is to enable pupils to become aware of the interrelations between the different pieces of knowledge; to teach pupils perceive the multidimensionality of information and to deduce general consequences and generalizations arising from new pieces of knowledge; at the same time to stimulate their reflection, searching and orientation in information. Usage of inter-subject relations enables achieving activation of pupils. The importance and novelty of this aspect of inter-subject relations comes from the fact that during centuries, in the Czech, formerly the Czechoslovak scholar system, or the Slovak scholar system, the passive form of instruction was diffused. It is often referred to as the encyclopedic approach to education. The pupils used to passively receive information and without any further substantial consideration and analysis it was enough to just memorize it.

Integrated instruction stems from the principle of inter-subject relations. Integration in instruction is indeed based on associating topics from two or several subjects. Integration takes place on the level of topics, thematic units, and even study fields and areas (FEP). It means connecting the objectives and contents of education, where the method of interconnecting the contents is important. In the widest sense of the word, integration connects the theory with the real life (quotation from the presentation, slide 4). As stated by Bílek (2008 p. 44), there were different projects of integrated instruction applied throughout the world since the 1970s. At the same time, the integration had different character and degrees of connecting topics of the subjects, ranging from the coordinated instruction of similar subjects, combined models and united instruction within the so-called integrated subjects. In the Western countries, the integration of scientific subjects under the name of Science is often used.

The present article aims at presenting integration of instruction of a vocational subject and the instruction of a foreign language on the particular example of Geography and English. This method of integration of instruction of a non-language and a language course is known under the abbreviation CLIL. The contents of the article are formed by the description of CLIL and the practical presentation of instruction of the Regional Geography of the America on the 2nd degree of the primary school using the CLIL method.

Practical examples were created as part of the theses of students at Faculty of Education, University of South Bohemia in České Budějovice. These practical examples of teaching work with classical lessons which are integrated into the strategy elements of method CLIL. We recognize that contribution is therefore absolutely not deal with (mainly in its practical part) modern teaching methods, but merely seeks a lesser extent, to integrate modern elements to the traditional teaching of Geography.

At the same time presentation of the interactive program to the extent the article is complicated because the lines of text to reader interactivity somehow lost. Use strategies CLIL brings new ideas into teaching, a new space for the geographical thinking of pupils (thinking in English, links with Czech and applied to a geographic theme etc.). This leads to innovation lessons, the basic structure may, in certain activities to be focused more topographically, if we want a "classic", yet not boring.

2. CLIL – CONCEPT, PRINCIPLES AND OBJECTIVES OF TEACHING

The use of the CLIL, i.e. Content and Language Integrated Learning method in education enables integration of a foreign language and one of the other scholarly subjects. Thus, through a non-language subject, tutors can lead pupils to the practical use, strengthening and exercising of the acquired language skills and knowledge and the other way round.

The advantage of the CLIL method, as indicated by for example Novotná (2011), is the immediate use of the language in situations that require understanding or communication of a particular content. Thus, pupils use the language actively and spontaneously, and do not question it. On the contrary, they mostly soon forget about the language itself and concentrate on the topic of the lesson. In this way, CLIL can bring new, more illustrative approaches and methods of teaching scholarly subjects (in our case Geography), and through use of foreign language materials for instance, it gains a multicultural scope.

The CLIL methodology is not straightforwardly defined, and as mentioned by Mehisto et al. (2008), it has many different forms and uses. According to MŠMT (2008), teaching using the CLIL method does not require any language skills of pupils in the introductory year. It takes place partly in the foreign language and partly in the mother tongue. Later, lessons can take place in the foreign language entirely, but it still follows two educational objectives, one in the respective non-language subject, and the other within the foreign language. This is the so-called duality of objectives, mentioned by for instance Tejkalová (2011). According to MŠMT (2008), for lower grades of the second degree of primary schools, a simpler form of the CLIL method is appropriate. This form is based on alternation of the mother and the foreign language according to the pupils‘ needs. The vocabulary in the foreign language is directed at the terminology of the scholarly subject. Directions given during the lesson are also given in the foreign language. However, learning of the subject matter, formulation of the more complex tasks, explanation of any grammar points and foreign language phrases is conducted in the pupil's mother tongue. A more complex form of use of the CLIL method, appropriate for higher grades of the second degree of primary schools and for high schools, already uses the foreign language for the purposes of the learning of the subject matter, for the formulation of the directions and discussions. However, in case of need it is still possible to return to the mother tongue. The culmination of use of this method is the teaching of the scholarly subject in the foreign language completely, while the accent is put on mastering the technical terms in both the foreign and the mother tongue (Soukupová, 2013).

Teaching using the CLIL method does not represent, as it is sometimes wrongly interpreted, teaching of a non-language subject in a foreign language, and it does to represent either the teaching of a language on the basis of topics from scholarly subjects, i.e. on the basis of inter-subject relationships (MŠMT, 2008). From the methodology point of view, there is a key difference between the language teaching and the teaching of non-language scholarly subjects in a foreign language. Language teaching, as stated by MŠMT (2008), is targeted at exercising 4 main skills (reading, listening, speaking and writing). However, in the teaching of a scholarly subject these four skills become the means of acquiring new information and their learning (Dalton-Puffer, 2007, p. 3). It is concretely the skill of dealing with the foreign language in real situations and in the practical learning of a scholarly subject that is considered one of the biggest advantages of the CLIL method. The practical importance of the method was underlined and its use was supported also by the EU Action plan (EU-LEX 2003).

In spite of this, or for this same reason, as noted by Novotná (2010), the teaching of this kind requires bigger attention of both pupils and teachers. The pupil must exercise bigger effort to understand in the foreign language and on the other hand, it is necessary to adapt the language speech of the teacher to the level of pupils from both the point of view of language expertise and the use of the technical terminology of the given non-language subject. According to the author this limited capacity of using different languages brings positive development of pupils' thinking. Pupils start to alternately use the mother and the foreign language, they are capable to view the same problem from different perspectives and the interactive style of teaching is achieved.

The balance between the scholarly contents and the language according to Tejkalová (2011) cannot be achieved in each individual lesson. Already Kelly (2009) introduced three language levels that manifest themselves at the use of the CLIL teaching method; the peripheral language – interaction between the teacher and the pupil enabling the routine communication in class; the technical language specific for the given subject; and the academic language that the pupil and the teacher need to be able to discuss the chosen topic.

In the teaching using the CLIL method it is required, according to Klečková (2011), to use those teaching methods that help overcome language barriers and lead the pupil to embrace the subject matter of the non-language course together with the language skills. That is why the key is to actively involve the pupils to the lesson through the use of appropriate teaching methods quite responding to the hierarchy of the so-called learning pyramid (Kalhous et al. 2002). When using activating methods (such as for instance brainstorming, problem solving, practical exercises, work with pictures and texts, knowledge games, etc.), the center of the activity is the pupil (Sitná, 2009), who is directly and actively engaged in the education process. The pupil even represents the main composing part of the teaching process. However, success is not achieved through the "mere" active involvement of pupils. Equally important are the competencies of the "CLIL" teacher herself. The teaching using the CLIL method according to Kelly (2009) had better be realized by teachers qualified both for the teaching of the foreign language as well as for the given non-language subject. The obvious part of teaching using the CLIL method is the more frequent use of the non-verbal forms of communication, expression and understanding of the concepts that enable pupils to overcome the insufficient language skills so as to enable them to understand the new lessons (Klečková, 2011).

3. INTEGRATION IN TEACHING GEOGRAPHY AND USE OF THE CLIL

The implementation of the CLIL method into the real, practical teaching of non-language subjects progressively becomes common practice in the last ten years also in the Czech elementary and high schools. A big contribution related to introducing the CLIL into the school practice in the Czech Republic was the project NIDV (2011a) – "Contents and language integrated education on the sedond degree of elementary school and lower degrees of high schools". It was targeted at the support of teaching using the CLIL method through the methodical retraining of teachers, creation of a methodical guidebook for teachers, organization of conferences and so on. Part of the created methodical guidebook (NIDV 2011b) for teachers using the CLIL are also exercises from the teaching practice of teachers participating to the elaboration of the guidebook within a project, from different school subjects, including geography.

Precisely, Geography, given its multidisciplinarity, offers a wide scale of possibilities of using integrating elements in the teaching. Geography, among others, therefore appears as one of the most convenient subjects for the realization of the CLIL method in practice. Most of the accessible practical examples of use of the CLIL within Geography lessons is thematically focused on the teaching of the regional Geography (mainly of the countries of Europe and America). In the current pedagogical practice prevails the teaching using the CLIL methodology in the Geography lessons in connection mainly with the English language, to a lesser extent the connection with the French, German or the Spanish language is used. In practice, a number of teaching lessons is focused mainly on connecting the teaching of Geography with the realities of the English speaking countries. The objective of such lessons is to elucidate to pupils the English language in practice (through English names, lyrics of the songs, short informative texts and so on), to orientate the teaching of the regional geography in a more practical direction, by using to a bigger extent a more entertaining form of teaching and thus motivate the pupils to the study of both mentioned subjects.

The present article shortly presents two educational guidebooks that originated from final theses at the department of geography at PF JU Ceske Budejovice. The theses are an example of the possibilities of using the CLIL method in the teaching of the regional geography.

3.1. Interactive Czech-English teaching program from the regional geography of the United States of America for the 2nd degree of elementary schools

The first teaching material about the USA (Soukupová 2013) was created within the program Smart Notebook for the interactive Smart Boards and contains overall 65 slides with 7 appendices. It is divided in 5 chapters accompanied by the elaborated work sheets and exercise parts. The interactive material can be used as a whole within the geography lessons or separately, partly in the geography lessons and partly in the English lessons. Conditions are the agreement and an accommodating approach of teachers of these subjects. The teaching program should serve as a more entertaining teaching of the regional geography of America. The pupils should be positively motivated towards the study of the US geography through videos, photographs and playful exercises. To motivate further study of English it encourages the connection of the foreign language with the practice through authentic signs, songs and so on. The pupils have the possibility to verify that already at the primary school they are capable alone or with the help of the teacher to understand the overall meaning of the speech, simple instructions, written texts or signs and titles in the English language (Soukupová 2013, p. 7).

For this interactive teaching material, a character of an English speaking guide was created and dubbed. It is the famous Uncle Sam, who is a popular American character, always dressed in American colours. He is dubbed with a voice with a friendly sound. However, he appears to be strict and uses stringent sentences and words. Sam always gives introductory robust information on the given topics, often reminds with emphasis the pupils about the next interrogations, or asks the pupils himself about their knowledge of the regional geography of the USA and stands within the guidebook for an exercising element.

Extracts of the teaching material were included in the submitted article. Of course, their quality in the form of a picture in the text does not reach the quality of the presentation from the interactive board. As the first example of the teaching material we introduce a slide entitled the Basic Information about the USA (Fig. 1). Through this the pupil gets an introductory information about the state – location, number of inhabitants, neighbouring countries, political system, head of State, capital city. The slide is complemented by the political map of the continent of America with the indication of the USA for better orientation. Two white stars in the bottom part of the slide refer on the one hand to the appendix with extended information (source: Bridge magazine), and on the other hand to the next slide with the information about the president of the USA. This information appear after clicking on the respective star. The appendix appears in the program Adobe Reader and can be printed in case of need. The slide is complemented with and English-Czech vocabulary of the more difficult words (Soukupová 2013, Appendix, p. 2).

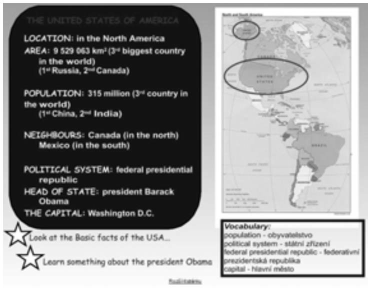


Figure 1: Basic Information of the USA
Source: Soukupová 2013

The second illustration is represented by the slide about the climate of the USA (Fig. 2). By clicking on the portrait of Sam, a dubbed bubble is played, serving as a motivational introduction into the topic (length: 0:15s). Two cases with the reminder of the tasks and a question for reflection are situated on the slide (the top case is only read after the display of the webpage in the program Smart Board, this is why it is not visible in the Fig. 2. In the top case, there is a reminder of the possible work with the exercise sheet and the instruction for the opening of the map. The question is concerned with the comparison of the differences between the climate in the Czech Republic (CR) and in the USA. This slide has an exercise sheet prepared Climate in the USA), which is added in the appendices to the program and can be printed or copied to the pupils beforehand (it is written in MS Worg). The work sheet contains a text in a simple English text with the English-Czech vocabulary of terms and the supporting exercises in the Czech language, which serves for creating notes about the topic and is relied with the English-Czech vocabulary of terms, that serves in the preparation of notes on the topic and is connected with this and the next slide of the work sheet.

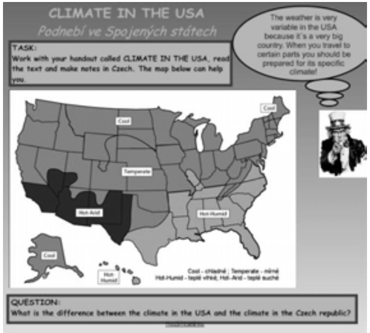


Figure 2: Climate in the USA
Source: Soukupová 2013

The particular regions of the USA are processed in the presented teaching material teaching material always on two slides, which have the same basic structure. On the first slide there location of the region within the USA created in the program Arc Gis, and in the case the states of the region are listed. On the second slide conceived in the form of a picture collage there is always more detailed information and interesting facts thath characterize the region (Fig. 3 a Fig. 4).

Figure 3: Introduction to the region Southeast
Source: Soukupová 2013

Figure 4: Interesting facts about the region Great lakes
Source: Soukupová 2013

3.2. Czech-English teaching handbook for the teaching of the regional geography of Canada for the 2nd level degree of elementary schools

The teaching material is composed of the workbook for pupils entitled "Canada, the Country of the Maple Leaf" and of the methodical handbook for teachers (Krejčí 2013). The integrating elements of the English language and Geography are therefore already visible in the title of the workbook (English-Czech title). The didactic material was conceived in a way to respond to the valid principles of educational documents (RVP ZV), modern trends in education and the maximal integration of intersubject linkages, in particular of the English language and Geography (Krejčí 2013, p. 2).

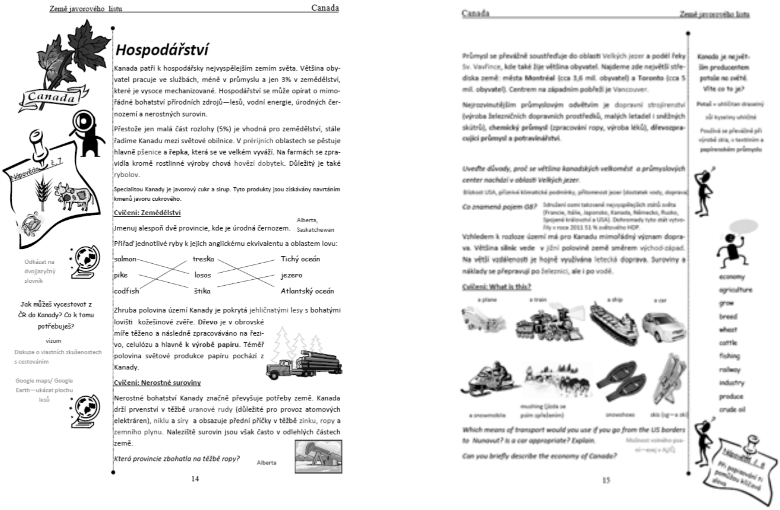
The workbook enables at the same time the exercise of pupils' abilities using the methods of skimming (capture of the main idea of a text) and scanning (acquisition of a concrete information from the text). Text or tasks that are created in the English language in the workbook serve mainly as a source of information and an instrument for exercising or enriching the vocabulary. The workbook prioritizes the use of communicative methods in teaching (discussion, dialogue, expression of an opinion, defence of one's position), that can fluently move between the English language and the mother tongue according to the needs and abilities of students. The grammar and the written speech are secondary in the use of the workbook. The English texts are written in an easy language, mainly in the present or the past tense. Both tenses should be fully mastered by children in the 7th grade of a Czech elementary school, so they should be able to fully concentrate their attention to the vocabulary and the information in the text.

The accent is put in the whole material to the interconnection with life, ordinary life situations, tasks and questions that the pupils daily encounter. The objective was to compel children without forcing them to actively participate during classes, to awake their curiositu and motivate them to use the English. On the other hand, regard was given not to submerge pupils with an excess of unuseful information. The author, in creating the material, cared in particular about its understandeability and clarity. The structure of the book is conceived in a non-traditional way, however with a clear concept. The author uses symbols reminding the pupils about the particular activities such as "learn", "work with a map", "key words" and so on. The book also contains a dictionary and a list of topographic concepts.

The workbook for pupils (Fig. 5) was chosen on purpose in the black and white version for the reason of cheaper distribution to all pupils. Although the workbook is primarily created in the A4 format, it is possible to reduce it to the A5 format, which will make the printing even cheaper. The individual chapters are always conceived in a way to fit into a double page, which facilitates the pupils' orientation in the text and in the topic of the lesson.

Figure 5: Culture and other interesting. Working textbooks for pupils
Source: Krejčí 2013

The version for the teachers is in colors (Fig. 6). It is supposed to serve as a source of correct answers, inspiration as well as any help with the treatment of the topic. The handbook for teachers has the same structure as the book. Correct answers are marked in red in the text, which facilitates the orientation of the teacher, who often has very little time for consulting the book. The blue color is used to identify methodical notes. These guide the teacher how to use the book, what to pay attention to, and they point out the methods that can be used in the given concrete case (mental map,



Země javorového listu — Canada

Canada

Hospodářství

Kanada patří k hospodářsky nejvyspělejším zemím světa. Většina obyvatel pracuje ve službách, méně v průmyslu a jen 3% v zemědělství, které je vysoce mechanizované. Hospodářství se může opírat o mimořádné bohatství přírodních zdrojů—lesů, vodní energie, úrodných černozemí a nerostných surovin.

Přestože jen malá část rozlohy (5%) je vhodná pro zemědělství, stále řadíme Kanadu mezi světové obilnice. V prérijních oblastech se pěstuje hlavně pšenice a řepka, která se ve velkém vyváží. Na farmách se zpravidla kromě rostlinné výroby chová hovězí dobytek. Důležitý je také rybolov.

Specialitou Kanady je javorový cukr a sirup. Tyto produkty jsou získávány navrtáním kmenů javoru cukrového.

Nápověda č. 7

Cvičení: Zemědělství

Jmenuj alespoň dvě provincie, kde je úrodná černozem. Alberta, Saskatchewan

Přiřaď jednotlivé ryby k jejich anglickému ekvivalentu a oblastem lovu:

salmon	treska	Tichý oceán
pike	losos	jezero
codfish	štika	Atlantský oceán

Odkázat na dvojjazyčný slovník

Jak můžeš vycestovat z ČR do Kanady? Co k tomu potřebuješ?

vízum

Diskuze o vlastních zkušenostech s cestováním

Zhruba polovina území Kanady je pokrytá jehličnatými lesy s bohatými lovišti kožešinové zvěře. Dřevo je v obrovské míře těženo a následně zpracováváno na řezivo, celulózu a hlavně k výrobě papíru. Téměř polovina světové produkce papíru pochází z Kanady.

Google maps/ Google Earth—ukázat plochu lesů

Cvičení: Nerostné suroviny

Nerostné bohatství Kanady značně převyšuje potřeby země. Kanada drží prvenství v těžbě uranové rudy (důležité pro provoz atomových elektráren), niklu a síry a obsazuje přední příčky v těžbě zinku, ropy a zemního plynu. Naleziště surovin jsou však často v odlehlých částech země.

Která provincie zbohatla na těžbě ropy? Alberta

14

Canada — Země javorového listu

Průmysl se převážně soustřeďuje do oblasti Velkých jezer a podél řeky Sv. Vavřince, kde také žije většina obyvatel. Najdeme zde největší střediska země: města Montréal (cca 3,6 mil. obyvatel) a Toronto (cca 5 mil. obyvatel). Centrem na západním pobřeží je Vancouver.

Nejrozvinutějším průmyslovým odvětvím je dopravní strojírenství (výroba železničních dopravních prostředků, malých letadel i sněžných skútrů), chemický průmysl (zpracování ropy, výroba léků), dřevozpracující průmysl a potravinářství.

Uveďte důvody, proč se většina kanadských velkoměst a průmyslových center nachází v oblasti Velkých jezer.

Co znamená pojem G8?

Vzhledem k rozloze území má pro Kanadu mimořádný význam doprava. Většina silnic vede v jižní polovině země směrem východ-západ. Na větší vzdálenosti je hojně využívána letecká doprava. Suroviny a náklady se přepravují po železnici, ale i po vodě.

Cvičení: What is this?

a plane, a train, a ship, a car, a snowmobile, mushing (jízda se psím spřežením), snowshoes, skis

economy, agriculture, grow, breed, wheat, cattle, fishing, railway, industry, produce, crude oil

Which means of transport would you use if you go from the US borders to Nunavut? Is a car appropriate? Explain.

Can you briefly describe the economy of Canada?

15

Figure 6: Economy of the Canada. A Teacher's Guide Book
Source: Krejčí 2013

Furthermore, they refer to the multimedia elements in teaching (Google maps, Google earth, YouTube). The methodical handbook is complemented by full links to videos, songs, animated movies, and so on. Then, we can find here a list of useful literature, magazines and websites (Krejčí 2013, p. 47).

The presented exemplars of teaching handbooks (in 3.1., 3.2.) were partly tested in the pedagogical practice, in the geography lessons of a 7th grade at elementary school. While using the interactive program in teaching, due to time restrictions, the activities were mainly targeted at the work with practical slides in the form of games and exercises. Overall, pupils were captivated by the work with the program. The active involvement of pupils was mainly supported by teaching games. The created speaking guide (Uncle Sam) influenced from the motivational point of view the pupils positively and was regarded as a certain enlivening of the lesson. The pupils did not have major problems with the prevailingly English driven lesson, however some of them confirmed that there is difficulty in understanding the guide Sam. On the other hand, it is specifically this way of listening that provides pupils a direct contact with the foreign language. It was confirmed that in learning the foreign language, it is important to get used to its ordinary conversational form. Through the listening of information related to geography, a non-language subject, the language teaching becomes more prompt, more immediate. The written transcript of the record of the guide's text proved to be very adequate. Problematic was the involvement of all students in the lesson at the same, partly caused on the one hand by the language barrier, and on the other hand by the higher number of pupils in the class. It appeared that the interaction with weaker pupils would require a longer time period. The disadvantage for these pupils was the high share of the English text used in the particular slides.

4. CONSLUSION

The importance and impetus towards the use of intersubject linkages within the education on elementary and high schools is anchored in the fundamental curricular documents of the Czech Republic. The objective of integration of subjects is represented by two motives. On the one hand, the objective is through the teaching of one subject to deepen the knowledge of pupils in another subject, and on the other hand, to activize pupils through a search of relationships between information. In general, geography, thanks to its multidisciplinarity, is suitable for linking with other scholarly subjects in general, but also for linking with the teaching of languages. It is this principle of development of integration that is the basis of the CLIL method. The general objective of the method is to lead pupils towards the practical use and strengthening of the acquired language abilities through a non-language taught subject, and the other way round. The CLIL was developed and publicized in the Czech Republic through the National institute for further education, NIDV (2011 a, b). The CLIL method was used within the creation of 2 teaching materials of the regional geography of America (USA and Canada) for the second degree of elementary schools focused on the teaching of the regional geography by using pupils' abilities in the English language. The first material represents an interactive Czech-English program of the regional geography of the USA. The program was created in the program Smart Notebook for interactive Smart Boards and contains 65 slides with 7 appendices overall. It is divided in 5 chapters that are accompanied by the created work sheets and exercising parts. The program uses videos, photos, playful exercises, authentic signs, songs, etc. Within the teaching of realities of the USA, the pupils listen to the spoken word, simple instructions, written text or titles and names in the English language. The second elaborated material is made of a Czech-English teaching handbook in the regional geography of Canada in the form of a workbook for students and a methodical handbook for teachers. The workbook contains texts and tasks in the Czech and English language that serve mainly as a source of information and an instrument for exercising and enriching of the vocabulary. The workbook uses the methods of skimming, scanning, communicative methods such as discussions, dialogue, expression of an opinion, defense of a position, etc. Technical geography texts in English are written in a simple language that should be fully mastered by the students of the 7th grade at elementary school. The handbook for teachers serves as a source of correct answers, inspiration as well as any help with the treatment of a topic.Both didactic materials, the interactive program and the workbook for pupils, are versatile. They can be used for the classic teaching of geography, for geography seminars, as a complementary material within the teaching of English, especially for English conversations. The elaborated teaching materials represent original concepts of the use of the CLIL methodology in connecting distinct subjects, and through this in interconnecting knowledge and abilities of pupils gained within the education. The presented didactic materials have a high motivational character and represent a good example and an outline towards the use of the CLIL methodology within the actual teaching practice.

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EXAMPLES OF FIELDWORK METHODS IN PHYSICAL GEOGRAPHY EDUCATION (HUTNÁ CATCHMENT, SLOVAKIA)

Martina Škodová[1], Lenka Balážovičová[1], Alžbeta Medveďová[1] and Karol Weis[1]

[1] Department of Geography and Geology, Faculty of Natural Science, Matej Bel University in Banská Bystrica, Tajovského 40, 974 01 Banská Bystrica, Slovak Republic, e-mail: Martina.Skodova@umb.sk

ABSTRACT

This paper presents four different examples of practical research methods in a form of full-day field exercises for undergraduate students, directly related to the Geography and Landscape Ecology degree. Following methods are introduced: (1) Geological survey of the river valley, (2) River corridor survey and aquatic biota monitoring, (3) The evaluation of spatial and temporal changes in the landscape structure and (4) Phytosociological vegetation assessment and succession processes in the River Hutná catchment, Ľubietová, Slovakia. Research work, undertaken as a part of this field course, is divided into two stages: 1. stage includes four days of field data collection (students are divided into four groups), 2. stage involves desktop data analysis and processing and the production of research outcomes (data files, maps, statistical assessment etc.). Some examples are presented in this paper.

***Key words**: fieldwork, research method, geology, vegetation, river valley, landscape structure, water quality.*

1. INTRODUCTION

The innovation in geography education does not have to be solely related to using the latest modern technologies, but it can be connected to both new and traditional approaches to geography education that can be implemented in the field. Dubcová et al. (2013) describes fieldwork as a method to gather data samples and information about processes and their relations in the landscape. Students, that are involved in the field work based on active exploration obtain knowledge and skills that are longer lasting than those received from the education at school. Geographical aspect of the local landscape is a key source of knowledge for understanding the relationships between its various components. It has been shown, that one of the most effective teaching methods in geography and landscape ecology are the ones carried out by a direct student experience in the field (e.g. Boyle et al. 2007; Hope, 2009; Mogk and Goodwin 2012; Scott et al. 2012). This paper presents a range of landscape-ecological fieldwork methods carried out by the Department of Geography and Geology as a part of field course for undergraduate degree in Geography and Landscape ecology. Field course is undertaken in Ľubietová, 25 km from Banská Bystrica, Central Slovakia.

2. FIELDWORK SITES

The River Hutná, a left tributary of the River Hron, is located in the central part of Slovakia, about 25 km southeast of Banská Bystrica (Fig. 1). The catchment area is about 13.4 km^2 large and contains a range of interesting geomorphological, geological, vegetation or anthropogenic parameters and contrasts ideal for fieldwork. Left river valley slopes belong to the Zvolenská basin and the Poľana range geomorphologic units and the right slopes create part of Veporské hills. While the left slopes are very rich in geology (Neogene volcanic rocks, Paleogene sediments), the right side belongs to the Mesozoic crystalline mountain core. Volcanoclastics with impermeable clays in the subsoil of the left slopes are of low cohesion and the valley is therefore affected by active landslide movements. The separation and accumulation of the slope sediment forms so called 'landslide springs' that causes creation of wetted depressions without water flow (Medveďová et al. 2007; 2008). In the past, both river valley slopes were formed by natural forests. These were dominated by beech, fir-beech, oak and oak-hornbeam communities. The river corridors were typical with alluvial forests. Currently, a lot of the area has been deforested to be used as agricultural land and built-up area. With the decrease in sheep and cattle grazing, many of the meadows are subjected to the vegetation succession processes.

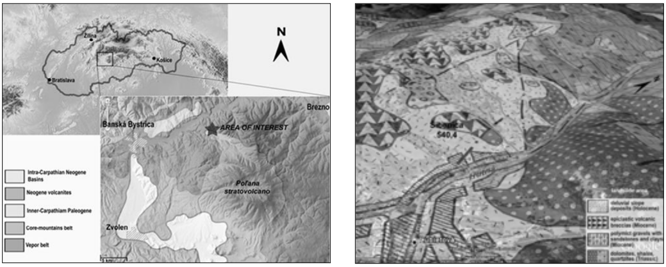

Figure 1: Location of research sites in Slovakia – within the geologic division of Slovakia (left) and geological structure of locality (right)

Source: Medveďová et al. 2007, http://mapserver.geology.sk/gm50js/

3. RESEARCH METHODS

Four different methods were selected to enable second year undergraduate students to solve some specified problems of the model area during their five-day field exercise in May 2014. Four days were spent in the field and one day was dedicated to data processing and analysis. The methods used were: (1) Geological survey of the river valley, sampling and evaluation, (2) River corridor survey and aquatic biota monitoring to determine the hydromorphological habitat quality (3) The evaluation of spatial and temporal changes in the landscape structure in and around Ľubietová village and (4) Phytosociological vegetation assessment and succession processes on a landslide.

3.1 Geological survey of the lower river valley in the Hutná surroundings

One of the cornerstones of basic field research is geological mapping. Each group of students were given a basic topographic and geological map 1:50 000 of the area to be surveyed and were asked to sample five different locations, preferably only one or two from Quaternary sediments (Fig. 2). Each geological map was accompanied by a detailed text description listing some major rock and mineral representatives that could be found in each mapped sector. After sampling part, students used the Digital Geological Map of the Slovak Republic at scale 1: 50 000 available on the Geological Map server of State Geological Institute of Dionýz Štúr (Káčer et al. 2005) for finding the correct rock typology and to describe the geological class, sub-class, group or complex of strata. Equally important was to insert the given rock type into the chronological strata.

3.2 Field survey of the river corridor and habitat quality of the Hutná River

During this part of field exercise students mapped the hydromorphological features along the River Hutná channel. Each group was given a legend and a basic topographic map and was sent to map a 500 m stretch of river. Their aim was to sketch a detail map and evaluate their section in terms of diversity of river forms and habitats in the river channel and in the adjacent riparian zone (Fig. 2). This method was adopted from the British survey methodology for river corridors (NRA 1992), adjusted for educational and research purposes on the Slovak watercourses (Anstead 2013; Anstead and Barabas 2013). In addition to the hydromorphologic forms (such as substrate type, channel bars, islands, pools and riffles, eroding banks etc.) students were asked to record density and composition of bank vegetation (not of the whole riparian corridor). The output was a map, cross-sectional sketches, vegetation data and a text description of the riparian corridor diversity and condition.

The river corridor survey was then followed by an observation of ecological value of the stream and the water quality. In this activity, macroscopic invertebrates were used. It has been known for long that the heterogeneity of the abiotic environment affects the quality and diversity of biotic communities, and thus the ecological stability of the river ecosystem (eg. Hynes 1970). Mapping of the physical elements of river habitats lead students towards identification of sites that could be more or less interesting for observing the relations between abiotic and biotic components of the river ecosystem. Their assumptions have been subsequently verified using a biomonitoring method for aquatic macroinvertebrates. The methodology uses international BISEL index that was developed in Belgium for educational purposes and has been demonstrated in Slovakia (Pačenovský 2005; Anstead 2013). BISEL index is based on a principle that certain types of organisms prefer clean water with high oxygen content, while others are able to live even in heavily polluted environment, taking into account the physical nature of the habitat. Biotic index values range from 0 to 10, with the lowest index meaning the heaviest water pollution. The detailed procedure for sampling methodology, identification of taxonomical group and determining the index is described in a handbook by SAŽP (2006).

Figure 2: The Hutná River valley with a limestone quarry (a), students undertaking measurements of physical and chemical properties of water (b), controlling field samples according to the geological map (c), riparian corridor of the lower Hutná River (d).

The range of applied methodologies concerning the river channel and corridor survey of the Hutná River was enriched by a determination of the selected biotic and abiotic habitat variables in relation to a presence or absence of certain animal species tied to aquatic habitats like otter (*Lutra lutra*), muskrat (*Ondatra zibethicus*), crayfish (*Astacus astacus*) and others. A part of this and the previous macroinvertebrates surveys was the measurement of physical and chemical parameters in the river channel: temperature, pH, electrical conductivity and the amount of free oxygen. The measured and recorded data were analysed according to the methodology described in the project VEGA 1/0836/08 'Habitat requirements of otter (*Lutra lutra*) in waterways of Slovakia' (Urban et al. 2010 a; Urban et al. 2010 b; Urban et al. 2011).

In the survey forms adopted from the above project students recorded data of individual parameters that could be divided into the following groups (Fig. 4):

(1) river flow properties (hydrological connectivity, habitat type, the proportion of riffles, pools, depressions, backwater, flow turbidity and sinuosity, changes in the channel width and depth etc.),

(2) river bed and bank properties (quality of bed substrate, fish shelters, the presence of rive channel engineering structures and routine maintenance, bank heights and angles, bank material),

(3) the presence of objects and structures in the river channel (perpendicular objects, their length and number, cross-sectional profiles of these objects and whether they act as a migration barrier),

(4) vegetation (width of riparian vegetation, presence of riparian macrophytes, fallen trees, percentage of coverage),

(5) animals (presence of residence signs like droppings, scent marks, tracks etc., the type of substrate, presence of crayfish),

(6) other human interventions (dump yards, disturbance rate, visual water pollution…).

3.3 Evaluation of changes in secondary landscape structure

Secondary landscape structure has been mapped in the surveyed Hutná catchment in Ľubietová parish (Fig. 3). Students divided into smaller groups surveyed the given area using a topographic map 1:5000 from 1975. This field exercise was focused on: (1) mapping the elements of the current landscape structure (updating the old map) according to the methodology by Pucherová et. al. (2007) and (2) the identification and interpretation of changes in the secondary landscape structure. The surveyed results were processed into new maps with legends and interpretations of the different types of changes in the secondary landscape structure (Fig. 3).

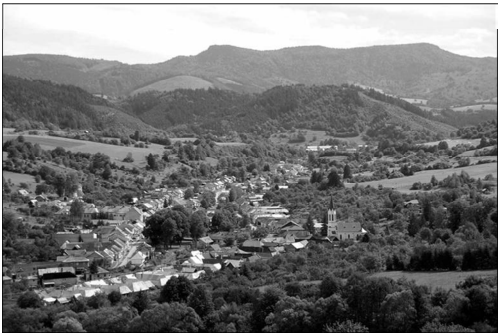

Figure 3: Ľubietová village and the volcanic massive of Vepor (1277m a.s.l.) – Hrb (1255m a.s.l.).

3.4 The evaluation of the current vegetation on a landslide site

This field exercise was focused on observing the presence and composition of vegetation cover on a landslide body in the Hutná catchment. Students were given updated relevant information and documentation about the geological structure, landform, land cover, climate, surface water and groundwater, potential natural vegetation of the site and the development of the landslide itself. They also had available detailed topographic maps (1: 5 000) with marked landmarks in the landslide area and aerial photographs.

Vegetation survey according to the Zurich-Montpellier school (Braun-Blanquet 1964) was carried out in the field on 10 permanent research plots. Vegetation was recorded using the combined scale of abundance and dominance according to Braun-Blanquet (1964). Due to the nature of the predominantly successional vegetation present on the site, the degree of succession was determined according to Ružek (2001).

After the field part, the data were processed and evaluated in a database software TURBOVEG for WINDOWS (Hennekens & Schaminée 2001). Vegetation types were named according to the list of non-vascular and vascular plants of Slovakia (Marhold & Hindák 1998). In instances, where this was possible thanks to the representativeness of data obtained, the individual entries were incorporated into individual syntaxonomical units according to the dominant, codominant and characteristic species (Ružičková et al. 1996). Students then used another software called JUICE version 7.0 (Tichý 2002) to establish and determine the diversity of species (index N_0 and H') and ecological demands for each of the vegetation-plot entries (Ellenberg et al. 1992).

This fieldwork exercise was complemented with a demonstration of ground water level measurements in piezometric wells and the regime measurements of flows in subhorizontal wells draining the landslide body.

4. RESULTS

4.1 Geological survey in the Hutná catchment

Students did not have any problems in selecting the sites, obtaining good samples and in identifying their position correctly on the given geological and topographic maps. However, the major problems occurred in the determination of the correct lithotype. The reason for this was that the geological base map provided was at the scale of 1:50 000 although the adjusted accuracy of lithotype borders was to a scale of 1:10 000. The generalisation of a medium scale map was a reason why students were finding less frequent representatives of a particular geological strata and its description did not correspond to the typical representative of that group of rocks, type or sub-type. One example of such uncertainty was Carpathian Keuper. It led to discussions that were, at the end, the most significant learning point in the activity, because they pointed out the specifics of geological mapping at small scales. Students also revealed the hidden pitfalls and errors of field mapping, such as anthropogenic contamination of samples near paved roads or forest tracks, samples that were transported over longer distances (downslope or along the riverbed), determination of weathered samples without fresh fractures etc.

4.2. Field survey of the river corridor and habitat quality of the River Hutná

The surveyed section of Hutná River (0 km at confluence with the River Hron to 3.5 km to the village of Ľubietová) is a typical representative of foothill rivers with rain-snow water regime and relatively natural meandering channel. Width of the river channel varied from 2.5 to 8 m and was shadowed by vegetation by over 60%. Major pollution from fly tipping or other waste wasn't observed. The local village water treatment plant had an emergency regime at the point of survey and was releasing polluted water into the stream. Heavy rainfall in the previous days had however increased the river discharge and diluted the nutrient rich sewage flowing out of the plant.

Based on the results of student field mapping (Fig. 4) that was well processed and interpreted, the surveyed river stretch can be described in three sections: (1) upper section (app. 3.5 km to 2.5 km); (2) middle section (app. 2.5 to 1.5 km) and (3) lower section (app. 1.5 to 0 km).

(1) The upper section had 200 m of the right bank artificially reinforced and bordered with built up land, left bank was more natural with woody and herbaceous vegetation. Here, the river channel had four 0,5 m transverse drop structures but signs of natural pool-riffle systems were also present. The left bank was typical with sedimentation signs in meandering stream and most frequent tree species in the banks were alders (*Alnus glutinosa* L.) and *Salix* sp. Right bank was overgrown with alder and sporadically, some random fruit trees occurred not normally present in riparian vegetation. Overall, students recorded seven groups of trees where alder accounted for 60 % of all of these on both banks. Using the BISEL index and macroinvertebrate keys, students found representatives of the *Ephemeroptera* and *Plecoptera* indicator groups. The resulting index came to six out of ten on average.

(2) The middle river stretch crossed an area of lower channel slope where the flow dropped its energy and meandered through soft sediment. Students pointed out the examples of various stages of meander development and observed the erosion and sedimentation processes taking place. Also some dry and semi-dry depressions next to the main river channel were recorded. Both banks had well established natural woody vegetation with most abundant alder (*Alnus glutinosa* L.), crack willow (*Salix fragilis* L.) and white willow (*Salix alba* L.), less frequent was Norway spruce (*Picea abies* L.) brought naturally from nearby woodlands. Higher diversity in macroscopic invertebrates was also recorded thanks to higher oxygen content, lower temperature, habitat and food diversity and natural processes prevailing over anthropogenic ones. Apart from the main channel, students also sampled backwaters with fine sediment and low oxygen content to see the change in species representation. The highest index was 9 and the average came to 6.25 in this section.

(3) The lower section of the stream that ends with a confluence to the River Hron, had similarly little human activity present that would influence the natural river processes of erosion, sediment transport and deposition. This resulted in a variety of fluvial forms present in the river channel. Students recorded a variety of alluvial bars and eroding banks, cantilevers and bank shelters, pool and riffle systems and various substrates including rock. BISEL biotic index was 6.6 on average with maximum value 8. From the indicator groups, students found *Plecoptera, Ephemeroptera* and *Amphipoda*

representatives. The bank vegetation was dominated by hornbeam (*Carpinus betulus* L.), sporadic vegetation complemented Norway maple (*Acer platanoides* L.) or guelder rose (*Viburnum opulus* L.).

With regards to the otter habitat assessment and evaluation, the presence signs were not found although otter should occur here. However, Muskrat (*Ondatra zibethica*) droppings were found under one bridge in the upper stretch and their presence was also confirmed by local shepherd who had seen the animal at different times of the year. Crayfish (*Astacus astacus*) was observed at two locations. The presence of good riparian vegetation and abundant macrophytes indicated that by observed discharge this salmon-trout river would be also good for breeding grayling (*Thymallus thymallus* L.). After the analysis of flow and channel variables, more agreement was found with the typical attributes of hyporhitron than epirhitron, whilst in the upper section of the surveyed catchment (above the village) both zones are intersected with the prevailing representatives of lower salmon zone (metarhitron). This was also shown by macroinvertebrate analysis. The prevailing natural processes in the river attract many invertebrate species which create a rich food source for fish.

The objective of measurement of physical and chemical parameters of water was to demonstrate the diversity of variables, such as the presence of existing water input into the river channel (by surface or underground springs), organic or anorganic pollution from sewage or fields, decomposing organic matter in the channel etc. The field measurements students made using an electronic Multimeter HQ 40d with optical LDO probe and gel pH probe (Intellicate probe), conductivity measurements were carried out using WTW Cond 3120 probe. Students than used these data to find relationships between the physical parameters of the habitat, biotic component and water properties.

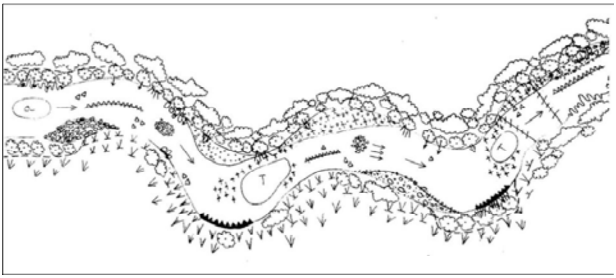

Figure 4: An example of a student map of river corridor.

4.3 The evaluation of changes in secondary landscape structure

After this fieldwork exercise that took place around Ľubietová village (Fig. 5), students identified the following subgroups of secondary landscape structure's elements: continuous forests, small-scale plantations of trees, linear woody vegetation, scrublands, riparian tree vegetation, pastures, meadows, hedgerows, narrow fields, orchards, water streams and other modified urbanised elements, technical elements and elements of transport.

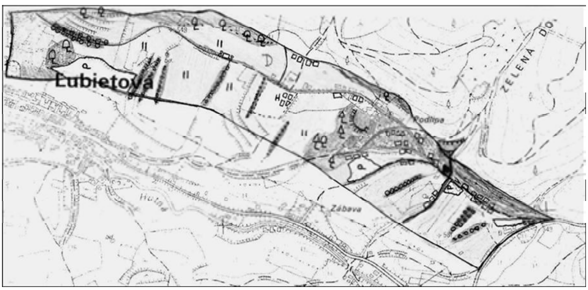

Figure 5: Student work – map of current land-cover structure (or "Landcover map" or "Map of secondary landscape structure").

When comparing the current landscape structure with the one in 1975, several significant changes were identified. The greatest impact on changes in the landscape structure had the abandonment of traditional forms of agriculture (such as grazing, cultivation of agricultural crops – succession processes, shifting of the forest boundaries), construction (also in flooding and landslide area) and the related flow control measures, water treatment plants, changes in the road network and others.

4.4 The evaluation of current vegetation on a landslide site

Vegetation in the study area consisted of a mosaic of grassland, shrub, forest and hygrophilous habitats at different stages of secondary succession. At some locations these were disturbed by tree felling, bush clearance, grazing and mowing. Degree of afforestation on the landslide itself increased with altitude. The following phytosociological communities on the landslide area have been identified:

(1) Lowland and foothill oat-grass meadows (Association: *Arrhenatherion elatioris* Luquet 1926, Association: *Pastinaco sativae-Arrhenatheretum elatioris* Passarge 1964) – phytotype of wet and semi-moist habitats at the bottom of the landslide with periodic mowing and low degree of succession processes.

(2) Moist meadows of foothill and mountain areas (Association: *Calthion* R.Tx. 1937 em Bal.-Tul. 1978, Association: *Lysimachio vulgaris-Filipenduletum ulmariae* Balátová-Tuláčková 1978) – phytotype of linear tall herbal community accompanying willow scrubland along ditches with periodically high groundwater levels.

(3) High stem sedges of eulitorial degree (Association: *Magnocaricion elatan* W.Koch 1926) – phytotype growing on a contact with the stable water in landslide micro depressions. The water table here even in the terrestrial ecophase does not drop deeper under the soil surface and the soil never dries out. It is therefore dominated by wetland species.

(4) Reed communities of stagnant water and marshes (Association: *Phragmitetum communis* W. Koch 1926, Association: *Phragmitetum vulgaris* Soó 1927) – Phytotype of high stem growth of Common Reed (*Phragmites communis*).

(5) Herbaceous vegetation marshes of stagnant and slow flowing waters with fluctuating water level (Association: *Oenanthion aquaticae* Hejný ex Neuhausl 1959) – phytotype of standing waters with fluctuating water regimes, in particular under the wall of separation of the landslide. Wetland species dominate.

(6) Foothill shrub willows (Association: *Salicion eleagni,* Moor 1958) – phytotype of spare pioneer communities of line character with shrubby willows along drainage channels.

(7) Succession stages of wetland meadow communities – phytotype of mosaic willow bushes, which represent succession stage of oak-hornbeam forests and bear very well waterlogged soil. Succession series take place in areas with higher water table on waterlogged meadows and in the immediate vicinity of the old drainage systems with reduced functionality.

(8) Successional stages of grassland communities on draining meadows – phytotype of mosaic shrub communities of sloe plum (*Prunus spinosa*), goat willow (*Salix caprea*) and Scots pine (*Pinus sylvestris*), that grows on the landslide slopes of the convex relief microforms, and also on the northwest and northeast sides of the landslide.

(9) Successional stage of transitional forest – tree storey phytotype developing in the central part of the landslide. It emerges in the stage of transitional forest gradually becoming dominated by climax species. In the surroundings of the less functional parts of draining system in depression relief where local temporary as well as perennial water stagnation occurs near the surface. Dominant here are willows.

Field investigation examined succession processes at ten permanent research plots (16 square meters) and on three of these the process was confirmed (comparing data from the last four years). Over the last three years there has been noticeable reduction in the area of tree growth as a result of uncontrolled anthropogenic interference (tree felling, shrub clearance, extensive grazing and mowing in the framework of the project 'The maintenance of permanent grassland'). Although in the case of interventions to the willow shrubs, they tend to regrow more rapidly than other species.

5. CONSLUSION

This paper introduced examples of field methods in landscape ecology carried out by second year undergraduate students during a one week fieldwork in the Hutná catchment in Slovakia. The methods included geological survey, the phytosociological evaluation of vegetation and the processes of succession, the evaluation of changes in the landscape structure and the river corridor and stream biomonitoring of the Hutná Brook in Ľubietová region. Geological mapping of the bottom of the river valley showed the many pitfalls that can occur during sampling and determination of rock types. The field survey of river corridor and biotic quality of the Hutná Brook offered a range of methods in mapping and testing water quality, students picked up a range of new terminology for river habitat assessment. The Hutná River exhibited from clean to moderately clean water quality (the BISEL index was 6 to 6.6). The presence of muskrat and river crayfish signs was also recorded, but signs of otters were not found. After analysing the different variables of the brook and the macroscopic aquatic invertebrates, students categorised the river as hyporhitronic rather than epirhitronic type for fish. When considering the landscape structure, the most significant factor was anthropogenic activity, like changes in traditional forms of agriculture, tree felling, construction of channel revetments, changes in the road network etc. Vegetation cover on the studied landslide was determined by students as a mosaic of forest, shrub, grassland and wetland communities. Intensive processes of secondary succession take place here, which increases the stability of the entire landslide. All of these methods have strongly enhanced field mapping skills, but also offered students to cope with new challenges, tools and methods of data analysis and developed their interdisciplinary and causal thinking. Such type of method rich fieldwork has been shown to be an important, if not the most essential asset of geography education.

ACKNOWLEDGEMENT

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POSSIBILITIES OF USING FREELY AVAILABLE ELECTRONIC DATABASES IN TEACHING OF ENVIRONMENTAL GEOGRAPHY

Martin Valach[1] and Alena Dubcová[1]

[1] Department of Geography and Regional Development, Faculty of Natural Sciences, Constantine the Philosopher University in Nitra, Tr. A. Hlinku 1, 949 74 Nitra, Slovak Republic,
e-mail: adubcova@ukf.sk

ABSTRACT

Currently, there is a large amount of information with the database character that has significant potential also for teaching of geography. The freely available sources (or conditioned by free registration) include also several databases containing data on the state of the environment e.g. pollutant emissions, register of environmental burdens, information on the quality of watercourses, etc. The aim of this paper is to present the possibility of using these data in geographic education at different regional levels. The proposals mentioned in this paper are designed mainly for students of geography at universities. After suitable didactic transformation; however, they could be useful even at lower levels of education.

Key words: *database, teaching, geography*

1. INTRODUCTION

One of the important elements of the current geographic education is the linkage of not only partial geographic disciplines but also other related branches. The impact of anthropogenic activities on the landscape has been extremely intense in recent decades and still persists. By its methods and set of analytical tools, environmental geography has a wide range of possibilities of measuring and assessing the impact of human activities on the landscape (Ruda, Hofmann, 2010). This scientific discipline is located at the intersection of geography and environmental science. As reported by Bouwer (1985), it includes the geographical study of environmental problems creating combinations and syntheses between the spatial approach and a man – landscape approach. Thus, it explains the spatial dimensions of environmental problems such as pollution, degradation, and spatial aspects of creation and protection of the environment. Mičian, Zatkalík (1986) highlight the wide range of methodological apparatus which is offered by geography (particularly through environmental geography) in solving environmental problems, since it has "always" concentrated on the study of interactions between environment and society.

In addition to the necessary methodological apparatus, also data play a key role in addressing environmental issues enabling further work – there are different ways to analyze, combine, and interpret them. In recent years, virtual environment of the Internet has been containing considerable amount of data of different nature which can also be used in teaching of geography or environmental geography. Such data are, also in accordance with the law, regularly published e.g. in the Information System of Environmental Burdens, Slovak National Emission Information System, National Register of Pollution, etc. These database systems usually offer wider possibilities for choosing and combining data (e.g. for selected years, selected pollutant, selected territory). Furthermore, they offer creation of printouts or they transform selected data into tables and graphs with the possibility to export them into the selected format. Svatoňová (2006) draws attention to the fact that information on the Internet can have different quality, therefore, it is necessary to pay attention to the choice of information sources. Data quality in mentioned information systems is guaranteed by the relevant state institutions.

2. TEACHING OF ENVIRONMENRAL GEOGRAPHY USING DATA FROM ELECTRONIC DATABASES

In this paper, we focus on the use of databases that are freely accessible or they are conditioned by free registration – Information System of Environmental Burdens and National Emission Information System. Proposals of the projects serve as potential practical extensions for specialized subject with environmental-geographic focus by which students acquire theoretical bases from the issue.

Project proposal: Environmental burdens in local landscape

The project aims to map the environmental burdens (EB) in the local landscape e.g. in the district. A substantial part of the necessary data is freely (without registration conditions) available in the Information System of Environmental Burdens (IS EB) on the website http://envirozataze.enviroportal.sk/. This system secures data collection and provision of information on EB and it is a part of the public administration information system. The information system is established, operated, and the data (with the exception of probable EB) are accessible by the Ministry of Environment of the Slovak Republic under a special regulation.

Environmental burdens represent highly negative, barrier, and risk elements that largely affect the functional-spatial structure of the landscape and limit the regional development. The estimated number of probable environmental burdens in the Slovak territory is 30,000 of which about 5% (1500 sites) belong to the high-risk and most of them have no owner or responsible entity, which is at the same time their biggest problem. Burdens represent the residues after different types of human activities (industry, agriculture, mining activities, spaces after the Soviet army, etc.) which pollute surface and ground waters, air, soil, bedrock, and in many cases they significantly affect the physiognomy of different types of landscape (Michaeli, Boltižiar, 2010).

Procedure

Firstly, students acquire theoretical knowledge from the field of EB on the relevant subject (about their origins, risks, classification, etc.). Subsequently, with the help of freely available IS EB they sort out the EB from the selected area. The procedure is shown in fig. 1, 2, 3.

Figure 1: Selection of EB register (if the specific register was not selected, you will see all registers

Source: http://envirozataze.enviroportal.sk/

Figure 2: Site selection on the example of the Nitra Region and Nitra District (if the site was not selected, you will see a list of EB for the whole territory of Slovakia)
Source: http://envirozataze.enviroportal.sk/

Figure 3: Selection of activity leading to the creation of EB (if the selection of a particular activity was not realized, you will see all activities)
Source: http://envirozataze.enviroportal.sk/

They supplement the list with selected characteristics of EB which are also available in IS EB (except from the probable EB). They can also use an option of generating a printout which is shown in the vertical menu on the left side of the webpage. This allows free combination of data that the user wishes to include in the final form of printout. After the completion of the selection of environmental burden site and completion of the data selection to be included in the printout, the user enters a verification code and the system will generate a printout based on selected parameters. The printout can then be either directly printed or exported to PDF format. The procedure of creating a printout is shown in fig. 4, 5, 6.

Figure 4: Selection of EB on the example of a small hydropower plant in the Nitra City (printout is generated only for registers B and C)

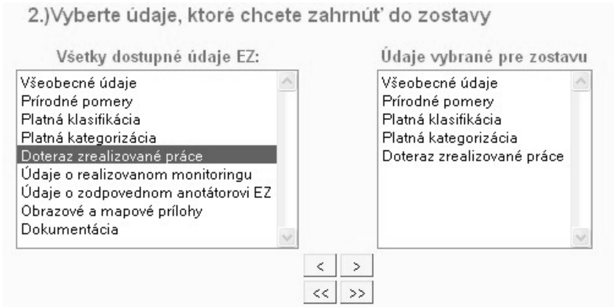

Figure 5: Selection of data which will be contained in the printout is realized with the use of arrows. Double arrow moves all available data on EB into the selected data

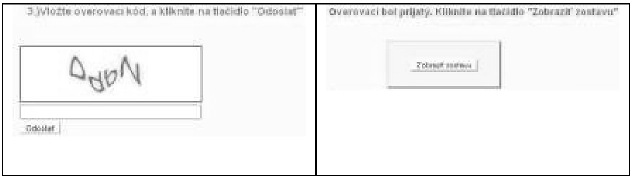

Figure 6: Inserting the verification code is the last step to generate a required printout
Source: http://envirozataze.enviroportal.sk/Tlacove-zostavy

Since the project has a long-term nature (1 semester), students create also a photo documentation related to the topic. The list of EB in the selected district is also possible to interpret by graphic or cartographic outputs. The final output of the project can thus have the form of final presentation or term work.

Project proposal: Emissions of selected pollutants

The second project aims to introduce students to the possibilities of working with data from the National Emission Information System (NEIS). NEIS was developed with the support of the Ministry of Environment and Slovak Hydrometeorological Institute. The launch of the system (in 2001) was also financed from the resources of the project PHARE/AIR/30 and with the support of the Danish fund DANCEE. The project includes also procedures for collecting data on emissions, their verification at branches of environment of district offices as well as procedures ensuring an import of these data into the central database and their presentation at the central level. NEIS program is developed in accordance with the legislation in Slovakia and the latest changes made in legislation of air protection in relation to the implementation of EU directives are accepted. NEIS replaced the former Emissions and Air Pollution Sources Inventory (EAPSI) which was in operation from 1985 to 2000.

Advantages of wide deployment of NEIS lie in an increase in the transparency of the process of collecting data on emissions from stationary sources of air pollution and setting of charges for air pollution, in the improvement of keeping regulations relating to air protection, in an unification of data collection on air pollution and their verification at all levels of public administration, in an improvement of the quality and credibility of data used at all levels. Moreover, quality and credibility of the data provided at the international level also increases.

Procedure

The website of NEIS offers several possibilities for choosing data. The first is a *choice with the map*. After clicking on the particular region, a map up to the level of districts is displayed in which, using the method of cartogram, the emissions of defined pollutant are shown (e.g. solid pollutants) to the chosen year (e.g. 2012). It also displays a table with the values of emissions (tons/year) of defined pollutants for the entire region for the years 2000-2012. After clicking on the selected district, a table with emissions in this district for the years 2001-2012 is displayed (fig. 7, 8, 9).

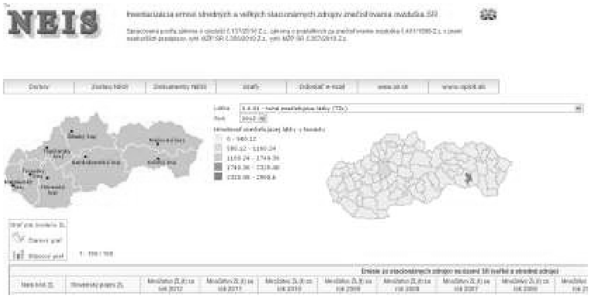

Figure 7: Basic insight into the NEIS website

The advantages of this method of selecting data are e.g. speed, lucidity, view in the map, and the fact that no registration is needed. A considerable disadvantage, however, is the fact that sources (or source operators) are not shown for the individual pollutants, which in practice makes it impossible to interpret their state and development.

Figure 8: Selection of the region (on the example of the Nitra Region)

Figure 9: Selection of the district (on the example of the Nitra District)

Much wider possibilities of choosing data from the central database of NEIS are offered by *"Zostavy NEIS [Reports of NEIS]"* which are available free of charge, but registration is needed. Once registered, the user has access to data from eight reports containing annually updated data from the year 2000. Output of each report can be modified by the user rather broadly especially through the selection of Výber stĺpcov [Selects columns], Parametre stĺpcov [Parameters of columns] and Podmienky výberu [Conditions of selection]. The resulting report can then be exported to formats such as XLS, CSV or HTML.

Example:

We are going to create and download a report that will contain the following parameters (fig. 10-15):

<u>Operator</u>

<u>Pollutants</u>: solid pollutants (TZL), sulfur dioxide (SO_2), nitrogen oxides (NO_X), carbon monoxide (CO), <u>Year</u>: 2012, <u>District</u>: Prievidza

Figure 10: Selection of a report – Emissions by operators

Source: http://www.air.sk/neiscu/main_gui.php

Figure 11: Selection of columns: enter the year, name of the operator, district and pollutants, continue: click on Zápis [Record]

Figure 12: Select the parameters of report columns, continue: click on Zápis [Record]

Figure 13: Select the criteria for the selection, continue: click on Zápis [Record

Figure 14: The system will generate a report according to selected conditions (part):

The last on-line step when working with the report is its export to the selected format and download to the computer. This operation uses the possibility of “Stiahnuť zostavu [Download report]”. The report will be saved in the selected format (e.g. XLS) and sent to the defined folder in the compressed form (ZIP).

Figure 15: Downloading the report
Source: http://www.air.sk/neiscu/main.php

NEIS is the most comprehensive database in the field of recording air pollution in Slovakia which can be considered its greatest advantage. It includes emissions data for 130 pollutants that are recorded regularly since 2000. A kind of disadvantage of this system is rather difficult entry of selection conditions e.g. selection of logical operations, orientation in the data types of individual columns, understanding aggregate functions, etc. To familiarize with all options in the database, the “helper” can be used which guides the user through the entire process of creating reports.

3. CONCLUSION

Still more and more accessible information technologies will become increasingly important also in geographic education. Wide possibilities of selecting data offer also a number of ways to analyze and interpret them. The proposals in this paper are aimed at familiarizing students with selected electronic databases in a practical way. Wide range of anthropogenic activities are raised also by a wide range of environmental impacts. Using information from the register of environmental burdens, students can quite clearly identify what consequences are left by specific human activities on the environment. Similarly, the manufacturing activities of industrial plants are reflected in the volume and structure of emissions of pollutants. Clearness is supported also by the focus of the proposed projects on the local landscape in which students are oriented very well. Students of geography teaching study programs can use such data in future practice e.g. in teaching environmental education, at work in the leisure time center, in project teaching, etc. Understanding the relationship of activity – result significantly helps also to the development of polytechnic thinking and gaining a general overview which geography teachers should have. The issue of environmental burdens and air pollution, however, is highly relevant agenda also for geographers focused on regional development, spatial planning, etc. Several environmental burdens act as a limiting factor of development as well as overly polluted air can interfere with the localization of certain activities in a particular area. Data from electronic databases are therefore a valuable source of information for geographers dealing with the problems of regional development.

Nowadays, accessibility of information technologies is increasing and its potential for geographical education is improving as well. Large number of freely available data offers many possibilities for their further processing. Human activities cause a wide spectrum of environmental impacts. Using data from Information system of environmental burdens, students can identify the environmental impacts of various economic activities (e.g. industry, mining, agriculture, dumping). Also the amount and structure of pollutant emissions results from the specialization of each industrial plant. Prospective geography teachers can use these freely available data in various ways, e.g. in environmental education, for the purposes of project learning, etc. Understanding the relationship between human activities and their environmental impacts also contributes to general overview, which is so important for geography teachers. Issue of environmental burdens and air pollution is important also for the future geographers dealing with regional development or land use planning.

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GEOGRAFICKÝ ČASOPIS (GEOGRAPHICAL JOURNAL) IN TIME AND CENTRAL EUROPEAN SPACE

Vladimír Ira[1], Eva Ďurišová[1] and Pavel Šuška[1]

[1] Institute of Geography of the Slovak Academy of Sciences, Štefánikova 49, 814 73 Bratislava, Slovak Republic, e-mails: geogira@savba.sk, geogkniz@savba.sk, geogsusk@savba.sk

ABSTRACT

The paper focuses on the peer-reviewed journal Geografický časopis (Geographical Journal) and seven Polish, Czech and Hungarian geographical journals indexed in the SCOPUS Elsevier Bibliographical Database. This paper lists the most frequently cited authors and papers published in the Geografický časopis in the years 1990 – 2014 and analyses the SCImago Journal Rank Indicator (SJR) and the Source Normalized Impact per Paper (SNIP). Based on SJR and SNIP identifier data the Czech periodical Geografie – Sborník České geografické společnosti reached the top ranking. The second Czech journal Moravian Geographical Reports and Slovak Geografický časopis also obtained good results and their qualitative potential has been increasing especially in recent years. The analysis demonstrates that the scope of all journals is mostly regional (Central European), due to their relatively restricted range of authors. All journals serve mainly as conduits for the exchange of information among academics on a regional basis.

Key Words: *Geografický časopis, geographical periodicals, SCOPUS database, Central Europe*

1. INTRODUCTION

Contributions to scientific knowledge are often crystallized in the form of a scientific article. Such contributions may take the form of new facts, new hypotheses, new theories or theorems, new explanations or a new synthesis of existing facts (Rousseau 2008). Innovative IT tools make it now possible to indicate papers that have resonated the most. Useful in this regard is an analysis of citations which creates the basis for contemporary bibliometrics and scientometrics. Its particular development could be observed in the last decade mainly owing to the digitalisation of scientific publications and their availability on the Web (Śleszyński 2014). Knowledge production is governed to an increasing degree through practices based on market-like operations. This may lead to the homogenisation of scientific publication practices, which are known to be heterogeneous and context dependent. One indicator of this homogenisation is the demand for publishing in international journals that is arising in a broad spectrum of sciences round the world. The attributes 'international' and 'quality' are increasingly being connected with such a type of journals (Paasi 2005).

The development, history and publishing of *Geografický časopis* are inseparable from the activities of the Institute of Geography, SAS. Sixty-seven years of published articles and studies represent a sufficiently long time for making an evaluation of prevailing trend of geographical thinking in our region. The aim of this contribution is to map the significance of this periodical both in the national and in international scale. The study brings analysis of journal's content and concentrates on the authors and institutions. Eventually there is also a citation analysis accomplished on a sample of articles written by the scientist from the Institute of Geography SAS in a set time schedule and comparison of the *Geografický časopis* with other scientific geographical periodicals published in Central European – V4 countries (based on citation indexes of the SCOPUS database).

2. CITATION ANALYSIS OF A DEFINED SAMPLE OF ARTICLES PUBLISHED IN *GEOGRAFICKÝ ČASOPIS*

The Slovak Academy of Scienceshas been building the electronic database of publications authored by its scientists more than ten years now. Institute of Geography SAS files more than 3,700 publications and more than 11,200 citations. We have had rather satisfactory responses after 1990. It is the reason why it was decided to carry out the analysis of *Geografický časopis* on the sample of publications of scientist affiliated to the Institute of Geography SAS for the years 1990-2015. Apart from citations indexed by the world citation databases WOS (Web of Science Core Collection, producer Thomson Reuters) and SCOPUS (producer Elsevier B.V.) other continuously filed international and national citations extracted from other sources and publications were also taken into account (Figure 1). The object of citation analysis in the quoted period consisted from 278 scientific and specialised articles published by researchers of the Institute in *Geografický časopis*. Number of all citations in the database from the quoted sample of articles in the period in question is 1,659. Hence, the average for all years is 5.96 responses (citations) to one contribution authorizrd by Institute's worker in the given period.

The quoted numbers are as of Aug. 31, 2015, as the database of publications and citations of the SAS is continuously complemented. It should be noted that the approximate 6 responses to one paper represent the ratio of citations (1,659) and all published articles (278); it means also those that are yet void of citations. WOS and SCOPUS citations from our point of view are all citations that were sought out in these citations databases; it means also citations of studies that have not been comprehensively processed or indexed (referred to as secondary documents).

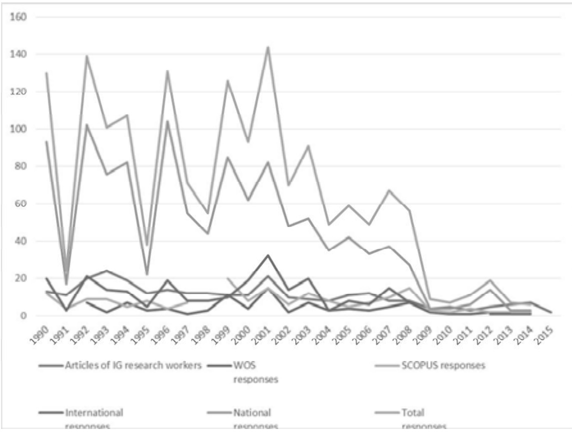

Figure 3: All citations of papers published by the IG SAS research
Source: SAS database

The most frequently cited authors of the Institute of Geography SAS are Ján Feranec, Ján Oťaheľ, Vladimír Ira, Ján Drdoš, Anton Bezák. Others include Mikuláš Huba, Milan Lehotský, Anton Michálek, Ľubomír Solín, Ján Urbánek, Jozef Jakál, Daniel Michniak, Vladimír Székely, Ján Hanušin, Peter Podolák, Daniel Kollár and Ján Szöllös. Ladies are represented by Anna Grešková and Monika Kopecká. Recently there also have been responses to works of young scientists (post docs) Pavel Šuška and Martin Šveda.

The most frequently cited articles of research workers of the IG SAS in *Geografický časopis* in 1990-2015 (total all citations unspecified) are:

BEZÁK, Anton. 1990. Funkčné mestské regióny v sídelnom systéme Slovenska. *Geografický časopis*, 42, no. 1, p. 57-73. (68 citations)

FERANEC, Ján – OŤAHEĽ, Ján. 1999. Mapovanie krajinnej pokrývky metódou CORINE v mierke 1 : 50 000: návrh pre krajiny programu Phare. *Geografický časopis*, 51, no. 1, p. 19-44. (59 citations)

IRA, Vladimír. 2003. The changing intra-urban structure of the Bratislava city and its perception. *Geografický časopis*, 55, no. 2, p. 91-107. (40 citations).

As far as total WOS and SCOPUS indexed citations, the most frequently cited articlesas follows:

FERANEC, Ján – OŤAHEĽ, Ján. 1999. Mapovanie krajinnej pokrývky metódou CORINE v mierke 1 : 50 000 : návrh pre krajiny programu Phare. *Geografický časopis*, 51, no. 1, p. 19-44. (17 citations)

IRA, Vladimír. 2001. Geografia času: prístup, základné koncepty a aplikácie. *Geografický časopis*, 53, no. 3, p. 231-246. (12 citations)

IRA, Vladimír. 2003. The changing intra-urban structure of the Bratislava city and its perception. *Geografický časopis*, 55, no. 2, p. 91-107. (10 citations).

The most frequently cited article ever published in *Geografický časopis* seems to be the study: MAZÚR, Emil – LUKNIŠ, Michal.1978. Regionálne geomorfologické členenie SSR. *Geografický časopis*, 30, no. 2, p. 101-125. The SAS database contains 125 citations of this article but presumably the number of citations is higher in reality because the responses have been filed only from 1997. This fact was also supported by article of Blažek (1986) published in *Sborník Československé geografické společnosti*, who mentioned this study as the one most frequently cited geographical publication in former Czechoslovakia. The fact that the work is also abundantly quoted by authors active in other scientific fields is also interesting.

3. EVALUATION AND COMPARISON OF *GEOGRAFICKÝ ČASOPIS* WITH SELECTED SCIENTIFIC PERIODICALS

Scientific periodicals are important communication channels of science in general. Articles and studies in such periodicals are the most sought out and most frequently used information sources for their availability and prompt dissemination of knowledge. There exist several tools for quality evaluation of periodicals or database products which make use of citation analysis. All indicators applied to evaluation and comparison of scientific periodicals are connected with the number of citations obtained by the periodical. The *Journal Citation Report* database enjoys the longest tradition in evaluation of periodicals and its quality indicator is the impact factor. In this case the focus will be on other evaluation and comparison sources, that is, indicators used by the SCOPUS database. The choice of this database has been motivated by the fact that *Geografický časopis* and selected periodicals published in the countries of the Vysegrad Four are processed and indexed in this particular database.

SCOPUS is the biggest paid, abstract, citation and referential database in the world. It was launched in 2004 by the Dutch company Elsevier. It represents the richest citation database of reviewed scientific literature of all scientific branches.

The aim is to compare quality of journals based on citations. The object of this citation analysis in the SCOPUS database are periodicals:

1. *Acta Universitatis Carolinae Geographica*, Czechia
2. *Geografický časopis*, Slovakia
3. *Geographia Polonica*, Poland
4. *Geografie – Sborník České geografické společnosti*,
   Czechia
5. Hungarian Geographical Bulletin, Hungary
6. *Quaestiones Geographicae,* Poland
7. *Moravian Geographical Reports*, Czechia
8. *Przegląd Geograficzny*, Poland

These periodicals have been processed in the SCOPUS database in different time intervals but they generally fall in the period between 2008 and 2014. This comparison analysis covers the last seven years. The database offers the option *Compare Journals*, which makes it possible to evaluate selected journals based on two identifiers.

SCImago Journal Rank Indicator (SJR) this measure of prestige is based on the idea that all citations are not coequal. Value of citation directly depends on the branch, quality and reputation of the periodical. It measures the scientific influence of journals and takes into account the number of citations obtained by the journals as well as the significance and prestige of the particular journal from which citation comes. It expresses the average number of weighed citations in the topical year to publications issued in the previous three years. The calculation is based on a complicated algorithm. This metrics guarantees that the final SJR number may represent the indicator suitable for comparison of quality of journals also belonging to other scientific disciplines (comparison of journals from different scientific branches).

Source Normalized Impact per Paper (SNIP) measures citation impact by means of the weighed value of citation according to the overall number of citations in given scientific fields (comparison of journals in the same branch). This indicator evaluates citation data of the journal according to individual scientific branches; it considers specificities of the scientific field:

- Citation frequency
- Covering of the field by citation database in terms of the readiness to obtain effect (promptness with which they start to be cited),
- Scientific field is created by the set of journals that cite the given journal (Ondrišová 2011, Fabián 2012).

The following diagrams bring an overview of SJR and SNIP indicators of individual periodicals (Figures 2 and 3). Table 1 contains mean values of identifiers for the years 2008-2014. It should be noted here that a problem emerged with assuming SJR and SNIP data in case of journal *Hungarian Geographical Bulletin*, whose title changed in the quoted period. Values of identifiers in this case were taken from the Journal Metrics (Elsevier) webpage under the previous title of the journal, that is, *Földrajzi Ertésítő.*

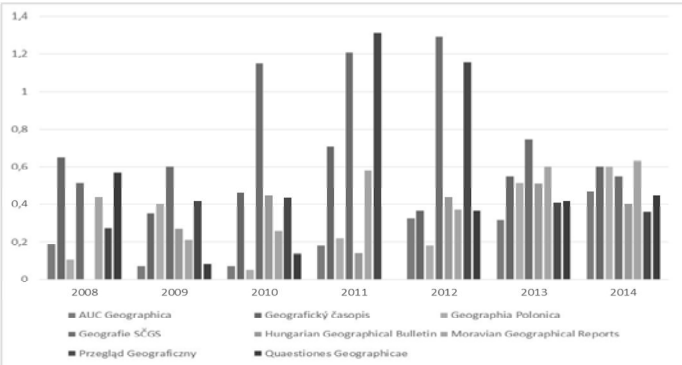

Figure 2: SNIP identifier
Source: Elsevier; own calculations

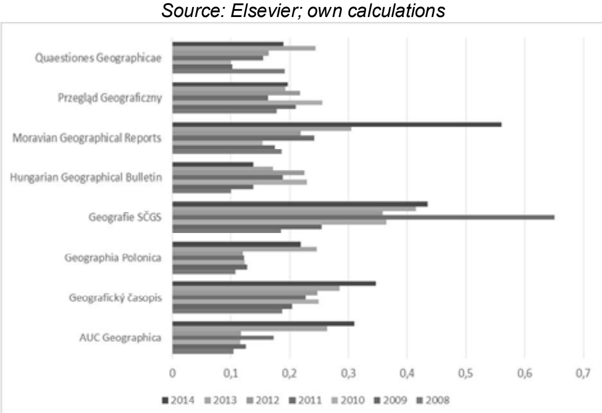

Figure 3: SJR identifier
Source: Elsevier; own calculations

Table 1: Average 7-year identifier of journals: SJR and SNIP

Journal	SJR identifier 2008-2014 average	SJR order	SNIP identifier 2008-2014 average	SNIP order
AUC Geographica	0.172	5	0.229	8
Geografický časopis	0.254	3	0.534	3
Geographia Polonica	0.152	8	0.305	7
Geografie SGČS	0.380	1	0.864	1
Hungarian Geographical Bulletin	0.170	6	0.314	6
Moravian Geographical Reports	0.263	2	0.440	4
Przegląd Geograficzny	0.202	4	0.620	2
Quaestiones Geographicae	0.163	7	0.350	5

Source: own calculations

4. CONCLUSION

Based on SJR and SNIP identifier data the Czech periodical *Geografie – Sborník České geografické společnosti* reached the top ranking. The second Czech journal *Moravian Geographical Reports* also obtained excellent results and its qualitative potential has been increasing especially in recent years. These two journals are also processed in the representative citation database WOS and the Moravian periodical entered the category of impact journals of Thomson Reuters agency in 2012-2013. Slovak *Geografický časopis* ranked third in both metrics and boasts a comparatively balanced level in individual years. Polish periodical *Przegląd Geograficzny* has also assumed a good position (second in the frame of the branch). Differences in evaluating indicators between other periodicals ranking at lower positions are small.

Analysed premier Czech, Hungarian, Polish and Slovak geographical periodicals serve mainly as conduits for the exchange of information among academics on a regional basis (see e.g. Bajerski and Siwek 2012). Important papers presenting the results of Central European geographical research to a wide international audience are rarely featured in these journals. Such research is usually published in the international journals or as monographs, as has been the case in the past.

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THE ORIGIN AND DEVELOPMENT OF DISPERSED SETTLEMENT IN NOVÁ BAŇA "ŠTÁLE" AREA AS A FACTOR OF TOURISM DEVELOPMENT IN THE REGION

Hana Bieliková[1] and František Petrovič[1]

[1] Department of Ecology and Environmental Sciences, Faculty of Natural Science, Constantine The Philosopher University in Nitra, Tr. A. Hlinku 1, 949 74 Nitra, Slovak Republic,
e-mails: hana.bielikova@ukf.sk, fpetrovic@ukf.sk

ABSTRACT

This paper brings focus on dispersed settlement in Slovakia that is a specific class of settlement. Areas characterized by dispersed settlement were settled with the aim of cultivation of a new agricultural land, located mostly in remote distances from existing villages. There had been arisen specific historical structures along these lines. The aim of this paper is to draw the outline of origin and development of dispersed settlement in region Nová Baňa, that is the important starting point for evaluating potential of tourism that would reflect the fragile characteristics of these historical landscape structures.

Key Words: *dispersed settlement, historical landscape structures, Nová Baňa region, Nová Baňa "štále" area.*

1. INTRODUCTION

Dispersed settlement is considered to be one of the few well-preserved cultural – historical landscape structures in Slovakia. It reflects socio – economical activity that was influenced by specific natural and historical conditions. It originated as a product of waves of colonization in Slovakia and its genesis was territorially and timely very variable (HUBA, 1989). It is represented by settlement called "kopanica", which is dispersed settlement that is established on agricultural basis. It has different regional names, in concerned area it is "štále". "Štále" were created in areas with complicated access in an effort to gain a new land. The hard access to areas resulted in an unspoiled nature. The unspoiled nature as well as traditions and authentic population give these areas great potential as an attractive destination for people seeking the escape from the humble cities.

There are not many authors whose interest would be placed on areas with dispersed settlement. BARNES, ROBINSON (1940) focused on cartographical illustration of rural dispersed settlement. Their main indicators of dispersed settlement were farm agricultures. Urban and rural settlement in north of Sweden during the period of 1930–1960 compared NORLING (1960). He found out that dispersed settlement vanishes due to adverse climatical and economical conditions.

Nowadays there are 5 areas with dispersed settlement in Slovakia. However, there hasn't been complex analysis of dispersed settlement done since 1961. Only partial analysis of certain areas or villages were done (HUBA, 1989; MESÁROŠ, 1966; LAUKO 1985, 1990; PETROVIČ, 2005;, ŠOLCOVÁ, 2012; ŠOLCOVÁ et al., 2015).

2. THE AREA OF INTEREST

The area with dispersed settlement called Nová Baňa "štále" region – one of the 5 Slovak areas with dispersed settlement (NBDR) is located in volcanic mountain ranges on the interface of west and middle part of Slovakia. NBDR covers area of 31 373 ha and 14 municipalities. Focus of this paper is on three of them, namely Nová Baňa, Veľká Lehota and Malá Lehota. All of these municipalities belong to Žarnovica district which is west part of the Banská Bystrica regional municipality.

Figure 4: Nová Baňa region with dispersed settlement

From the socio – economical point of view these municipalities belong to marginal areas mostly due to their remote location from the main administration centers.

2.1 Historical evolution of settlement in the Nová Baňa region

Origins of dispersed settlement in concerned area date back to 11th – 12th century. The most important phase of settlement in Slovakia falls to 13th and 14th century when there was a big German colonization (VEREŠÍK, 1974). Birth of the settlement in the Nová Baňa area have a bearing on 3 main colonization waves – German, pastoral and dispersed. The main point of interest for German prospectors was abundant precious metals fields. Some of the locations settled by Germans became the centers for its broader surroundings thanks to either their natural central location or thanks to the concentration of more city functions. Large timbered areas and areas of central Slovakia were also at the same time utilized by agricultural activity. Pastoral colonization dates back to 14th to 18th century. Mountain and sub mountain areas were not suitable for agricultural activities at the beginning of this colonization but it offered good conditions for pasturage. That means that this colonization meant settlement of these areas by shepherds (JANŠÁK, 1967). The last wave of colonization was dispersed wave, which finalized process of settlement in the central Slovakia and dispersed areas with native but also foreign inhabitants. In this area, dispersed settlement was related to mining and exploitation of natural resources, to timber production and to burning wood coal for iron-mills.

2.2 Dispersed settlement in the Nová Baňa region

Dispersed settlement in the Nová Baňa region dates back to 14th century and was influenced mainly by mining, coal mining and pasturing, later as a result of socio – economical changes was dispersed settlement connected with agriculture. The source of subsistence of many families in the area of Veľká Lehota and Malá Lehota was created by coal mining and to it related wood cutting. Table 1 and Table 2 show the development of settlement in NBDR.

Table 3: The development of population of settlement in NBDR

State to	Population	Density of population (on km^2)
1.3.1966	20846	66,4
30.6.2006	18442	58,8
% change	-11,53	-11,53

Source: Petrovič, 2007

Table 4: The development of population in village centres in NBDR

State to	Population in village centers	“štál” number	Population rate in villages centers (%)	Rate of population in “štál”
1.3.1966	**12755**	**174**	**61,2**	**39**
30.6.2006	**16123**	**169**	**87,2**	**13**
% change	**26,41**	**-5**	**42,48**	**-67,01**

Source: Petrovič, 2007

It is obvious that number of “štále” has fallen but not significantly. The fall is caused not by extinction of the “štále” but by combining more objects together and becoming bigger “štál”. However, one can observe the moving out of population from “štále” to central parts of villages, as there was a huge decline in the rate of population in ”štále” and incline in the rate of population in city centers. Many of the “štále” in the area are not populated and housing objects are used more as seasonal recreational objects.

The present situation we gives on the example 3 villages from this region. Nowadays there are 31 “štále” in Nová Baňa, 17 in Malá Lehota and 2 in Veľká Lehota. The names of these “štále” are mostly after the names of inhabitants, there are few “štále” which names are related to the characteristic of the place or its inhabitants. All of these “štále” are located in unspoiled nature with healthy and clean environment. All of these factors make the area interesting for people who are in search of objects suitable for secondary living. Table 3 shows housing situation in three of the concerned municipalities. From the Table 3 it is obvious that there are still vacant houses that could be used as a recreational objects. Currently, more than 30% of the houses not used for living. This trend will increase.

Table 5: Housing situation in concerned area in 2015

Municipality	Empty houses	Houses with permanent inhabitants	Cottages	Total
Malá Lehota	77	334	120	531
Veľká Lehota	54	398	57	509
Nová Baňa	36	262	94	392

Source: Internal documents of villages

This area offers not just great potential in technical infrastructure to develop tourism, but it also has great potential in touristic attractions. Few interesting products could be developed. One product could be oriented on natural attractions, particularly in Malá Lehota as it offers not just unspoiled nature. Malá Lehota tourism product could be based on Adnesitic stone sea, calcite caves that are habitat for bats as well as on discovery site of European ground squirrel. All of these would create great natural path in Malá Lehota, which would attract more visitors and empty houses could find their new usage.

Great touristic product could be developed as a trail connecting different “štále“ in area. Thanks to the hard access to “stale”, the nature remained untouched and so it offers high quality time spent in the nature. This could be taken as a family oriented trail that could connect different “štále” in Nová Baňa with information about the origin, or former purpose of the “štál”. In this way visitors could learn more about this socio – economical phenomenon.

Tourism in this area could also be oriented toward summer – winter tourism. In summer, area offers time spent by the water, as part of the Nová Baňa, called Tajch offers lake suitable for water activities. The area is tourist – open as it offers complete tourist infrastructure. Tajch could cooperate with part of Nová Baňa called Drozdovo which offers mostly winter activities. Ski resort Drozdovo offer ski lifts and slopes suitable mostly for families with children as well as in the proper winter conditions cross-country trails.

It is clear that concerned area offers great potential for development of tourism that could bring to life slowly perishing “štále”.

3. CONCLUSION

Housing situation as well as many (mostly natural) attractions of tourism makes this area perfect for further developing region by means of developing tourism. However, it is very important to choose right types of tourism that would reflect not just up-to-date character of the place but also historical aspects of these area. It is desirable to implement principles of sustainable tourism to prevent these unique historical landscape structures from inappropriate usage that could depreciate their value or could even destroy them.

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PERCEPTION OF BARRIERS TO CYCLE COMMUTING: THE GEOGRAPHIC PERSPECTIVE

Emil Drápela[1] and Hynek Böhm[1]

[1] Technical University of Liberec, Studentská 1402/2, 461 17 Liberec, Czech Republic,
e-mails: emil.drapela@tul.cz, hynek.bohm@tul.cz

ABSTRACT

The article tries to answer the question what are the reasons for the difference between the number of leisure cyclists and cycle commuters from geographic point-of-view. It is based on results of questionnaire survey carried out in 2014 in Brno and surroundings, focusing on the geographic aspects of the perceived barriers for commuting. However, the main purpose of the article is not to present the results of the survey, but to highlight the methodological limits of such investigations and propose the main frame of an innovative methodology, which in future could be used for better quantification of geographic aspects. Results of questionnaire survey are shown as shallow, and the exact numbers hardly describe the complex reality, especially in case when respondents are trying to give an answer that blame their laziness on external conditions. Therefore article describes how through asking questions regarding the choice of transport mode for specific route and complementary unstructured interview can achieve better results.

Key Words: *Cycling, cycle commuting, attitudes, mode choice, transport geography*

1. INTRODUCTION

Cycling is very popular leisure activity in the Czech Republic. Regarding to National cycling and in-line skating survey (Czech Tourism, 2011) there are 4.75 million active cyclists, which means 52.7 % of the population aged 15 and over ride a bike at least once a year. On the other hand, only 0.5 % of commuters to work and 0.4 % of commuters to school use bicycle as a main transport mode (Czech Statistical Office, 2011). The failure to use bicycle is interesting, especially when you consider that the number of bicycles in Czech households is comparable to the number of cars (n=4.76 million in 06/2013, Czech Ministry of Transport, 2013) which provide 44.4 % of all commuting.

This situation is caused by perceived barriers to cycle commuting that may be of different nature. Some of the most important perceived external factors to active commuting are distance (Nelson et al., 2008), relief (Vandenbulcke et al., 2011), weather or season (Müller et al., 2008), length of the bicycle network in the city (Santos et al., 2013), physical neighbourhood structure (Schwanen and Mokhtarian, 2005), price for other modes of transport (Wardman et al., 2007), free car parking (Carse et al., 2013), environmental factors (van Bekkum et al., 2011), traffic volume (Jones, 2012), level of road safety (Lawson et al., 2013) and complexity and contingency associated with everyday travel (Pooley et al., 2011). Very important are also internal factors like lifestyle (Gatersleben and Haddad, 2010), personal attitudes and perceptions (Gatersleben and Appleton, 2006), experience and life events (Chatterjee et al., 2013), age, gender and social background (Steinbach et al., 2011), physical fitness (Panter et al., 2011), the will to do some exercises (Oja et al., 1998) and knowledge of safe walking and cycling routes (Guell et al., 2013).

There has been published many studies about barriers to cycle commuting, people's attitudes towards cycling and motivation to cycle to work (e.g. van Bekkum et al., 2011, Vandenbulcke et al., 2011, Gatersleben and Appleton, 2006, Jones and Ogilvie, 2012). Regarding commuting to school papers can be divided into those dealing with children (for whom parents are deciding: e.g. Christie et al., 2011, Lang et al., 2011) and those aimed at students (e.g. Bonham and Koth, 2010, Whalen et al., 2013). Willingness to commute by bicycle is closely related to cycling safety (Chaurand and Delhomme, 2013, Schepers et al., 2013, Schepers and Heinen, 2013, Lawson et al., 2013) and impacts of policies for promoting cycling (Pooley et al., 2013, Goodman et al., 2013, Noland and Kunreuther, 1995). However, vast majority of these studies reflects reality of more developed countries than the Czech Republic, which is not always easily transferable to Czech conditions.

Due to failures of central planning in the period 1948-1989 the transport infrastructure in the Czech Republic is still at an insufficient level. Whilst the road infrastructure for cars is quite successfully developing over the last 20 years, growth of cycling infrastructure is much slower (Czech Ministry of Transport, 2013). In recent years there has been implemented results from two international research projects – Central Meet Bike and Mobile2020, whose aim was to learn from the experience of cycling developed Western European cities. The findings from these two projects have also been applied when creating Czech National Cycling Strategy. Official sources claim that the share of cycling for transport output is 7% (Czech Ministry of Transport, 2013), but it is only because in this number are included also leisure bike trips. Using cycling as an everyday transport mode is much smaller.

There exist no significant physical barriers for cycling (maybe with exception of legal rules in nature reserves etc.), it is door-to-door transport mode with possibility of off-road driving. However, many factors make the cycling unattractive in the eyes of people which makes it less competitive compared to other transport modes. The aim of this paper is not only to describe these perceived barriers (because they are well described in previous works), but also try to outline the ways how these mental constructs are created, how they are linked together and how their perception as a barrier can be revised in future.

2. METHODS

2.1 Study region

The study took place in Brno city and its close surroundings (up to 10 km from city border). Brno is mid-sized East European city with around 400,000 inhabitants (Czech Statistical Office, 2013, Ministry of the Interior of the Czech Republic, 2013) and second largest city in the Czech Republic after Prague. Brno metropolitan area is centre of commuting to work and school for wide region, more than 100,000 people commute to Brno daily (Czech Statistical Office, 2011). Moreover, Brno is important centre of tertiary education: there are located 15 universities with about 90,000 students (Brno City Municipality, 2013). The city is situated on the border of three different types of relief: hilly highlands in the north and west, karst with deep valleys and plateau with karst phenomena in the east and lowland plain in the south.

Cycling infrastructure in Brno is not very widespread in Brno: in 2012 there were only 30.9 km of bicycle paths (compared with 985.6 km of roads; Brno City Municipality, 2013). In addition, several sections are isolated from the rest of the bicycle network and their length is less than 1 km. There also exists strong imbalance in the placement of bicycle paths: only few of them are located in city centre, most of them are situated in city outskirt, when used for leisure trips by city inhabitants.

Very strong position within city transport system has public transport with more than 350 million passengers in 2012 (Brno City Municipality, 2013). For commuting to work located in Brno, 59.7 % of people use public transport, 24.7 % use car (average occupancy is 1.24 passengers), 10.7 % use combination of car and public transport, 3.6 % walk to work and only 0.6 % go by bike (and only 0.4 % within commuting to school). Within commuters there are twice more men than women. Average time spent on commute trip in Brno is 29 minutes (Czech Statistical Office, 2012). Poor use of bicycle for commuting is not typical for the region, smaller towns in the surroundings have the share usually between 10 and 20 %, some of them even higher (Strážnice 42 %, Pohořelice 39 %, Veselí n. M. 36 % etc.). On the other hand, minor share of bicycle transport is quite typical for Czech big and mid-sized cities, 9 of 13 big regional centres have the share less than 2 % (Czech Statistical Office, 2011).

2.2 Data collection

Data were collected by face-to-face interviews with paper questionnaires or tablets. The study area was divided into five sectors: north, east, south, west (all in city outskirt) and city centre. In each of these sectors were selected 2-4 places where cyclists often rest during their travels (rest areas, crossroads, garden restaurants, parks etc.) and where the data were collected. Interviewers addressed cyclists aged 15 and over, the questionnaire took around 25 min to complete. All respondents participated voluntarily and no incentives were given.

Within the questionnaire there were used mainly close-ended questions – single choice and multiple choice questions, scaled questions (using five-point Likert items: 1=agree not at all/of no importance, 5=agree completely/decisive), but also some open-ended questions for qualitative analysis. The questionnaire was inspired by questionnaires used in attitude survey and stated preferences survey for WALCYNG project (Institute for Transport Economics et al., 1997), some questions were used in almost unchanged form to be comparable with previous results from western countries. Data were collected in four weeks. In total, 300 people completed a questionnaire, 80 in city centre sector and 60 in each outskirt sector.

3. RESULTS

In total 7.2 % of respondents reported that they cycle to work or school at least once a week or more, 16.6 % said that they at least once a month. This high percentage that does not correspond with the above mentioned research is the result of used methodology, when the target group are active cyclists and is also more likely to meet with more active than less active cyclist. Cycle commuters are usually recruited of this group. In evaluating the reasons why these people are cycling to work, the most frequent answers (multiple answers possible) were cheapness, exercise, poor public transport, easiness and environmental issues. In open question where people could assess the attractive elements of cycling as a transport mode (regardless of whether commutes by bike or not) they appreciated the most fun and enjoying the exercise (16.2 %), easiness of use and flexibility (15.3 %), independence from any timetables (15.0 %), economic efficiency (13.8 %) and saving of time (10.5 %). Among other answers then appeared driving pleasure, environmental friendliness, enjoying surroundings and health benefits.

The main objective of the research was to uncover barriers to the development of cycling, so most of the questions asked on the negatives associated with cycling. The first one was an open question in which respondents described in their own words the reasons that lead them to the non-use of bicycles for daily commuting. The answers were very general, the most common were nature of work, lack of parking at workplace, deal with many things during the day, discomfort during cycling, its slowness and road safety issues. In a next step came a multiple choice question, which gave the opportunity to mark 3-5 main reasons why respondent do not commutes by bike. Results are shown in Figure 1.

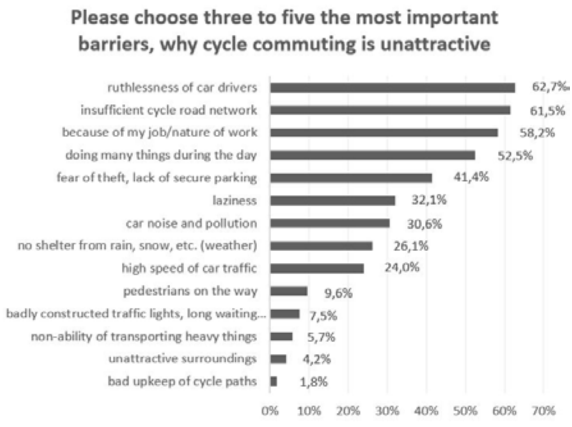

Figure 1: Perceived barriers to cycle commuting in Brno
Source: Own survey

An interesting fact is that although the main factors cited in the responses are similar in both cases, their frequency is changed, and e.g. the most frequent answer the second question was the concern for their own safety on the road (“ruthlessness of car drivers”), which in the first question was only the sixth most common answer. But what is even more interesting, almost 40% of respondents did not have a consistent answer in both cases, but at least one of the reasons they have placed in the open-ended question, they did not choose in the second question. It is therefore questionable whether in the second answer it was influence of pre-defined categories (but they could answer “other”: and said the reason) or whether they chose more socially acceptable answer, which showed them as more “cycling enthusiasts'" than actually are and where they blame on "objective reasons" for which they cannot commute to work by bicycle. Anyway, this is the result, which warns us against excessive reliance on these "exact numbers".

The questionnaire continued by questions that sought to uncover deeper connections of perception of barriers. Slightly surprising outcome had evaluation of route to work incline when most people rated it as average or little, though Brno is quite hilly city. This result denied the hypothesis that one of the key factors is the altitude profile of the route. Probably it is because of that cyclists need on their trips around Brno overcome higher elevation than it is near the centre, where most of commuting go.

One of the main findings was revealed through question aimed to determine attitudes of respondents to statements relating to cycling. It used five-point Likert items and results are shown in Table 1. While in the sub-questions that evaluated the state of cycling infrastructure answers require big improvements, in sub-questions that deal with promotion of cycling at the expense of passenger car transport respondents are much more reserved. Reducing the number of parking spaces in the city centre have met with little interest (3.2) and car-free city centre even with a slight resistance (2.9). These results could be interpreted so many leisure cyclists are also car drivers who for their daily routes use a car rather than a bike that is for them more for fun. A large minority of lifestyle cyclists is then quite supportive to car drivers – they have to use the same roads while moving in city, because there are only few cycle paths.

Table 1: The respondents' attitudes towards selected issues regarding cycling

Please say, how much you agree with these statements, according to this scale: Agree not at all 1 2 3 4 5 Agree completely	
The possibilities for cycling are not satisfying	4,2
Cyclists should have priority to car drivers at any crossings (pedestrian + cycling).	3,9
Cyclists should have priority to car drivers at cycling crossings.	4,1
Cyclists should have separated lanes.	4,2
There should be more cycle paths at general.	4,6
There should be more cycle paths in city centre.	3,7
Cyclists can go to pedestrian zone, if they ride slowly.	3,8
Car parking in city centres should be reduced.	3,2
The city centre should be free of cars.	2,9
I would not appreciate any measures in benefits for cyclists, if car driving conditions are hanged for the worse.	2,8

Source: Own survey

3. DISCUSSION

3.1 Critical evaluation of survey

Although the survey meet the high standards required for scientific research, the evaluation showed the limits for the use of a questionnaire for this purpose. The main problem was that a large percentage of people have tried to present themselves as bigger fans of cycling, than actually are. These false answers were then revealed in another similar question, where answers of these people were inconsistent.

From the perspective of geographical aspects affecting cycle commuting has the most significant influence the cycling infrastructure, which in Brno is still not at a high level. The need of using roads for commuting leads to conflicts with cars, endanger safety of cyclists and their movement in the stream of cars depreciates health benefits of cycling. The two most important perceived barriers to commuting concerned to the lack of cycling infrastructure.

In third and fourth place in importance are placed factors associated with lifestyle and daily rhythm of people. Besides the objective objections that some jobs are not compatible with commuting by bike, there are also comments about the equipment of workplaces, where there is no space where to safely store bicycles. Cyclist-friendly workplaces are one of the main ways to achieve greater expansion of cycling, because use of relatively small investment in bike racks or suitably equipped garage can bring quick progress. Employers can be motivated by improving the health of its employees, which brings regular physical activity. As Ogilvie et al., (2010) remarked: “A low level of physical activity increases the risk of obesity and many preventable chronic diseases including coronary heart disease, type 2 diabetes and cancer of the colon.”

Other positives of cyclist-friendly workplaces include the possibility to change from cycling in decent clothes and the opportunity to take a shower. Many workplaces this requirement does not comply and therefore it is difficult to reconcile for a cyclist commuting and work. In a situation where it is easier to park the car than the bicycle preferences are on the side of passenger car transport. The lack of secure parking places are then linked with crime, which is the fifth most important barrier.

At the next place is laziness factor, which is also affected by local relief. In additional questions that were not presented in the previous part, it was found that rather than driving uphill respondents discourages the need for physical exertion. The influence of the relief had the secondary importance.

Finally, in eighth place we find the influence of the weather. It is possible that in some other cities in the Czech Republic can be the weather perceived as a bigger barrier than in Brno, which is characterized by relatively warm and dry climate. On the other hand, we must admit that the sub-zero temperatures and icy in winter, spring and autumn rains and summer heat do not avoid Brno. But the weather is not as strong barrier, because most of the year is from cycling point-of-view well.

3.2 Improvements to method

The original questionnaire was designed based on the strict definition of the contract by customer, who wanted to find out whether it pays off to start the business in the Czech Republic or not. However, after our objections there were made some changes, which meant the inclusion of additional questions that were based on stated preferences method. Thanks to this it can be better quantified or could be refined their influence in the creation of mental constructs. These questions can be divided into three types:

First type

Hypothetical situation, impact assessment on five-point Likert scale (Very important 5, not at all 1). Examples:

How important would facilities for showering/changing at school/work be for your decision to cycle?

If there was a bicycle lane all the way to school/work, how important would that be for your decision to cycle?

If it cost 50 CZK per day to park a car at school/work, how important would that be for your decision to cycle to school/work?

Some of those questions have already been included in the original questionnaire, later the number was extended, while in each question the emphasis was on a clear definition of the various influences. It was necessary to avoid any generalization.

Second type

Hypothetical situation, selection of one transport mode for a given situation. Examples:

If your workplace was in Líšeň, would you choose car, bicycle or public transport for your trip?

If you travelled to visit friends in the place where is your workplace, would you choose car, bicycle or public transport for your trip?

This kind of questions should be grouped together into logically coherent system which will differ from one another either location (they should be chosen on the basis of a geographic factor) or the purpose of the trip. Then it is possible to compare the responses among themselves.

Third type

Abstract situation, defined parameters of trip, selection of one option. Options should be printed on special cards. Example:

If you chose the mode of transport for your journey to work and had these possibilities, what would you choose?

Car: 15 minutes, no change, 60 CZK for petrol, 30 CZK parking cost.

Public transport: 20 minutes, 1 interchange, average waiting time 5 minutes, 20 CZK ticket.

Bicycle: 30 minutes, indoor parking place in the building.

While using this stated-preference ranking (traditional conjoint analysis) custom processing should be performed using advanced mathematical methods, whereby to obtain high-quality data are needed higher number of questions. Certain problem is then also a fictitiousness of situation when the respondent cannot imagine the situation quite realistically. Positives include the ability to quantify the factors sophisticated.

All three of these types of questions (third type only marginally) were tested successfully in the survey and contributed greatly to improving the understanding of barriers to cycle commuting. Their thoughtful inclusion in the questionnaire may improve further research that will deal with choice of transport mode. All the effort is based on a fact that "what people do rarely matches precisely what they believe" (Pooley et al., 2011). This contradiction is visible in everyday life and must be taken into account also in the transport geographic research.

4. CONCLUSION

A big difference between number of leisure cyclists and cycle commuters in the Czech Republic is caused by several factors, of which has the greatest influence insufficient infrastructure, road safety issues, lifestyle and daily rhythm of people, inadequate equipment of workplaces with cycle, laziness and weather. On the other hand, route elevation profile in the city of Brno has only a small influence.

During the research there was a situation that it was necessary to innovate the questionnaire, because within the polling it has been revealed a number of cases where respondents changed their responses such a way that they look like more enthusiasts into cycling then they really are. Therefore, there were proposed three types of questions, which contributed to improving the quality of research. First of them was the hypothetical situation in which respondent assess his or her preferences on five-point Likert scale. Second type was hypothetical situation in which respondent chose one of offered transport mode. Third type was stated-preference ranking based on traditional conjoint analysis.

With increase of car-dependency within Czech population is becoming increasingly difficult to promote sustainable modes of transport for everyday use. Although many people are aware of the environmental and health benefits of walking and cycling, comfort coupled with a personal car makes a difference between what people perceive as right and what they do. Therefore, the research on attitudes and preferences is in this case associated with a difficult uncovering of hidden truths beneath not always truthful answers. Difficult methodological issues associated with this problem were outlined in this article.

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SELECTED CROSS-BORDER COOPERATION GOVERNANCE FORMS WITHIN THE EU

Hynek Böhm[1] and Emil Drápela[1]

[1] Technical University of Liberec, Studentská 1402/2, 461 17 Liberec, Czech Republic,
e-mails: hynek.bohm@tul.cz, emil.drapela@tul.cz

ABSTRACT

State borders still constitute a mental barrier in the current EU, despite joint internal market was created. However this barrier can be partly eliminated by conducting a cross-border co-operation (CBC), which can result into creation of cross-border regions. These regions create their own governance structures. The research goal is critical evaluation of contemporary forms of cross-border regions governance and a proposal of good-practices examples transfer from the Upper Rhine Valley and Greater Region into newly created Czech-Polish-Slovak European Grouping of Territorial Co-operation (EGTC) TRITIA.

Research outcomes state that public actors decide about the current shape of the CBC. Functional CBC governance structures are influenced by the presence of the EU funds and involve all levels of public administration, not excluding a central administration. Therefore one can recommend a widening of the co-operation scope and adding the partners representing national and euroregional levels also in the EGTC TRITIA.

Key words: *cross-border co-operation, cross-border regions, governance, cross-border, co-operation actors*

1. INTRODUCTION

The existence of differing administrative systems creates barriers to the balanced development of different European regions. Cross-border cooperation (*CBC*) has an important role in eliminating these barriers.

Border areas constitute approximately 40% of the EU's territory and are home to one third of its 500 million citizens. These areas are often economically weak, with relatively underdeveloped infrastructure and significantly higher unemployment in comparison to more central regions within their parent states.

The first cross-border cooperation network, 'Euregio', was established in 1960 across the French-German and German-Dutch borders (Dokoupil 1999, p. 159). Euregio did not have any direct institutional link to the European Communities, but it heralded the later formation of other cooperation units which used the title 'Euroregion'. The euroregion concept has become one of the principal platforms for cross-border cooperation.

The existence of differing legal systems, administrative structures and competences of relevant partners, together with a prevailing modus operandi which is insensitive to cross-border issues, makes the search for an optimal form for cross-border cooperation governance structures difficult. Yet the existence of the European single market, based on the four freedoms of movement, reinforces the imperative to design suitable governance forms for cross-border cooperation.

The INTERREG programmes, launched in 1990s, aim to support the completion of the single market through cross-border cooperation. These programmes have had a substantial impact, helping to increase the number of cross-border cooperation initiatives substantially (O´Dowd 2002) and engaging a wide range of actors. Analyses of CBC generally agree that member states tend not to engage in cross-border cooperation directly (e.g. Perkmann, 2003 or Schmitt-Eggner, 1998).

Cross-border cooperation is not a panacea for the problems experienced by border territories, however structures established to coordinate CBC can be effective in reducing or eliminating the negative effects arising from the existence of borders. The focus of this paper, giving an information about ongoing research, is the analysis of the creation of CBC governance structures in three different cross-border regions:

- The **Greater Region of Luxembourg**, more commonly known as simply the **Greater Region** (composed of territories from France, Luxembourg, Germany and Belgium).
- The **Upper-Rhine** region (comprising territories from France, Germany and Switzerland).
- The European Grouping of Territorial Co-Operation (EGTC) **TRITIA** (encompassing territories from the Czech Republic, Poland and Slovakia).

We work with hypothesis that the decisive actors in CBC governance are public administration authorities below national level, and also that EU funding has a substantial influence on the shape of CBC governance. Main research methods will be based on three case studies and qualitative research with CBC actors.

2. FRAMEWORKS FOR CROSS-BORDER CO-OPERATION

For the purposes of this paper, CBC is understood as '*an interaction between neighbouring regions within the EU (including Switzerland)*'. Specifically, the interactions which will be considered are those which are initiated by public or civil society actors.

After sixty years of European integration, European borders have become psychological rather than physical barriers. Van Houtum (2004) notes that this psychological barrier is the product of the interface between various administrative, legal and cultural systems. The newer EU member states – those which joined after 2004 – have a shorter experience with CBC and employ different approaches to the creation of frameworks for CBC governance than do the countries of 'old Europe'.

The single market, supported by the existence of the Schengen area, has European integration as its goal; that is, to ensure the freedom of movement of people, goods, capital and services. The coming into existence of these four principal freedoms in turn encouraged the process which Boesler (1997) describes as 'Entgrenzung' (dissolution of borders). 'Entgrenzung' corresponds to a decreasing role for national states and the increasing importance of regions, which enter into CBC more actively.

In the context of the increased importance of regions the concepts of paradiplomacy and new regionalism take on increased relevance. These concepts acknowledge the autonomy of local political actors and examine CBC from a bottom-up perspective; underlining local actors' use of CBC as a tool to achieve their goals in cross-border regions. Some authors (e.g. Scott, 2000) refer to transborder regionalism, of which the emergence of new political communities is symptomatic. These new political communities cross borders and traditional mechanisms of international cooperation, developing new transfrontier models for advanced regional interaction which are capable of efficiently solving problems. According to Schmitt-Eggner (1998), a cross-border region is not only a territory, but is also its engine. This foresees the existence of a specialized body responsible for CBC management.

Knippenberg (2004, 618) and Perkmann (2003, p. 163) analysed the behaviour of politicians from border regions and identified a desire to avoid the limitations imposed by policies made at the national level. Perkmann nevertheless does not consider this *cross-borderisation* to represent any kind of threat to the sovereignty of national states.

The regions are one of the key recipients of EU funds. When CBC was connected with EU funds via the INTERREG programme in the end of 1980s, the number of cross-border initiatives dramatically increased. Some authors (i.e. O´Dowd 2002) contend that EU money is the only motivation for many cross-border initiatives; others (Scott 2000) consider working with INTERREG as a primary purpose of Euroregions. The role of EU funds in the creation of CBC governance structures will therefore be analysed here.

Some authors (i.e. Anderson 2002) have mentioned the existence of a certain democratic deficit within CBC governance structures, a result of the fact that their creation is independent of the democratic electoral process. People living within a cross-border region are often unaware of their existence, and lack a sense of affinity with them. Often, the structures of CBC governance can be perceived as the exclusive preserve of a small circle of individuals.

Public administrations – municipalities and regions – are the principal CBC actors which are responsible for creating and shaping CBC governance structures. The role of national states and international organisations lies mainly in creating normative frameworks and providing financial incentives supporting cooperation (Anderson 1997). Actors outside of public administration tend to have a significantly smaller role than public actors.

3. CASE STUDIES

3.1 Upper-Rhine

The Upper Rhine region contains 5,800,000 inhabitants within an area of 21 500 km². The river Rhine is a substantial element characterising the whole territory, which can be divided into four sub-regions: Alsace (F), north-west Switzerland, Baden-Württenberg (D) and southern Rhineland-Palatinate (D). Approximately one fifth of the inhabitants live in cities with a population greater than 100,000: Karlsruhe (D), Strasbourg (F), Freiburg (D), Basel, (CH) and Mulhouse (F).

Figure 1: The Upper-Rhine Cross-border region
Source: http://www.region-suedlicher-oberrhein.de

There are four smaller areas – Eurodistricts – where CBC is conducted at a geographically lower scale in the Upper Rhine:

- Trinational Eurodistrict Basel
- Freiburg region – Central and Southern Alsace Eurodistrict
- Strasbourg – Ortenau Eurodistrict
- Regio PAMINA Eurodistrict (around Karlsruhe)

Upper-Rhine is a trinational cross-border region which is based on the balanced polycentricism created by the two core cross-border areas, Basel and Strasbourg, with an important role also played by Karlsruhe (Beck and Wassenberg 2011, p. 128). Functional cross-border integration has been achieved most effectively in the area of Basel as this area is one of the Europe's three most important areas for cross-border commuting (Metroborder 2010, p. 144). Metroborder was an ESPON funded project addressing cross-border metropolitan regions in Europe – mainly the Upper Rhine Valley and the Greater Region – in relation to the policy aim of polycentric development.

3.2 Greater Region

The Greater Region contains 11.33 million inhabitants and covers an area of 65,401 km², comparable in size to the Benelux, Bavaria or the Czech Republic. There is no major city in the region; the role of the centre is shared by a network of cities and is based on the link between Luxembourg and Saarbrücken; it is within this network, the so called *quattropole* of Luxembourg, Trier, Saarbrücken and Metz that most cooperation takes place. At a larger scale, this network also includes Nancy, Kaiserslautern and Liege. There are strongly developed cross-border links between some of these agglomerations.

Figure 2: The Greater Region Cross-border Region
Source: Metroborder 2010, p. 156

The Greater Region is a relatively heterogeneous area with a significantly polycentric structure. Comparatively small Luxembourg (with merely 85,000 inhabitants) enjoys a special significance within the region due to its position as a seat of European institutions and its status as a banking centre, which results in a large number of attractive job vacancies.

CBC within the Greater Region is complicated by issues deriving from the differing legal and administrative systems of each of the four countries – Belgium, Germany, France and Luxembourg – whose territories form the region. These territories are:

- The Grand Duchy of Luxembourg;
- The German federal states of Saarland and Rhineland-Palatinate;
- The French Region of Lorraine and Departments of Moselle, Meurthe-et-Moselle and Meuse;
- The Belgian region of Wallonia.

Available attractive job-vacancies mainly in Luxembourg have resulted in a high level of cross-border commuting. The shape of the CBC has been heavily influenced by this activity. Most commuters come from Lorraine (France), with a significantly smaller number from Germany (Metroborder 2010, p 65).

3.3 Contextual conditions and the development of cross-border cooperation in both regions

As well as being situated on the Franco-German border, these two regions share a number of other common features. In both cases, the framework conditions for CBC were set by national states, with France and Germany playing an important role. Additionally, both regions have involved more vertical levels of public administration, with a dominant role for self-administrative units at regional level.

Cooperation initiatives in the Upper-Rhine have covered the same territory since the beginning of the 1970s. Perhaps as a result of this, we can observe the first signs of an emerging transfrontier identity together with transfrontier regionalism in this region. *The Upper Rhine conference*, which provides the institutional framework for CBC in the region, thus acts as an animating unit for CBC. In contrast, the current extent of cooperation in the Greater Region is the result of a 'snow-ball effect', Luxembourg and Wallonia having joined the original French-German cooperation later on.

Common to both regions is a phase of construction and diversification of political institutions in the 1990s, with attempts to create transfrontier inter-parliamentary bodies. In both regions EU money assisted in adapting CBC governance structure in accordance with INTERREG programme specifications. In the Greater Region a substantial number of cooperation initiatives are currently supported with EU funds. The most recent phase of CBC involved 'vertical differentiation' of the cooperation structures in both regions – the creation of cooperation structures at lower regional levels, as well as the transfer of vertical agendas 'downwards'. This process is more advanced in the Upper Rhine, where the Eurodistricts have been launched; however a similar transfer is expected in the Greater Region, where the city networks will co-operate at a lower level.

CBC is markedly multi-levelled in both of these cross-border regions, for which the framework conditions were set by intergovernmental agreements and where relations between France and Germany play an important role. Most of the cooperation levels are represented in the highest level CBC governance bodies; with the exception that in the Greater Region the municipal level is formally absent, although cities co-operate through the city networks. Nevertheless, the results of the METROBORDER project show that there is still a major unexploited potential for cooperation in both regions. In the case of the Upper Rhine region experts have identified the need to simplify cooperation structures, whereas the Grand Region needs to strengthen its cooperation governance bodies. It is important to increase involvement from the business sector and civic society in both cross-border regions.

Civic society involvement in CBC structures is an important element in the creation of a cross-border region, as it makes the cooperation process more legitimate and generally acceptable. However the realisation of this ambition is a complicated long-term task. There are already some examples of good practice, such as civic society cooperation pillar in the Upper Rhine region or the Economic and Social Committee in the Greater Region.

Joint economic success is a key political objective of CBC. According to METROBORDER findings, in order to exploit the potential of a cross-border region fully, business actors should be involved to a considerably greater extent than is currently the case. In both cross-border regions the business sector played an important role in some cooperation phases: heavy industry representatives helped to initiate cooperation processes in the Greater Region, while existing biochemical cross-border clusters have been playing an important role in the economy of the Upper Rhine valley. However, public actors still dominate in CBC structures in both regions.

CBC is a process based on multi-level governance in both cross-border regions without direct EU involvement. Nevertheless EU policies, whether in the form of a methodical and legislative framework or through funding programmes (particularly INTERREG and Horizon 2020) have defined the institutionalisation of CBC. In both regions, EGTCs (The European Grouping of Territorial Cooperation (EGTC) is a cooperation instrument at the Community level established for the creation of cooperative groups in Community territory, invested with legal personality, in order to overcome the obstacles hindering territorial cooperation. Recourse to an EGTC is optional). have been established and the level of CBC institutionalisation is quite high. In both regions, the legal governance frameworks are bi- and multilateral agreements between individual member states as well as the Karlsruhe Agreements. In the Upper Rhine the Eurodistricts exploited the EGTC legal form, whereas the Grand Region actors applied this instrument for the managing authority of the INTERREG A programme covering its whole territory; another EGTC was established for the functioning of the Grand Region summit. Institution building has been linked with the need to adapt structures to the INTERREG programme requirements. Nevertheless the legal from of cooperation does not itself represent a key success factor or cooperation pre-condition. The Karlsruhe agreements constitute a sufficient legal basis for cooperation. Founding the EGTC was mostly motivated by desire to exhibit the 'European' label, and possibly to ensure a better position for the 2014–2020 generation programmes. The Agreement of Karlsruhe empowers the Länder Baden-Württenberg, Rheinland-Pfalz, Saarland and the Swiss Cantons to sign agreements other than those binding under terms of international law with each other and with the communal territorial entities referred to in the treaty.

Barriers to Co-operation

METROBORDER (2010) research examined the barriers to cooperation. It is apparent that the existence of differing administrative structures within all of the regions involved in CBC is the source of the most significant barriers to cooperation.

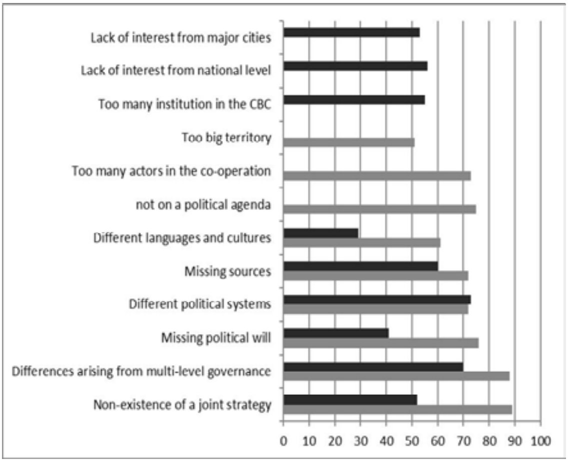

Figure 3: CBC barriers
Upper Rhine ▉, Grand Region ▉
Source: Metroborder (2010)

4. CASE STUDY: EGTC TRITIA AND ITS COMPARISON WITH THE UPPER RHINE AND GREATER REGION

EGTC TRITIA is composed of the Moravian-Silesian Region (CZ), Silesian and Opole Voivodship (PL) and Žilina region (SK). With an area of 34,069 km², largest cities of Katowice (PL, 300,000) and Ostrava (CZ, 300,000) and 7,855,000 inhabitants, the EGTC belongs to the biggest cross-border region in Europe. There is a major concentration of heavy industry – coal mining and steel production – mainly in Silesian Voivodship and the Moravian-Silesian Region. All of the regions involved have been undergoing economic reconstruction, not yet complete. In all of the regions manufacturing industry, mainly automotive, has newly emerged. Seven public universities and numerous private tertiary education institutions reinforce regional innovation potential.

Similarly to the Eurodistricts in the Upper Rhine, there are smaller cooperation units – Euroregions – within the TRITIA territory:

- Těšínské Slezsko/Śląsk
- Cieszyński/Teschinensis
- Silesia
- Praděd/Pradziad
- Beskydy

Figure 4: The EGTC TRITIA Cross-border region
Source: Böhm 2014

Only the Beskydy Euroregion covers the territory of all three countries involved in the cooperation process; the other three are bilateral Czech-Polish initiatives.

All of the regional centres of EGTC TRITIA are geographically substantially remote from the national capitals, most noticeably Ostrava (377 km from Prague) and Opole (313 km from Warsaw). The core area of the EGTC is an agglomeration around Katowice and Ostrava with 5.3 million. Whereas the Silesian Voivodship and Moravian-Silesian Region represent the urban and densely populated part of the EGTC, the Opole Voivodship and the Žilina Region are its rural part.

The regions constituting EGTC TRITIA are significantly poorer than the regions constituting the Upper Rhine or Greater Regions. Moreover, there is no major economic engine or metropolis in the EGTC TRITIA territory. This is why there is no substantial cross-border labour market or cross-border flow of commuters in the TRITIA regions. This leads to the absence of specialised structures to deal with the cross-border labour market (such as INFOBEST structures in the Upper Rhine). Except for Ostrava all of the bigger cities are geographically at least one hour's journey by car from the borders.

The first cross-border initiatives between Poland, Slovakia and the Czech Republic appeared in the second half of 1990s, mainly involving municipalities of middle and smaller size. Almost immediately these euroregional initiatives were afforded the opportunity to co-operate on the administration of European funds with national ministries. This share of competences is still in place today.

The formation of EGTC TRITIA encountered a very hesitant welcome from national authorities and a direct refusal from the euroregions. The flat EGTC structure requires the involvement of the other vertical public administration levels (including the level of the national state), as well as economic actors and civic society organisations. In comparison with the Upper Rhine and Greater regions there is a significantly lower level of 'institutional thickness' in the EGTC TRITIA. Public administration structures in this region cannot create functional institutions that are able to forge suitable framework conditions for the balanced development of the cross-border region.

The primary motivation for selecting the legal form of EGTC was the possibility that EGTC TRITIA might have a significant role in administration or at least use of EU funds. However because experience with this legal form was minimal in Slovakia and non-existent in Poland and the Czech Republic the process of EGTC adoption with national authorities was slow.

4.1 Research on TRITIA cross-border governance among experts from this territory

A survey of experts in the TRITIA territory (Using Metroborder (2010) methodology, the author conducted questionnaire-based research with the aim of checking whether practice from the Upper Rhine and Greater regions could also be applied in TRITIA territory. Czech, Polish and Slovak respondents from central, regional, local and euroregional levels of public administration and representatives of universities, NGOs, development agencies and business sectors took part in this study) carried out in 2012, focused on attitudes to cross-border cooperation. The responses of experts from all three countries were quite similar, with the exception of the significantly lower level of sensitivity towards environmental issues displayed by Polish experts. Some complementary questions with smaller participants´sample were afterwards asked in 2015, with an aim to verify the validity of 2012 findings.

Most Czech and Slovak respondents (72%) agreed that EU funds represent a substantial cooperation incentive for both CBC conducted by euroregions or EGTC TRITIA; however the majority (60%) of Polish respondents did not think that this was a decisive motivation for the EGTC TRITIA. In 2015 the interviewed experts have not changed their mind much.

The biggest barrier to cooperation identified is the non-existence of a joint cooperation strategy and a lack of political will to co-operate; unlike the Upper Rhine and Greater regions, where CBC has traditionally enjoyed a high level of political support. Yet the strategy has been almost been completed in 2014, the experts still don´t see any major commitment from the political elites of all four co-operation partners, with possible exception of Slovak side – the smallest co-operation partner region.

Whereas on the whole Czech and Slovak respondents consider that the current flat EGTC TRITIA structure is a problem, this view was not shared by Polish experts in 2012. Similarly, Czechs and Slovaks perceive the absence of business actors in the cooperation structures as a problem, at odds with the general feeling among Polish respondents. This attitude started to be changed in 2015, after first years of TRITIA functioning and with the arrival of new TRITIA director, who declared ambitions to involve business actors into CBC too.

Actors from almost all public administration levels have entered into CBC and its governance structures in the Upper Rhine and Greater Region, whereas the current EGTC TRITIA governance structures are created entirely by the regions. When asked who they thought should enter into the TRITIA CBC governance structures, most respondents emphasised the importance of engaging more business actors, large cities and universities. The need to engage non-governmental organisations and administration at the national level was comparatively deemphasised.

The TRITIA region is currently lacking clear economic engines, such as Basel in the Upper Rhine or Luxembourg in the Greater Region, which could stimulate a cross-border labour market. Nevertheless, most of the experts believe that a cross-border labour market could be created, initially at a smaller scale around Czech Třinec, which creates with its functional economic supraregional actors certain economic attractor for both Slovak as well as Polish economic actors.

All three cross-border initiatives are realised in different context conditions. It is possible to say that the relatively small size of the Upper Rhine territory makes CBC *governance* easier, as it provides more opportunities for effective interaction of vertical and horizontal cooperation structures. The EGTC TRITIA has, in addition to possessing too large an area for effective CBC, another disadvantage in the absence of the largest cities within cooperation structures and the large distance of these cities (with the exception of Ostrava) from national borders.

The geographical scale of CBC co-determines the concrete design of CBC governance (Beck, Wassenberg 2011). Based on the previous research results (Beck, Wasenberg, Metroborder , and the author´s own) it is likely that geographically smaller cross-border regions have better 'default' conditions in which to set functional structures of CBC governance. Bigger cross-border regions face the need to match the expectations of actors from all vertical cooperation levels, which is complicated.

France and Germany developed a substantial effort to create favourable conditions for CBC, particularly with regard to the two nations' complicated history. Although the Upper Rhine and Greater region governance structures were modified in the project specialisation and professionalization phases, they existed before the linking of CBC to EU funding. The newly created EGTC TRITIA was established as a means to channel INTERREG and other European funding. The formation of EGTC TRITIA as tool to use European funding resulted in a substantial level of resistance from the other vertical CBS actors including the national states, concerned with the loss of their competencies in the administration of EU funding.

The current flat EGTC TRITIA structure based on the cooperation of four founding regions contrasts most markedly with the Upper Rhine, where the CBC governance is shared among all vertical public administration levels, with attempts to involve universities, the private sector and civil society. Based on this experience EGTC TRITIA should seek to open its cooperation structures to the other levels of public administration.

The legal basis used for CBC does not necessarily influence the quality and intensity of the cooperation. CBC *governance* structures in and of themselves are not capable of guaranteeing the smooth implementation of cooperation. This can only be achieved through the engagement at a high level of true leaders, political or other, in the CBC structures (Beck, Wassenberg 2011). A simple systemic engagement of leaders can lead to greater *cross-borderization* and the formation of political cross-border communities; this is at the moment more likely in the 'old EU'. The conduct of CBC should be based to a much greater extent on the professionalization of its actors, who will then engage with CBC as their only agenda. Also, strategies which offer other ways of involving potential CBC actors from non-public administration backgrounds can be a next step leading towards improvement of the conduct of CBC.

5. CONCLUSION

The main goal of this paper was a critical assessment of CBC governance in three selected cross-border regions.

Building on previous research, the central conclusion to this paper is that the best conditions for the conduct of CBC exist in regions where there is a broad engagement of the vertical levels of public administration, of civic society, the business sector, of universities and of R&D actors. Despite initial expectations, it was found that national states have played an important role as the creator of framework conditions or as direct CBC actors. Out of all three of the studied regions the Upper Rhine Valley exhibits the most suitable structures for the efficient performance of CBC.

The need to overcome the limitations arising from national policy and the existence of national borders does not present any challenge to the authority of national states. On the contrary, national states are formative actors of CBC. In the countries whose regions create EGTC TRITIA there is still visible competition between central ministries and the regions over the power to act as the decisive distributors of European funds. The possibility of working with European funds is for many CBC actors from both old and new Europe a decisive stimulus to engage in CBC. CBC governance in EGTC TRITIA and the Greater Region was significantly influenced by the existence of the European funds, which confirms that EU funds do substantially influence CBC governance design.

The ongoing research focuses on better reconciliation of the CBC governance structures with the management of European funds and smooth application of the multi-level governance principle mainly in the "new" Europe.

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HISTORICAL FORESTRY MAPS AS A SOURCE OF INFORMATION FOR RESEARCH DEVELOPMENT LANDSCAPE ON THE EXAMPLE OF RESEARCH SELECTED LANDSCAPE BAROQUE COMPOSITION IN THE CZECH REPUBLIC

Jan Šperk[1]

[1] University of Ostrava, Faculty of Natural Science, Department of Physical Geography and Geoecology, Chittussiho 10, Ostrava, Czech Republic, e-mail: jan.sperk@osu.cz

ABSTRACT

The paper deals with the possibilities of using historical forestry plans and maps for research landscape development. The article summarizes the development of the forestry map series and their importance for research landscape. In the second part of the paper describes the use of these maps and plans in a concrete research baroque composed landscape near the town of Jičín in northeast the Czech Republic. This baroque landscape composition was built by František Josef Šlik in the 18th century. In the landscape composition he used the local terrain and forest to emphasize the visual lines in space.

In the forest near the central chapel of the composition were made four forest aisles, which allowed visibility of other objects in the landscape. With the study of preserved forest plans and old maps was monitored their development from building the composition to the 20th century. For this research forest maps proved to be an interesting and often ignored source of information.

***Key words**: forestry maps – baroque landscape composition – landscape development – František Josef Šlik*

1. INTRODUCTION

Cultural landscape development research is still among the current topics of contemporary geography and various other scientific fields. The complex research of land use/cover requires an interdisciplinary approach connected mostly with the study of archival materials and old map works. A range of studies based on the study of old map works can be found in the Czech and foreign environment. For comparison these studies for forest cover changes: Olah, B., Boltižiar, M., 2009, Boltižiar, M., Chrastina, P. 2006 or Szabó, P., Müllerová, J., Suchánková, S. and Kotačka, M., 2015 (Last studies based on study of medieval historical charters documents). For forestry maps in the Czech Republic for example Fencl, P., Roček, I., Waage, V. and their publications reproductions of forestry maps (for example Fencl, P., Roček I., Waage,V. (eds.), 2011). In most cases, these are national map works which were being created in the 18th and 19th century in most European countries. For a detailed study of smaller landscape units, also smaller map works are used which were created for the purposes of individual areas or manors. These help to add knowledge gained from the studies of national map works.

The goal of this article is to point to the possibilities of one such specific source use – the forestry maps and plans on the example of the study of baroque landscape composition in Jičín district in northeast Bohemia in the Czech Republic. Forestry maps and plans rank among the relatively well extant map works of certain manors, and owning to their inspiration in German environment also among relatively universal map works in Central Europe. Similar to the national map works, they started to be created at the end of the 18th century and are one of the often marginalized sources of knowledge of the Czech cultural landscape development.

2. STATE MAP WORKS IN THE HABSBURG MONARCHY AS THE BASIS FOR THE RESEARCH OF HISTORICAL CULTURAL LANDSCAPE AND ITS DEVELOPMENT

The maps created within a national mapping of the Habsburg Monarchy during the 18th and 19th century are among the most used map works for landscape development in the Czech Republic. They include primarily three so called military or also imperial mappings and an elaborated Stable land registry. The first military mapping was conducted during 1763–1768 and rectified during 1780–83.

This map work captured the landscapes of the Czech lands at the end of the Baroque period, but it does not have accurate geodetic foundations. However, it is a valuable source of information about the then landscape in 1:28,880 scale.

The second military mapping was conducted during 1819–58 and made use of materials created within a stable land registry survey. It captured the area of the Czech lands prior to the Industrial Revolution. The scale is identical to the first military mapping. Simultaneously, the Stable land registry, probably the most important map work of the Habsburg Monarchy, was created during 1826–43. Detailed map sheets were made in the fathom scale of 1:2,880 and they still are the most detailed source of information about the then land use/cover.

The last large mapping was conducted during 1877–1880 and is called the third military mapping. Quality topographic sections were created in 1:25,000 scale and other derived maps of smaller scales were created from these. Unfortunately, a large part of topographic section was not preserved. All these mappings make an important source of information about the landscape of the Czech lands and are variously supplemented with non-national map works during researches. They include mainly manor plans, district maps, special and thematic maps. Furthermore, they are compared with other written or visual sources.

3. FOREST MANAGEMENT PLANS AND FOREST BOOKS IN THE CZECH LANDS

Contemporary forest management plans (FMP) are to a large extent a result of forest legislation in the Czech lands. The first legal adjustments concerning forests can be traced to the Middle Ages, e.g. in the Statutes of Přemyslid prince Konrád Ota from 1189. However, a larger expansion of legal adjustments concerning forest covers started with the centralization of Habsburg Monarchy in the 18th and 19th century. It was connected also with a high wood consumption for a beginning industrial production and increasing number of population. Thus, the first attempt to unify forest management was the 1775 patent issued by Maria Theresa. It adjusted and unified a range of duties related to wood extraction and forest land protection. This set of rules penetrated through noble manors very slowly but it gradually asserted itself. Later, the rules were supplemented many times with other decrees and regulations and were valid almost 100 years. Then, an Austrian forest law no. 250 was issued in 1852 reacting to new, more modern procedures in forestry and production. The management itself according to the forest management plans was enacted in the Czech lands in 1819 and since the half of 19th century it had been applied to ecclesiastic and municipal properties as well. Yet, a dispensation could be given to the owners of forests of less than 50ha who processed only a so called forest management programme.

In the 20th century, a temporary forest protection law had been in force since 1918 in the Czech lands which was replaced by the Interim forest protection law in 1928. It was in force with supplements until 1945 when the norms concerning the forest management proceeded again from the 1852 Austrian forest law. After the 1948, a unified administration with a range of amendatory regulations and norms affected the forest management in the Czechoslovak Socialist Republic, but a separate law was issued no sooner than in 1960 and in 1977. Currently, forest management in the Czech Republic follows the Forest law no. 289/1995 Sb. with a range of amendatory regulations.

Since the 18th century, all these laws have the principle of forest cover extraction balance and continuousness in the Czech lands in common. Since the beginning of 19th century, the forest management plans had been created by not only a documentation like forest books, revenue tables but also by map records. These map records were often made based on the state map works and they form a relatively interesting source of the Czech (or Austrian, Central European) cultural landscape development. The Stable land registry maps, with changes of forest cover registered into which, were primarily used to survey a forest border on smaller manors.

Forest books are mainly created from the tables of age classes as per individual forest sections. They record age and species forest structure, felling (forest cover extraction) seasons, wood pricing and quality. However, they are hardly interpreted without map materials.

4. FOREST DISTRICT MAPS AND FOREST MANAGEMENT PLANS OF THE ŠLIKS' NOBLE FAMILY MANOR

An interesting baroque landscape composition was created at the manor of the Šliks family near the town of Jičín in northeast Bohemia in the 18th century. The beginnings of its creation trace to the 17th

century and count František Josef Šlik (1656–1740) is considered its main creator. Landscape adjustments were based on a visual interconnection of smaller sacral objects as well as some farming and settlement buildings. The characteristics of a local terrain, which is permeated by smaller volcanic bodies on several places, were smartly used in the composition. Furthermore, forest cover was used to highlight visual lines in the composition in the form of forest aisles and, on the contrary, covering a view of unrelated surrounding elements. A presumptive form of the composition is shown on Fig. 1.

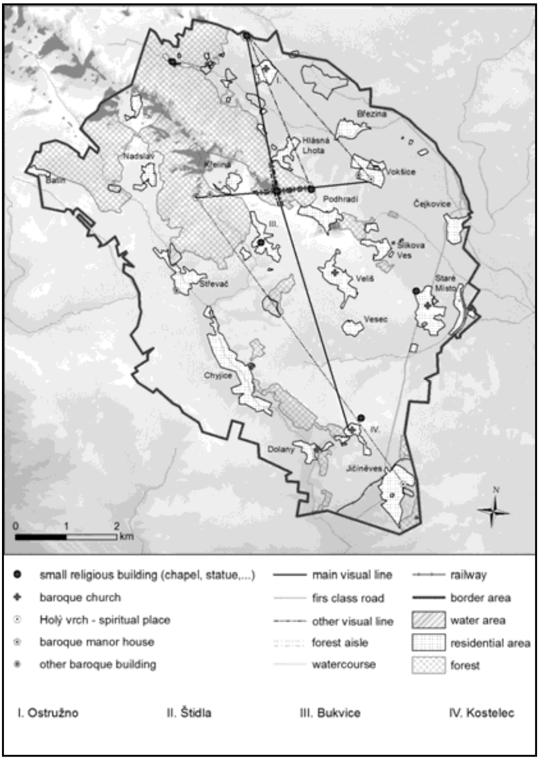

Figure 1: The concept of a form landscape composition of František Josef Šlik. Map data consists current form area

The state map works of the Habsburg Monarchy and the plans and maps made within the Šliks' manor were used for the research of this landscape composition development. Between these, the forest management plans proved themselves very useful for the completion of the development of forest aisles in the composition central part. The resources of the Central management of the Šliks estates in Jičíněves and Vokšice manor farm estate (one of the management centres of the Šliks' manor) which are placed in the State regional archives in Zámrsk (Státní oblastní archiv v Zámrsku – SOA Zámrsk) were used for the research. Several extant forest management plans with map materials form a part of these resources.

Unfortunately, these resources do not make a unified time line and are affected by the change of forest management during the 19th century. The research with regard to the topic of baroque landscape compositions was focused on only a selected part of forest district under the manor farm estate administration – the part which was called Křelina forest district. There is the central building of the whole landscape composition, the Loreta chapel, with forest afiles oriented towards the four cardinal directions (see Fig. 1). These aisles were recorded on map sheets of the so called 1st military mapping of the Habsburg Monarchy (with only two aisles out of four being depicted) probably for the first time. The existence of all four aisles is documented by the extant forestry maps.

There are actually three types of forestry maps:

1) Surveillance maps – showing the distribution of forest cover on individual forest districts and larger forest units. These maps show a stylized predominant kind composition of a certain part of forest, they further capture important elements in a forest district in the form of springs, watercourses, larger roads and also forest aisles. Figure 2 is an example of such a map.

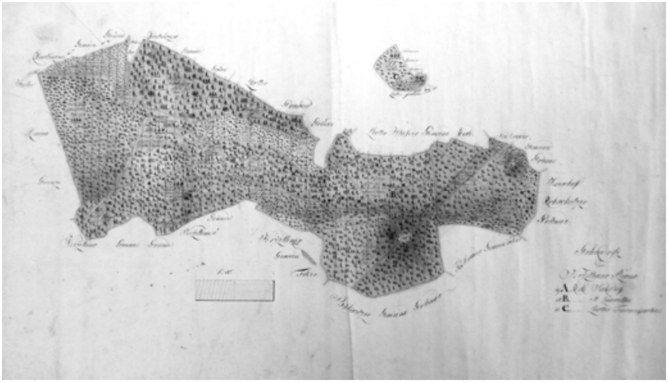

Figure 2: Example of surveillance map for Křelina forest district with scale bare and description of the forest parts.
Source: SOA Zámrsk, photo author

2) Forest cover maps and felling plans – showing individual forest districts and forest parts with a record of conducted forest felling of wood. Sometimes, the records of tree age and the size of cover are included. Unfortunately, the kind forest composition appears only exceptionally; in case of this forest district not until the first half of 20th century. Moreover, some records are not colorized and are drawn by a pencil. Example of this type of map is Fig. 4.

3) Other plans and maps – including various partial plans like e.g. a situation plan of hunting ground in the Křelina forest district (see Fig.3).

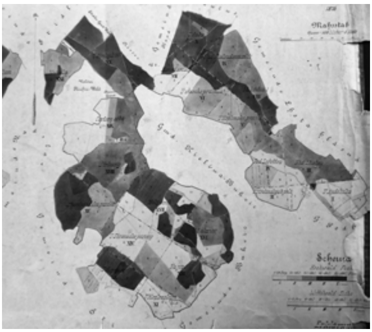

Figure 3: Cut from situation plan of hunting ground in the Křelina forest district with forest aisles.
Source: SOA Zámrsk, photo author

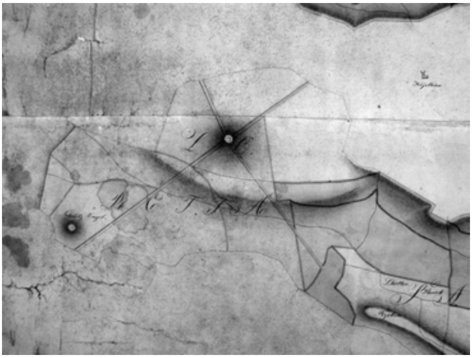

Figure 4: Example of forest cover maps from Křelina forest district.
Source: SOA Zámrsk, photo author

Different types of forestry maps are not in these particular resources. Maps and plans can be divided into three periods of time according to their creation period. The first contains the maps from the first half of 19th century when the first modern forest management plan was being created as per new regulations at the Šliks' manor. The materials for them were made in 1810 capturing the situation from 1800 to 1830s. They are followed by non-colorized maps from 1840s and 1850s. These maps capture mostly all four forest aisles in the Loreta surroundings and provide the functionality of the whole landscape composition, which is essential for the research of František Šlik's landscape composition. The existence of forest aisles can be verified also thanks to the national maps works of the Habsburg Monarchy. The forest cover age entered in the forest cover maps from this period in the forest parts near the aisles confirms it as well. However, one of the aisles was gradually disappearing during the 1830s, probably as a result of proceeding basalt extraction in a quarry near the Loreta chapel.

The second period is made by the 1876 maps. New source maps were probably not created between 1810 and 1876. These were created based on the imperial prints of stable land registry. Because the northeast forest ride is already missing in the stable land registry maps, this situation was reflected also in derived forest maps. Therefore, the maps give evidence of rather the felling periods and forest cover development near the aisles. Although almost complete felling and new cover planting was done in some forest parts, the remaining three aisles were most likely systematically maintained.

The third part includes forest cover maps from the end of 19th century capturing the situation from 1897 to ca. 1912. Only the 1897 maps are complete, then the fragments with felling records from individual years written on maps by a pencil were preserved. Regarding the forest aisles, they are recorded in the same extent as on the 1876 maps. A broad-leaved cover of the age similar to the 1876 situation was found in the Loreta surroundings according to these maps. A complete felling and replacing by new cover was done on some plots along the forest aisles. The forest plans are completed by a preserved forest book from 1895.

Figure 5: Example of forest aisle near the Loreta chapel.
Source: photo autor 2014

Only forest books and forest management plan from 1941–1950 were preserved towards the first half of 20th century. This plan summarizes also the previous plans and forest district management and confirms the development of aisles and forest in the Křelina forest district in the 19th century which is captured on the preserved maps. It also contains a detailed forest kind composition on individual plots. The forest plans together confirmed one of the work hypotheses concerning landscape composition development from its origin up to now. This hypothesis assumed that forest aisles enabling the interconnection of all buildings and elements in the composition were systematically maintained until the second half of 20th century; even though the unified time line cannot be put together using the preserved archives. The composition thus remained functional practically since its origin until the 20th century.

5. ISSUES OF USING FOREST PLANS AND MAPS

When researching this Baroque landscape composition, the forestry maps proved themselves being a very good and relatively detailed source of information about its development. However, the well-preserved state of archives and their completeness is an issue. There are manors, as e.g. the Schwarzenbergs' manor in south Bohemia, which are characterized by long-term and unified possession within one family, and on the contrary, fragmented manors with often changing owners. The unified possession supports the origin of continuous time lines and quality forest records. Also the Šliks' manor had been relatively unified in the long term, although a part of the manor was separated after the death of František Josef Šlik. Yet the preserved forest plans are incomplete and without the completion by other sources, mainly the national map works of the Habsburg Monarchy, the time development reconstruction of aisles would not be possible.

The second issue a researcher encounters while studying these sources are the changes in forest management during the 18th and 19th century. Often, they include the transition from older division and forest management systems to more modern and profitable systems. The transition to a so called Saxon system was common in the second half of 19th century. It was reflected not only in the taxonomy change but also in the division of forest plots and parts. The preserved forest books cannot be easily compared if also the current forest plans are not preserved.

Another issue is the cartographic map quality. Even though they are very nicely graphically processed, they are not naturally precisely geodetically surveyed and often the quality of cartographic processing is different. During the 19th century, the take-over of map sources from the imperial prints of the Stable land registry occurred. However, this brought also other issue of the interpretation of forestry map works, namely the topicality of recorded road network, waters and other objects in the maps. Some maps have manually done adjustments, some do not because their main goal are the records of felling and forest cover management and not a precise surface capturing. Thus, it is important to verify the information using also other sources focused on this field of studies.

6. CONCLUSION

The potential of the use of old forestry maps for landscape development research is relatively high. These map works are often forgotten when the detailed researches of the land use/cover changes on smaller size areas are conducted. But in fact, these map works in connection with forest management plans could produce interesting completion of the knowledge gained most often from the national map works of the Habsburg Monarchy in the areas of higher forest cover concentration.

Working with forest maps, it is necessary to allow for the incompleteness of preserved archives, different quality of their processing and changes in forest land management during centuries. The maps are a suitable supplement for data gained from other sources and can help with their accuracy improvement.

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UPLAND ARCHETYPE OF FLUVIAL-EROSION VALLEYS – HRADISKO MUNICIPALITY

Vladimíra Lišková[1] and František Petrovič[1]

[1] Department of Ecology and Environmental Sciences, Faculty of Natural Sciences, Constantine The Philosopher University in Nitra, Tr. A. Hlinku 1, 949 74 Nitra, Slovak Republic,
e-mails: vladimira.liskova@ukf.sk, fpetrovic@ukf.sk

ABSTRACT

Landscape as we know it today, is the outcome of long-term endogenous and exogenous processes, which continuously form it. The landscape archetype can be designated as a primary anthropogenic modification of landscape structure in accordance with natural conditions. For effective landscape use, it is important to know not only its attributes and features, but also changes in the configuration of its elements, especially because of human activity. The research of landscape archetypes is substantiated for that reason. This article deals with the definition and identification of landscape archetypes, evaluation of the Hradisko municipality, which is the area of interest and in two time periods, namely in the years 1949 and 2007. Consecutively we compared changes in configuration of landscape features and evaluated trends in landscape development.

Key Words: *Landscape archetype. Hradisko municipality. Land use. Changes in landscape structure. Trends in landscape development.*

1. INTRODUCTION

The development of human society and technologies in the 20th century is closely linked to the exploitation of natural resources, pollution and devastation of the environment. We are already aware of the negative impact of anthropogenic activity on a global scale. If we want to preserve the natural landscape for future generations, than sustainable development should be imperative. To achieve this, it is necessary not only to study landscape as a whole, but also its historical structure. Our ancestors did not have as many conveniences and did not possess the means to make radical changes to the landscape, which would not be in accordance with natural conditions, which is why the research of archetypes is essential. The development of landscape archetypes allows us to track changes in the configuration of landscape features and the overall landscape structure, therefore we are able not only to evaluate trends of development, determine the landscape-ecological limits, make predictions, but primarily to propose regulations for environmental optimization regarding the utilization and development of a region. In this paper we focus on trends in landscape archetype development in the period between 1949 and 2015.

Generally the landscape is considered a broad portion of a territory, homogeneous for some characters such that it is possible to distinguish the type by relationships between structural and functional elements. The broad scale of a landscape implies, that many processes can be observed in the interior across a broad spectrum of temporal scale (Farina, A. 1998).

According to Jančura (2000) landscape is a system characterized by structural, functional, evolutionary, significance and value relations.

Landscape structure is a carrier of a significant amount of data, which the landscape offers, which allows its classification and evaluation (Jančura, P. 1998).

Primary landscape structure was created by natural processes. It consists of geological composition, geo-relief, climate, waters, soils, flora and fauna.

Secondary landscape structure – reflects physiognomic characteristic landscape features, which form a specific arrangement. It represents changes of the original, natural or potential status (Jančura, P. 1998).

Current landscape structure – reflects the current state of the surface, generally in a time scape of 5 years in relation to the present (Jančura, P. 1998).

Historical landscape structure – represents a historical point of view and is aimed at mostly isolated relicts (Jančura, P. 1998).

2. THEORETICAL-METHODOLOGICAL BASIS

The issue of landscape, as well as landscape archetypes is interdisciplinary. For example in the context of archaeology, the memory of landscape is being examined, as well as landscape archaeology.

According to Beneš and Bůna (1994), **landscape memory** is defined as a mechanism with a specifically in-built feedback. Speculations about the future formation of landscape (in recent times there have been debates about the optimization of landscape structures) cannot just be based in the prolonged presence of humans. It is important to consider the whole history of a landscape and insights of many fields of science, especially those with focus on history. It is vital to look “far behind” when optimizing the landscape. These authors understand archaeology as a science, which synthesizes methods and strategies of ancient communities in longer time periods, which could be used as a certain impulse or inspiration for overcoming the current crisis of our technological society. Archaeology is therefore understood partially as a science of the future of humanity.

Landscape archaeology is an alternative to the tradition of settlement archaeology, particularly in three senses: First, it operates with data from a larger continuous territory, making it possible to study settlement processes in the framework of larger spatial structures (e.g. settlement areas and regions). To create a model from such structures is one of the primary tasks of contemporary (theoretical) archaeology. Second, it is preoccupied with the internal cultural landscape (settlement spaces) and with those components that do not have preserved physical remains or are not recognizable by traditional means. Third, it applies non-destructive (or at least less destructive) methods of data collection, which bring results that would not be obtainable by use of more traditional approaches. Given the aims of landscape archaeology, the results include the identification of the diachronic development of settlement in the area of interest, the reconstruction of the forms of settlement structure and their location within the landscape, and the continuity of settlement areas. At the same time, non-destructive means of research are much more considerate of the archaeological part of cultural heritage, and significantly contribute to the protection of monuments (Gojda, M. 2004).

According to the Oxford dictionary (2015) the word **archetype** originates from the mid-16th century. It is a Latin word of Greek origin “arkhetupon” meaning something moulded first as a model, connecting the words arkhe – primitive and tupos – model.

From a psychological point of view the term archetype is understood as an original model of a person or any prototype (www.psycheandnature.com, 2014), similarly a landscape archetype represents an original model, which can be found in various landscape types and various scales. The originality of this model correlates with natural laws, different genesis, age and scale. Archetype is understood as a manner of adaptation of the landscape to the impacts and changes due to anthropogenic activity, from the early Paleolithic to the present. It is a homogenous area, which differs from its current surroundings. Identical way and intensity of land use with a typical procuration of landscape elements associated with specific forms of relief and typical arrangement of the above elements is characteristic for archetypes. (Hreško, J. – Kanásová, D. – Petrovič, F. 2010).

Pauditšová and Reháčková argue that for each archetype, there is a typical form of relief, land use of same manner and intensity, with a typical representation of landscape elements and their spatial distribution. The determining factor in the division of landscapes to archetypes is the way and intensity of land use, whereby there are units assigned: forests, fields, meadows, etc., which are then specified in more detail by other established criteria. The research of cultural landscape archetypes represents according to Pauditšová and Reháčková (2009) a field of study within which it is necessary to study landscape not only from the point of view of standard landscape-ecological procedures, but also from the socio-historical point of view. To identify archetypes of cultural landscapes, which we can currently identify, it is important to analyze the development of an area, to know its past, not only in terms of quantification of changes resulting from methods and management of an area, but also from the point of view of historical events.

Last but not least it is essential to be aware of the current state of an area (e.g. landscape structure from a quantitative and qualitative point of view, landscape relief etc.). Landscape archetype in this sense, integrates landscape development affected by natural processes, anthropogenic interventions, but also social development.

Archetype typology

According to Hreško, Kanásová and Petrovič (2010) we differentiate between eight landscape archetypes:

1) Lowland fluvial archetypes
2) Fluvial erosion furrow and basin archetypes
3) Karst landscape archetypes
4) High-elevation landscape archetypes
5) Cultural-natural archetype of traditional agrarian land
6) Natural-cultural landscape archetype with mining activity
7) Natural-cultural archetype of vineyards and orchards
8) Cultural-dwelling archetype

These archetypes have been assigned based on the analysis of development, use, land management and last but not least historical events associated with that area. The first step in analyzing archetypes is a visual examination of the landscape, interpretation of aerial images (orthographic view) in multiple scales with relevant identification at the level of a model territory. We can state, that Slovakia as a prototype consists of all assigned archetypes (Lišková, V. 2014).

2.1 Methodology

When assessing the landscape archetype it is necessary to use several different methodologies. Firstly we must assess those natural conditions of the area, which are determinants from the perspective of its use. The selected area Hradisko is special not only due to its midland location in a flysch mountain trench, but also because of the shape if its residential area and adjacent small fields which evoke a pentagram. The reason for the creation of these fields in the direction of level lines and precipices, or more precisely the creation of terrace fields, is likely because of irrigation and an effort of the original population to retain moisture in agricultural areas. Such an arrangement of landscape elements can be observed on map outputs of the second military mapping by the Habsburg Empire (1806-1869) in this area.

Cartographic presentation of results has an important role in the integrated understanding and research of an area. Maps are a vital and effective expressive and communicative instrument. At the same time they are a necessary spatial foundation of further scientific analyses, and also solutions for social practice (Drdoš, J. – Oťaheľ, J. 2007).

The very evaluation of development trends of this archetype is the outcome of fragmental processes, which were performed in the environment of geographic information systems (GIS), specifically ArcMap 10 – from vectorization of raster images, subsequent overlay of layers using the overlay method, to the final analysis and evaluation of findings.

We used aerial images from two periods – 2009 and 1949 for our research and evaluation of development trends. The foundation for mapping the current landscape structure were aerial images in a scale 1 : 5 000, base topographic maps in 1 : 10 000, satellite images from Google Maps, Google Earth and field research. GIS, specifically ArcMap 10 was used to create map outputs which depicts the current status of landscape structure in the year 2015. Simultaneously, verification of landscape elements through field research and comparison to satellite images was undergone.

Further steps were taken in accordance to methods of Jančovič and Petrovič (2012), so an analogue (visual) interpretation of vertical aerial images, consecutively a digitalization of spatial data using the onscreen method on the basis of an analogue visual interpretation of aerial images in the scale 1 : 5000 with GIS ArcMap 10 followed. An aerial image from the year 1949, which was at first ortho-rectified with historical aerial images from the year 1949 in ERDAS IMAGINE was vectorized in GIS ArcMap and a digital model was used, processed by vectorization of level lines from base maps in the scale 1 : 10 000. After the creation of maps an overlay of landscape structure followed.

Vectorized maps were used for further statistic evaluations of the mapped territory. Said maps enabled us to determine the size of individual landscape features and which part of the mapped territory they occupy. On the basis of resulting statistical data and maps, we analyzed the secondary landscape structure of the examined territory in two time periods: 1949 and 2015. By comparing maps of historical and current landscape structure, it is also possible to assess how human impact on the surrounding environment developed. From maps of historical and current landscape a map of changes in the landscape in the period from 1949 and 2015 was created. When evaluating the changes in landscape we have used data from the transformation matrix. Through this we have identified changes to specific landscape elements within a given time period – the type of a landscape element and its size. In detail, we evaluated the spatial proportion of landscape elements, as well as their changes in their abundance.

Within the framework of landscape change assessment in the examined period (1949 – 2015) we have identified trends in the development of the area, which had decisive influence when forming the landscape to its current form. When assessing the most dominant trends, we based our research on landscape evaluation according to Cebecauerová (2007), who defined 12 types of changes to landscape. For the purposes of this paper we chose the following 9 types: intensification of agriculture, extensification of agriculture, urbanization, de-urbanization, drainage, flooding, afforestation, deforestation and overgrowth. In GIS, ArcMap 10 and by identifying these types of change, we created the main trends of changes in landscape in 1949 – 2015.

3. TERRITORIAL DELIMITATION AND BRIEF DESCRIPTION

The Hradisko municipality is located in the north-eastern part of Slovak Republic, in the south-west of Prešov region, in the district of Kežmarok on the southern border with the district of Levoča (figure 1). GPS co-ordinates – 49°3'25" N, 20°31'20" E. The total area is 265.9 ha.

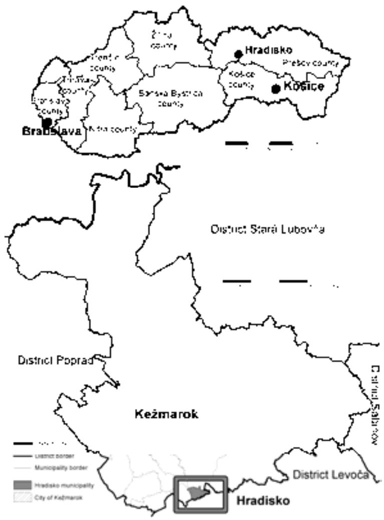

Figure 1: Delimitation of Hradisko municipality

From a historical, but also from the administrative point of view, it belongs to the Spiš region. The municipality is situated at an altitude of 840 m above the sea level in the geomorphological unit Levoča hill-side (table 1). The bedrock of this area consists of two Cainozoic layers. The majority of the territory consists of paleogenic (Oligocene, Miocene) medium- and coarse-grained sandstone in absolute predominance over non-limy clay-stone of bielopotocký complex (Flysch). River basin streams are formed by Pleistocene-holocenic deluvial sediments aggregates (lithofacial) which consist of undistinguished deluviums, rubble and deluvial clay (SGIDŠ, 2015).

Table 1: Geomorphological composition of the municipality Hradisko

System	Alpine-Himalayan
Subsystem	Carpathians
Province	Western Carpathians
Subprovince	Outer Western Carpathians
Region	Podhôľno-magurská
Unit	Levoča Mountains
Subunit	Levoča plains

Source: Mazúr, E., Lukniš, M. 1986

From a morphological-morphometric point of view it is strongly dissected uplands. The plain-fork relief consists of plain-block morphostructure, horst and wedge horst of the Central Carpathian Flysch mountain ranges. In the north-eastern part of the municipality deep V-shaped valleys without or with only weakly developed floodplains are present (Zaťko, M. et al., 2002).

According to Lapin et al. 2002 the Hradisko municipality is situated in a moderately cool, very humid sub-region, in a cool region with average July temperatures ranging from 12° C to 16° C.

From a hydrological point of view (Šimo, E., Zaťko, M. 2002) the waters of the municipality belong to the upland area with a snow-rain combined runoff regime with a slightly distinct secondary increase of water bearing at the end of the autumn and the beginning of winter. Four streams flow through the territory – Tvarožiansky stream on the western border of the territory and its rightward inflows, whereby one flows through the urban area (from south to east) and the second flows along the western border from east to west. The fourth is a leftward tributary of the Ruskinovský stream flowing in the eastern part of the territory from south to north.

The soils are oligobasic dystric acidic Cambisols (Šály, R. – Šurina, B. 2002). Potentially fir woods and fir-spruce woods should be present here. In the river basin of Tvarožná, Submontane and montane floodplain woods should be present. Occasionally we should find oak-hornbeam with lime tree. (Weismann, Ľ. 1986). No conservation areas are in this territory.

The first written mention of the village comes from the year 1264 (SO SR, 2015). According to the official website of the municipality, the earliest anthropological finds come from the Iron Age and archaeological finds confirm the presence of humans in the Bronze Age. In the past the inhabitants lived of agriculture, pastoralism and woodcutting. Currently the municipality has 98 permanent residents of Slovak nationality and roman-catholic confession. However according to the local inhabitants, less than 80 people live here. The events in the second half of the 20th century greatly affected the whole community. According to a personal interview with a local resident, since 1979 the military circuit Javorina had a great impact on the lives of all inhabitants. It occupied the lands of local residents. Aside from that, they were reportedly banned from building any new houses until 1989, because they were to be evicted due to the expansion of the military circuit. After 1989 transport infrastructure was supposed to be meliorated. The road, which connected the village with the two closest towns – Kežmarok and Levoča should have been repaired and the surface was supposed to be reinforced, but currently it almost completely disappeared.

4. LANDSCAPE ARCHETYPE DELIMITATION IN THE HRADISKO MUNICIPALITY

Virtually every type of landscape carries in itself traces of historical-social development and economic changes, which are reflected in the manner of utilization of landscape, land use and the secondary landscape structure. The result is a composition of patterns and textures with more or less regular arrangement of spatial units. The typical features of archetypes are: a certain regularity of patterns, spatial arrangement of elements and their relationship to abiotic and biotic components of the land. The most important factor in maintaining the archetype when land is being used is the relief. Equally important is the relationship between archetypes and socio-economic characteristics of the area, including historical, social and political development. (Hreško, J. – Kanásová, D. – Petrovič, F., 2009).

Fluvial erosion furrows and valleys landscape archetypes

This archetype is typical for the flysch highlands and uplands of northern and north-eastern Slovakia, e.g. in the area of the Oravian Beskyds and Spišská Magura. The forms of relief determine mainly the properties of the geological structure, which predispose the development of morphologically distinct V-shaped valleys or widened erosion furrows between individual mountain ridges. Intense fluvial modelling and hill-slope processes are currently count amongst the most dynamic landscape constituents. Archetype formation is associated with the structure of settlements in bottom and foot locations of valleys with predominantly two-sided build-up area and a proportionately large range gradient of activities from gardens and narrow stripe forms of arable soil, or more precisely terrace fields, through seeded grasslands and pastures, to woodland formations. Fan-shaped, or feather shaped patterns of land cover, with dendritic patterns of vegetation formations in some places in young erosion forms of gullies are the outcome of mutual interplay between humans and natural factors. In the conditions of more restricted river valleys in the mountainous part we can observe linear settlement groupings, which are parallel with the flow of water and vertical element arrangement of land use, arable soil and pastures shaped in narrow symmetrically arranged stripes of ground in the direction of fall lines (Hreško, J. – Kanásová, D. – Petrovič, F., 2009).

The Hradisko municipality bears all relevant signs of a fluvial erosion valley landscape archetype:

- Location in a strongly varied flysch upland
- The occurrence of deep V-shaped valleys
- The urban area is located in an upland trench between creeks
- The urban area is situated on both banks of a local stream
- The morphogenetic shape of the municipality – mass village with an irregular shape of the settlement adjusted to the topography and water flow, which creates a meander
- Behind the settlements there are usually narrow production gardens, agricultural areas – a mosaic of small-blocked fields, tied to meadows and pastures, which border with woodlands (figure 2)

Figure 2: Preserved landscape archetype in Hradisko (north-western view from the urban area)
Source: Vladimíra Lišková (24.7.2015)

Such arrangement of landscape elements is, however, typical for the cultural-residential landscape archetype, so we can assign the Hradisko municipality to both types.

5. HISTORICAL AND CURRENT LANDSCAPE STRUCTURE OF HRADISKO EVALUATION

The structure of the monitored territory is, despite its small area, significantly differentiated (figure 3 and figure 4). Mapping the status of the secondary landscape structure in the year 2015, confirmed occurrence of 16 landscape elements, whereas in 1949 there were only 12 (table 2). The most significant landscape element in 1949 was a mosaic of agricultural areas dominated by arable soils, which accounted for 71.3 % of the total area. Almost 9% of the area consisted of forests, more than 7% of cultivated meadows. A distinctive element was a linear vegetation, which accounted for almost 4% of the territory. This landscape element occurred predominantly on agricultural areas in direction of level lines. Much of this linear vegetation formed borders of narrow fields and separated them. Almost 3% were clearings, 2% were road communication (including paved and unpaved) and less than 2% were house-gardens. Other landscape elements together represented a share of 2% of the total area.

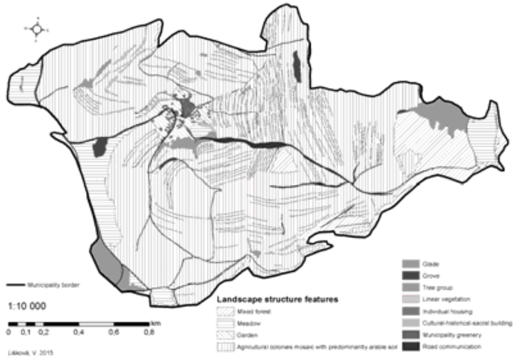

Figure 3: Historical landscape structure of Hradisko in 1949

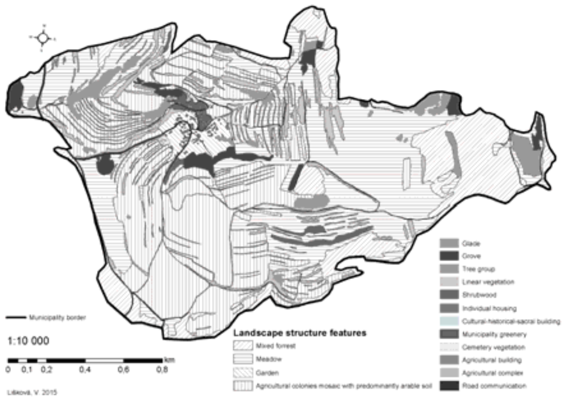

Figure 4: Secondary landscape structure of Hradisko in 2015

In the year 2015, the mosaic of agricultural areas with predominantly arable soil again took up most of the land– almost a third of the whole area 32. 38%. Nearly the same area was covered in meadows (32.36%). The woodland area increased to 16.17% which is almost double the size of the first monitored year. The linear vegetation also increased to almost 7%. Almost 3% consisted of small woods and tree groups. Up to 2% of the territory was covered in house-gardens. More than 1% were roads and clearings. Other landscape elements formed less than 2% together.

Table 2: Comparison of landscape structure development in the years 1949 and 2015

Landscape feature	Year 1949		Year 2015	
	Area (ha)	Percentage (%)	Area (ha)	Percentage (%)
Mixed forest	24,09	9,06	43,37	16,31
Glade	7,68	2,89	3,09	1,16
Grove	1,73	0,65	7,41	2,79
Tree group	2,38	0,90	7,68	2,89
Linear vegetation	10,32	3,88	18,35	6,90
Shrubwood	0,00	0,00	2,37	0,89
Meadow	19,07	7,17	86,78	32,63
Garden	4,79	1,80	5,18	1,95
Agricultural colonies mosaic with predominantly arable soil	188,93	71,04	85,82	32,27
Individual housing	1,05	0,39	0,97	0,36
Cultural-historical-sacral building	0,00	0,00	0,01	0,01
Municipal greenery	0,44	0,17	1,44	0,54
Cemetery vegetation	0,00	0,00	0,22	0,08
Agricultural building	0,00	0,00	0,01	0,01
Agricultural complex	0,00	0,00	0,04	0,01
Road communication	5,45	2,05	3,19	1,20
Overall	265,93	100	265,93	100

6. LANDSCAPE ARCHETYPE DEVELOPMENT TRENDS IN 1949–2015

Same as the Slovak Republic, the Hradisko municipality has undergone three significant economic changes – the rise of agriculture, the creation of the military circuit Javorina, state restructuring after 1989. Within our mapping we recorded seven different trends in development (no change, afforestation, deforestation, intensification and extensification of agriculture, urbanization, de-urbanization), which are depicted in figure 5 and table 3. However the largest part of the territory remained unchanged (almost 53%).

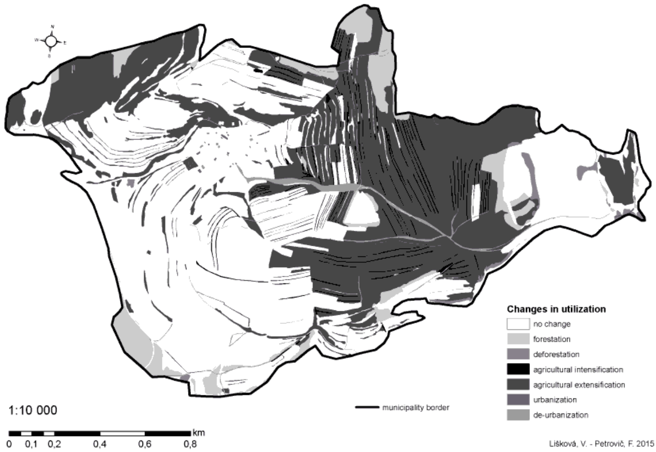

Figure 5: Trends in land use in the years 1949–2015

The second most significant trend was extensification of agriculture, which we recorded on almost 37% of the area. As we already stated, lands with arable soil occupied an area larger than 70% in 1949. After 1989 agricultural lands have been shrinking, but decayed agricultural buildings are evidence of their previous function. The share of arable soil has decreased to almost 33% by the year 2015, while the difference between previous mappings is more than 100 ha. Intensification of agriculture occurred only on 1.6% of the territory. However, it is likely, that this trend will change in the near future, thanks to funding of agriculture. Even if not to such a degree, as it was in 1949. A less significant trend was afforestation. We recorded it on more than 6% of the territory. Deforested areas were less than 1% of the total area.

Table 3: Trends in land use in the years 1949 – 2015

Type of change	Area (ha)	Percentage (%)
No change	139,87	52,60
Forestation	16,75	6,30
Deforestation	2,31	0,87
Agriculture intensification	4,22	1,59
Agriculture extensification	98,76	37,14
Urbanization	0,85	0,32
De-urbanization	3,18	1,19
Overall	265,93	100

De-urbanization is and interesting trend. This trend was observed on 1.2 percent of the territory, on the other hand urbanization less than 0.3%. The reason was area occupation by the military circuit Javorina. The same goes for the fade of the road communication leading through Levoča Mountains to the town Levoča. The use of this road ceased because of the military circuit and for the locals it meant, that from less than 7 km, they now had to travel 34 km to Levoča. Thus making the situation harder for locals from the traveling point of view. Only one road leads to the municipality. Buses do not travel straight into the urban area, the bus-stop is ca. 500m away. Kežmarok, as the closest town, which is at the same time a district town, is more than 14.3 km away. This also could be one of the reasons for de-urbanization.

The acquired knowledge about the cultural landscape, based on results of land use research, have great significance for landscape-ecological research, because they can explain the cultural and historical background and causes for the formation, allocation and links between ecological networks (Žigrai, F. 1999), as well as the functionality of particular landscape elements in landscape management (Boltižiar, M. – Mojses, M. 2010; Mišovičová, R. – Pucherová, Z. 2008; Pazúr, R. – Oťaheľ, J. – Hurbánek, P. 2010). Thanks to landscape structure maps, we can now, not only visually, but also statistically demonstrate, where we should focus further development in the country (Jančovič, P. – Petrovič, F. 2012).

7. CONCLUSION

Based on our research, we can conclude, that the landscape archetype territory we have chosen, was suitable in particular for the reason, that the landscape structure remained unchanged. This was also confirmed by the second and third Habsburg military mapping (1806-1869 and 1869- 1887).

Despite all the time, that has passed the area of the archetype remained unchanged. The most significant landscape features, which remained without notable changes, were mostly linear vegetation, separating fields or meadows. These areas have terrace arrangement and in direction of level lines. Their main function is moisture conservation and soil stabilization (anti-erosion character). The soil is mainly used for agriculture. Besides that, they were a natural boundary between narrow fields. The vegetation is not solely created by anthropogenic activity, because their location coincides with precipices present in this area.

The structure of landscape elements is relatively unchanged due to attenuation of human activity because of the isolated location and weak infrastructure. Seeing that this arrangement lasted for hundreds of years, we can assert, that it is relatively stable and is absolutely adequate for this type of natural conditions.

By examining this archetype, or more precisely the constitution of its elements, we came to the conclusion that the current state conforms to the natural conditions. For this reason it is necessary to preserve it, eventually apply it to other areas, which have similar natural conditions as Hradisko.

ACKNOWLEDGEMENT

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SALES TECHNIQUES IN HOSPITALITY AND TOURISM

Josef Abrhám[1] and Jiřina Jenčková[1]

[1] University of Economics in Prague, Faculty of International Relations, Department of Tourism,
W. Churchill Sq. 1938/4, 130 67 Prague, Czech Republic,
e-mails: abrham@vse.cz, jirina.jenckova@vse.cz

ABSTRACT

At present it is not possible to rely solely on the cost pricing and the power of demand. Fixed prices are being replaced with a flexible price making approach. Businesses in the hospitality and tourism industry are trying to keep the competitiveness through more and more abundant application of sales techniques based on dynamic forms, pricing and immediate response to changes in demand preferences. The aim of the paper is to assess the current situation in both Czech hospitality and tourism services markets in terms of the use of such sales techniques that positively affect the increase in sales and maximize profits. Specifically, there are examined upselling, cross-selling and upgrading techniques. Own questionnaire survey of more than a hundred of relevant entities will be used as the data base.

Key words: *sale, tourism, hospitality*

1. INTRODUCTION

Pricing policy is one of the most important activities of each business entity. It is essential that the price making is in line with the long-term strategy, which provides the company with sustainable income and a profit growth. Today it is no longer possible to rely solely on cost pricing and demand forces. Fixed prices are being replaced with a flexible pricing approach that takes into account additional factors such as customer segmentation, location facility, seasonality, advanced reservation and booking, size of demand, choice of distribution channel (direct or indirect booking), product differentiation, payment terms, etc. Together with the development of information technology, access to internet and increasing competition there were also changes in terms of demand for the services of accommodation facilities. Advanced requests (booking) for accommodation are getting increasingly shorter. Businesses in the hospitality and tourism industry are trying to keep the competitiveness through applying sales techniques based on dynamic forms, pricing and immediate response to changes in demand preferences

The aim of the paper is to assess the current situation on the Czech hospitality and tourism services markets in terms of the use of sales techniques leading to maximizing revenues. Specifically, there are examined upselling, cross-selling and upgrading techniques. A pilot questionnaire survey, which covered the period from December 2014 to April 2015, will be used as a data base. The questionnaire was distributed among respondents through direct mail-outs to specific businesses, with the assistance of the Association of Hotels and Restaurants of the Czech Republic, Prague and the Czech Convention Bureau and over social networks and professional groups on LinkedIn and Facebook profiles. Foreign enterprises are classified as a check sample that may indicate differences between domestic and foreign environment.

2. SALES TECHNIQUES FOR REVENUES MAXIMIZATION IN HOSPITALITY AND TOURISM

Upselling, cross-selling and upgrading are both marketing as well as revenue management tools. The differences between these terms are often neglected and misused by public. The term upselling can be partially understood as an umbrella term for the remaining techniques. Its goal is to sell higher quality product/service than the customer initially ordered. Cross-selling consequently advises its clients on the services of other departments, such as restaurants or wellness. Usually it is a service/product that logically complements the original order. Upgrading aims at the increase in customer satisfaction as one gets better product/service for the same money. Upgrading can also help to mitigate the consequences of bad weather as the guests from cheaper rooms may move to the more expensive (and less occupied) rooms. Upgrading is not necessarily a service for free. Moreover, when using upgrading, great care must be taken because customers tend to expect more. Thus it can, on the one hand, make a customer happier during his first visit but on the other hand, it may disappoint him during the next visit, if he does not get the same service. In practice, this varying approach is more often used in a period of low demand, when, for example, luxury rooms are offered at a price of standard rooms (in order to promote their sales). The client is happy because he got something extra, the hotel suffered no harm in terms of cost and both sides are happy. Upgrading can also be used as a possible solution of the conflict at the reception, as a benefit for a guest or a form of apology.

Use of upselling in tourism is very wide. It can be applied for hotel rooms, conference services, catering services, wellness treatments, in guiding, transport and so on. Its primary objective is to increase revenues for a firm that uses it. Modern technologies can, in terms of upselling, partially replace employees since, for example, a website may propose during booking a more expensive alternative. The actual booking process is optimal for the application of these techniques. It is not always appropriate to wait until the actual arrival of a guest.

One can come across cross-selling mostly at the reception when a guest is checking-in or alternatively within concierge services. At that time, the staff should be able to ask appropriately about the purpose of the visit and subtly suggest other services. The training of this sales technique thus includes a communication with the guest and proper questioning. Cross-selling is not always about raising revenues. Shah and Kumar define four problematic customer groups. The first group of customers requires more and more care and customer support and subsequently the cost exceed the income increased by cross-selling. The second group brings together customers who buy more, but subsequently they return the purchased goods. In the other group we find customers who are passionate about sales and in the last group there are the customers who have an internally set limit for spending. Any cross-selling activities within these customer groups in aggregate lead to a reduction in revenues and thus to the loss (Shah, Kumar, 2012).

A decision whether to use all these promotion selling techniques depends on the information and data stored in the revenue management system – RMS and in-house hotel system – Property Management System. i.e. PMS. The last word to say has always a revenue manager in cooperation with a business director, who based on the data obtained and his own experiences will decide what will be offered, what will be the price and quantity, whether the offer will be limited in time and what will be the cancellation policy. The most important factor at this point is expected demand, which fluctuations may be partially controlled by these techniques.

As already mentioned, without careful training for all staff, the chances of success of these methods are pretty low. Indeed all employees should assign to training, including those who do not have to sell anything at first glance. Services are very fragile and their success and thus the marketability depend on the quality of the staff. From an assistant at the parking lot, through the receptionist, cleaners, workers of middle management to the top management of the company. Quality of services is a very broad topic, which is covered by countless literature. For this paper, more important is the quality of staff training, implementation of procedures into practice and the measurability of effectiveness (Cooper, 2013).

The basis of an effective training is a clear definition of its objectives. It is necessary to determine which services/products shall be promoted in this way with regard to the expectations and wishes of customers. A key slogan is “customer value”, one of the four “Cs” of marketing services. It is interpreted as an inherent value of the service for the customer therefore a degree of satisfaction of his needs. Economists would likely illustrate this issue by using indifference curves while for marketers more important is the knowledge of what the customer finds most convenient and consistent with his needs/wishes. It is important to know his customers, and the more information available, the better for the preparation of individual offers. A perfect knowledge of the staff about our services/products is a must, i.e. a so-called “product knowledge”; the composition of the packages; the composition of meals in restaurants and a recommendation of side dishes; contraindications treatments in wellness branch etc. The best possible option is if an employee can get a “first-hand experience”. Own experience gives him the opportunity to recommend a service/product faithfully and without the constant need for a hard copy manual or scenarios, with which hotel facilities are crowded. Employees should also be given a room for their own inventiveness and propose which service/product would match the other service/product; when and what questions to ask or what else to suggest to the customer. Alternative solutions that do not generate direct income business are not necessarily bad solutions. Their value may occur during subsequent visits. Employees must first and foremost be able to listen to what the customer says, so called “active listening” and to respond to the questions posed.

Although it may be seen like a banal task, in most enterprises providing services this is precisely the stumbling block. Proper communication with the client can reveal hidden desires that we can meet and peacefully apply the options of upselling / cross-selling. Motivating employees can take the form of setting targets, which they all will seek achieving, followed then by a reward. It is necessary to define clearly measurable goals and their remuneration. But motivation should not degenerate into a mindless contest of “who will sell more” but should be set so that it is clear to the employees that the goal is not to sell as many products/services as possible to customers, but sell more to those who worth it.

3. USE OF UPSELLING AND CROSS-SELLING IN THE CZECH REPUBLIC

The following text will provide an assessment of the current situation on the Czech hospitality and tourism services markets in terms of the use of sales techniques in the management in order to maximize sales. Specifically, there are examined upselling, cross-selling and upgrading techniques. As the data base will be used the pilot survey, which covered the period from December 2014 to April 2015, in the form of questionnaire platform in the paid version Survio.com. The data show the results in less than five months and is split into the Czech Republic and abroad. A total of 151 responses from the Czech and 27 replies from foreign tourism businesses were gathered. The questionnaire was distributed among respondents through direct mail-outs to specific businesses, with the assistance of the Association of Hotels and Restaurants of the Czech Republic, Prague and the Czech Convention Bureau and over social networks and professional groups on LinkedIn and Facebook profiles. Foreign enterprises are classified as check samples that may indicate differences between domestic and foreign environment.

The average time of filling out the questionnaire by the Czech respondents ranged between 3-10 minutes. The highest numbers of representatives have accommodation facilities, a total of 84%. Other types of facilities are represented only in the hundreds of units. 78% of companies surveyed are not a part of chain groups nor franchises. The most frequent types of accommodation facilities are four-star hotels (50.8%), followed by three-star (35.8%), five-star (17.2%) ones and lower categories participated in only 5% of businesses. A valid classification according to the website hotelstars.cz for the period 2013-2015 has almost 47% of the participating accommodation facilities. Regarding the distribution of the hotels according to their lodgings, the forces are fairly distributed. In the category up to 25 rooms or 50 beds there were 31.3% of respondents, and 50 rooms/100 beds made 20.9%, to 100 rooms/200 beds made 23.9%, to 250 rooms/500 beds made 17.2% and only 6.7% make the accommodation facilities with a capacity of more than 250 rooms/500 beds. As a check sample, we use catering facilities, where 27.4% represent a facility up to 50 seats and the largest group make restaurants with up to 100 seats, concretely 39.7%. Restaurants with 200 seats occupy 19.2%, with more than 200 seats the share is 13.7% of enterprises. Traditionally, most of the respondents replied in Prague and the Central Bohemian Region (54.3%). In the second place there is South Region (12.6%), followed by the Karlovy Vary Region (10%), Zlin (6.6%), the Moravian-Silesian and Liberec Region (6%), the Southern and Hradec Kralove Region (5.3%). Other regions participated within the range of 2-4%.

The research results show that the majority of tourism businesses (68%) provided their employees with training on sales/communication techniques such as upselling, cross-selling, etc. 60% of them provided just for a single training. 24% of enterprises train staff at least once a year, 17.5% of the facilities do that two to three times per year. In 34.6% of cases external expert company was contracted; in the full 57% there was in-house training provided mostly by a direct supervisor. A significant presence among trainers has also AHR ČR and CzechTourism (in full 48% of cases).

The question of a measurable effect of the training remains unanswered, because so far the results are irresolute. The representatives of businesses (43%) who reported an improvement emphasized a factor of innovation and the associated motivation of the employees. Quite often mentioned reason is the increase in the number of sold rooms of superior class and ancillary services. 56% of companies believe that there has been a steady improvement. Only as a temporary (approximately three months) see the improvements the representatives of 28% of enterprises.

As important must be considered a remark of one of the respondents who highlights the dependence on specific employees. He reiterates the importance of selecting quality employees and the thoroughness of their training. Frequently mentioned motivation also plays an irreplaceable role. Only 68% of employees are motivated to better sales. Out of this, over 90% of firms choose a financial reward. The remainder relies on: “good feeling”; benefits within the hotel; the material gifts or publication of the achievements of individual employees or a combination of both.

An effect of employee fluctuation is a contentious issue. The respondents of this question were divided into two identically large parts (45%), one of which asserts that there is no problem to train employees continually, while the second part cannot cope with this problem (44%). From the comments of other participants of the questioning one might conclude that the impact of fluctuations cannot be denied. 6% of the enterprises have no problem with the staff fluctuation. The issue of selecting quality employees has been echoed. An important outcome of this survey make the answers about manuals on sales techniques. Although almost 64% of companies use upselling / cross-selling as a standard part of a sales strategy, “upselling manual” is at disposal only at every other business.

A room for improvement can also be found in the feedback. It uses only about 52% of enterprises thus nearly 48% of the companies completely ignore its importance. Most respondents (67%) stated that they obtained the feedback from PMS and similar systems. Almost 40% of the representatives monitors key performance indicators (achieved average price of accommodation, RevPAR, etc.) and 31% of enterprises evaluates the best employee/department. Here it was possible to choose from several possible answers. Nearly 20% of businesses does not have a responsible person monitoring the results upselling.

The most important skill of the employees, according to data from the questionnaire, is a perfect knowledge of the offered product/service (78%); communication with the guest, 76%); empathy and knowledge of customer needs (61%) and their own sales skills (44%). The majority (69%) of the companies held regular training on the current range of products/services (once or twice a year). The training is usually led by a direct superior (88%) or a product manager.

The businesses that have not trained their staff on sales techniques so far, do not count with the correction in the near future (55%). Those who are planning training prefer a tailored training in their premises (68%). Some of them (21%) would also participate in the training in the nearest major city. There are also companies that prefer online methods (e-learning – 8%).

In general, there is a consensus that upselling/cross-selling is benefiting (83%). It is seen as a kind of an employee benefit, but also as a benefit for the employer who has the higher sales, average prices etc. The strongest reason is the client's benefit (76%) who feels that he is well treated and is therefore satisfied.

Foreign participants of the research are very diverse. At the moment it is smaller but an interesting check sample. Out of the twenty-seven respondents one comes from the United States of America, nine from Europe and twenty from other countries. From Europe there participated companies from the UK, Spain, the Netherlands and Croatia. From other countries one could mention a representative of Australia, India, Indonesia, as well as Oman, Cameroon and Macao. As with respondents from the Czech Republic, in this case prevail the representatives of accommodation facilities (63%). Abroad, however, is dominated by chains/franchises – more than half (55.6%) of the participants are part of a group. Individual categories of accommodation facilities are mostly represented by five-star hotels (30%) and four-star categories (35%). 20% were represented by the three-star hotels, 10% are representatives of the accommodation facilities of lower categories. Most of them (72%) lack an official certification according to uniform classification or its equivalent. The reason may be the lack of a similar system outside of Europe, or a different understanding. Most of the respondents represent accommodation facilities with more than 100 rooms (75%) where 30% of them are larger than 251 rooms. Among catering facilities clearly dominate companies with more than 100 seats (72%). The most numerous are the representatives of companies with more than 200 seats.

As in the Czech Republic, the majority of companies surveyed (81.5%) has trained its staff in sales techniques. Quite the opposite, however, is the frequency of access to training. Almost half of them carry out the training at least 2-3 times/year. Over sixty percent of respondents (unlike CR) use a direct supervisor as a trainer. External companies, so popular in the Czech Republic, occupy the fourth place (17%).

The measurability of the effects of training confirms 52% of research participants, which is a similar result in comparison with the Czech Republic, where the responses were evenly matched. Once again is highlighted mainly the impact on customer satisfaction as well as the improvement of employee skills to communicate and thus sell. A view of the durability of this improvement is consistent with the results from the Czech Republic – the majority of companies believe that there has been a steady improvement (62%), while a third believes only in a temporary effect.

Companies abroad cope better with staff fluctuations than in Bohemia. Over fifty percent of foreign respondents did not see the fluctuation problem. Of the opposite opinion are, however, inconsiderable 40% of enterprises. Surprisingly identical results were given for a question on the topic of the "upselling manual". Despite the fact that even in foreign countries 70.4% of enterprises consider upselling/cross-selling techniques as an important part of their sales strategy.

The motivation is again for the overwhelming majority (90.5%) of companies a matter of finance. Other respondents refer to the positive feedback from a customer, which leads to a better feeling of the employee, or to use of pricing for employees with the best results. The feedback has more weight (it uses over 82% of enterprises). Resources are used in a similar way as in the Czech Republic – most businesses rely on monthly analysis of data from business systems. A similar percentage relies on the evaluation of the performance indicators and the valuation of the best employees. As a further variant of feedback one respondent mentioned the mystery shopping. Mystery shopping, or "fictitious purchase" is a frequently used tool for quality control and also in the Czech Republic this phenomenon is covered by several specialized companies.

Foreign respondents are in line with the domestic ones also in terms of the requirements of the basic skills of the staff. Abroad, however, the leading requirement is the empathy and the ability of understanding the customer's needs (81.5%). Then follow product knowledge (78%) and communication skills (67%). Even here there are regular trainings on the current range of products, usually at least 1-2 times a year (80.2%). This training is carried out (as in the Czech Republic) by a direct superior (95%).

In comparison with the Czech Republic companies abroad are more open to new procedures. Most companies (74%) therefore plan to train its employees in sales techniques. The preference of a form is shared with the Czechs and they would like to carry out a training tailored to the needs of their organization in their own premises (74%). The second most popular option is an e-learning (33%). Only 11% are willing to drive to the nearest town.

96% of foreign respondents are convinced about the benefits of upselling/cross-selling. The most important thing for them is a benefit to the company itself (89%), the benefit to the customer (78%) and employees (74%).

In conclusion we can say that everything depends on the selection of high-quality employees. The issue was covered by several authors. Vaculka and Poláčková recommend hiring managers to use a single questionnaire for at staffing with approximately twenty questions that will help to get to know candidates better, outside pure biographical data. The authors recommend focusing mainly on communication skills, appearance, language skills, organizational skills, ability to react, assertiveness, stress resistance and flexibility. The emphasis is also placed on the manuals of all kinds. Training is seen as a crucial determinant of success and there is given an example of a training plan (Vaculka, Poláčková, 2008).

Employees can be seen as a basic pillar in the field services, although some positions are being replaced by modern technology (reservation, check-in, etc.). HR professionals develop increasingly detailed tasks for participants in assessment centres. The so-called "probationary periods" are used, candidates undertake a variety of psychological tests and IQ tests. During the selection process and the first few months of the employment everybody behaves like a perfect employee and ocnducts his duties excellently. Over time, however, the performance decreases. There may be several causes – a kind of "sobering" and finding that he is tired of the job description; lack of job satisfaction; too low/high demandingness; bad boss who just criticizes; inadequate financial evaluation and remuneration in general and so on. A thirst for knowledge is a human nature so some may be demotivated by a lack of continuous learning and growth in the industry. On the other hand, there might be a lot of training, however, many of them nowadays are poorly conducted and the staff perceives it as a punishment rather than a reward and a move forward.

The research showed that the most commonly used employee motivation to exercise is money. There are alternative methods, which are based on an improved feeling of employees. These are contributions to sport, health, culture, food expenses; the use of the hotel wellness/kitchen free of charge; language courses/internship/exchange within the brand network. As a motivation can be understood also teambuilding or social events for employees since they lead to mutual deeper understanding among colleagues and increase their sense of belonging. The ideal way is to ask each employee what motivates him, and come to the common understanding or a compromise. Employees can surprise you and ask for something completely trivial.

The most fundamental question remains the measurability of the results. Today, the majority of hotels have at disposal various management systems, from simple cash register systems to complex automated revenue management systems. Evaluating the benefits of training is always complicated and it is necessary to have enough historical data for comparison. As a result, evaluating the contribution of anything is often a pure estimate based on the assumptions and conjectures.

Real figures showing an increase in economic indicators can be easily exported and analysed. It is necessary to filter out external causes such as sudden changes in the market or holding large social events. It is always necessary to monitor data from a certain distance, both temporal and physical. Distance allows us to see things from a different perspective, and in some cases also reveals certain regularity in the development. Most important for any evaluation of the data is again an employee with enough training and experience, in this case mostly a revenue manager. In the Czech Republic there is really a critical shortage of good revenue managers and usually it is necessary to look for abroad. Pull-over of a quality revenue manager can cost a lot of money, but it is an investment that will return many times.

The volume of data having been analysed is too small for finding hard conclusions. Meanwhile, we are at the beginning of a long-term research (that will continue in the upcoming years 2015/2016) in this area and the outputs will gain more weight and meaning in the course of time. The aim of the paper was to outline the issue and drum up the interest of professionals in this area. The more experts solve this problem, the more likely the development of the tourism market moves forward.

4. CONCLUSION

Based on the research conducted we can state that the majority of accommodation facilities in the Czech Republic uses sales techniques leading to additional increases in revenues. However, applying relevant sales techniques cannot be implemented effectively without the appropriate staff training. Training should be done on regular basis, at least once a year. Out of those surveyed, more than two-thirds of the respondents provided its staff with training on upselling and cross-selling sales techniques. More than half of the companies assessed positively the impacts of training activities in relation to the increase in sales. Nearly a third of respondents, however, recorded after the introduction of new methods and training of employees only a limited effect.

As to maintain a permanent good performance of the staff, it is necessary to apply appropriate motivational techniques. The vast majority of those surveyed chose the form of financial incentives, which they combine with the benefits within the hotel, with presents of a material and non-material nature as well as with publishing the achievements of individual employees. Employee bonuses are usually calculated as a percentage of the additional revenues that were generated as a result of new sales techniques introduced.

The effect of the employee fluctuation is a contentious issue. The respondents grouped into two almost equal parts. Roughly half of the respondents believe that continuous staff training works positively. The second half of the entrepreneurs fails to train the staff on a regular basis. Only a negligible number of subjects show no problem with the staff fluctuation.

A fundamental question also represents the measurability of the results. Only two-thirds of the accommodation facilities use for the evaluation of the sales performance any information technology in the form of hotel IT management systems. Quantifying the impact of new sales techniques is more accurate in the medium to long term, because it is necessary to filter out the external influences on the strength of the demand as such.

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