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Department of Landscape Management
Faculty of Forestry and Wood Technology
Mendel University in Brno

Public recreation and landscape protection – with nature hand in hand…

Conference proceeding

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ACCESSABILITY OF ELEMENTS OF ATTRACTIVENESS FOR INHABITANTS AND TOURISTS IN CADASTRAL AREA SOBĚLICE

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Abstract
The current trend of recreation solution blends together with designing of elements of attractiveness in countryside and the ecological balance of all landscape features. This nature-friendly recreation brings a new view on the sphere of recreational exploitation of agricultural cadastral areas. Even like in a one-sided used landscape can be seen recreational potential, that can be further developed by specifically and newly designed elements of attractiveness.

Key words: controlled recreation, leisure time activities, landscape planning, comprehensive land consolidation

Introduction

Connecting recreational attractiveness of a landscape and land consolidation may obtain a new view on the sphere of recreational exploitation of an agricultural cadastral areas, which are mainly made of agriculturally used landscape. For this field research we can also use universal planning. This type of planning can include designing of recreational and leisure outdoor grounds as well. In the context of land consolidation as the biggest contribution is considered fact, that those areas can be delimited already on the level of parcels. In terms of recreational use of the landscape is really helpful the idea of controlled recreation as well. This means targeted planning of recreational activities in open countryside and thoughtful accessibility of cadastral area.

Materials and methods

As representative model landscape was chosen cadastral area of Sobělice (Fig. 1 Cadastral area Sobělice). Village of Sobělice is a part of village of Rataje and is located in Zlín region, west direction from the town of Kroměříž. Comprehensive land consolidation with unfinished uniting (the aim of analysis are plots which were not completed with land consolidation under the previous special legislation) in the village of Sobělice were started mainly to make accessible and to maintain anti-erosive protection of the cadastral area. The plan of comprehensive land consolidation with unfinished uniting in the area of Sobělice was approved in February of 2013 according to Pomothyová (2016). The building permit of the main field road C16 including planting of local biocentre, 2 local biocorridors and one interactive feature according to plan of comprehensive land consolidation was approved in February of 2016 (Pomothyová, 2016). Based on this approved plan of the comprehensive land consolidation with unfinished uniting, we have used a referential point of comprehensive land consolidation that is presented by the tower of Sobělice chapel.

Methodic classification of elements of attractiveness is based on approach that defines the elements of attractiveness according to Kubíčková and Fialová (2015). Next step is classifying cadastral area into zones of attractiveness according to the accessibility for inhabitants and tourists in a certain area. This division is made by

ArcMap program. Buffer zones that divide cadastral area into several parts are based on the referential point. Referential point is set on an introductory of land consolidation proceedings. This way determined buffer zones represent air distance from the central point of the village to the edge of the cadastral area as well as they divide cadastral area into several parts that contain different number of attractiveness. Next step in the solution is measurement of real distance from referential point to the specific elements of attractiveness. Real distance is based on the road network. This division gives us real idea of accessibility of elements of attractiveness, based on real distance, time and different transit options (walking, biking, public transportation).

Results

Based on division according to Kubíčková and Fialová (2015) were between already existing elements included important sacral inventory of the village (2x), area for physical education and sport, forest association and areal system of ecological stability. Transportation accessibility of 1 bus stop was also considered. Into newly designed elements of attractiveness were included 3 areas. First newly designed area is near proximity of physical education and sport area on the parcel of land number 1159, owned by the village of Rataje-Sobělice. It would be outdoors sport ground that would be connected to the physical education and sport area. Outdoor fitness trails and outside gyms represent new viewpoint on leisure activities, even in a very small village with a lack of other leisure activities according to Hybaj (2016). Second and third area are located on the parcel of land number 1118 and 1128, also owned by Rataje-Sobělice. It would be a relax park. Parcels are near proximity of forest association area. Location would be split by a new path, wheelchair accessible. Part of the path would be several wooden benches, a gazebo and planting original broad-leaved woody plants with emphasis on bigger distance between them, because it provides reasonably bigger safety and better countryside views. Elements of attractiveness were measured by ArcMap program. Because of small area of the cadastral landscape were buffer zones sized 200m, so 200-1200m (Fig. 2 Buffer zones of elements of attractiveness). Accessibility of elements of attractiveness by roads are located between 400 to 800m from the central point of the village (Fig. 3 Accessibility of elements of attractiveness by roads). Occurrence of elements of attractiveness decreases in direct proportion to further distance between the referential point and individual elements of attractiveness.

Discussion

How can we influence trend of tourists in countryside? On the basis of good designing trails in the landscape, we can regulate (decrease/increase) the number of tourists in the area. Also with aesthetically designed trails, we indirectly affect tourists for its use and at the same time reduce the amount of freely moving tourists in sites where it is not useful. It is necessary to say that it is not the intent of this newly proposed recreation method strictly restrict the free movement of tourists in the landscape. In our opinion, great potential of this recreation method is seen mainly in the areas and sites which are predisposed to damage and loss of biodiversity and ecological balance.

From this reason we have to know occurrence of current and newly designed elements of attractiveness in the cadastral area. It is first big step for the solution. Secondly we have to find out access possibility to the elements of attractiveness and accessibility via cadastre for inhabitants and tourists. After this we can complete the idea of controlled recreation.

Fig. 1: Cadastral area Sobělice

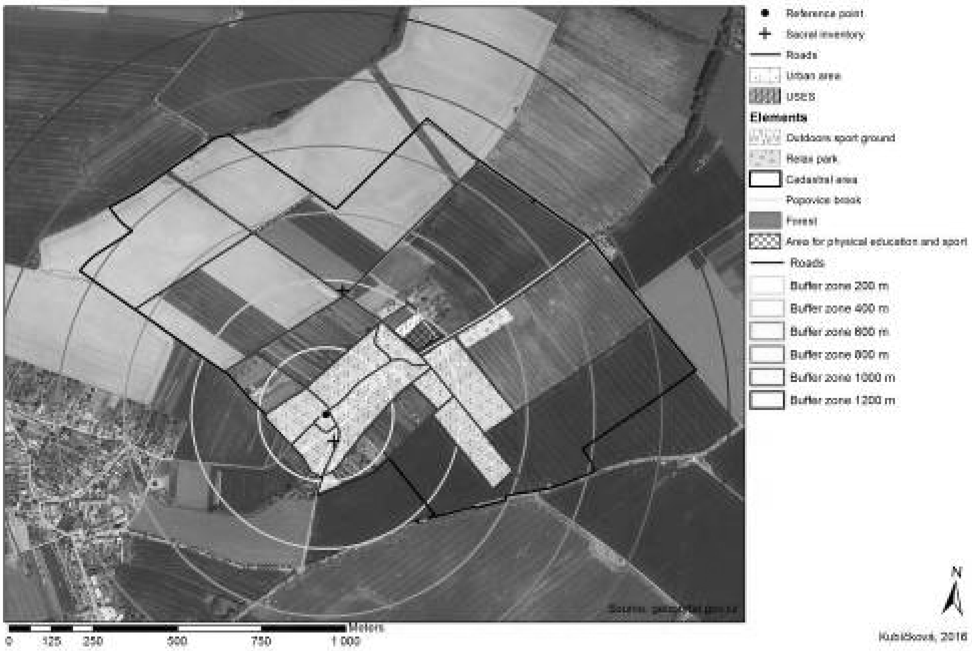

Fig. 2: Buffer zones of elements of attractiveness

Fig. 3: Accessibility of elements of attractiveness by roads

Conclusion

In terms of recreational use of the landscape, we proceed to controlled recreation. This means targeted planning of recreational activities in open countryside and thoughtful accessibility of cadastre, site and place (ie. elements of attractiveness) to keep them in balance with all landscape features. In our opinion the idea of controlled recreation is in step with sustainable development of landscape, nature-friendly recreation and universal planning. At the same time, these delimited elements of attractiveness can be used as initial base or actualization of local plan. It can be used as a base for the local government for strategic decisions about the area of the village as well. This division also gives the local government real idea about distribution of the elements of attractiveness in their village as well as their accessibility. Need to say that accessibility of specific elements of attractiveness on the area of a village through road network should reflect especially need of the most vulnerable inhabitants as are handicapped, seniors and families with prams. If those areas are accessible for those inhabitants, they are most likely to be accessible for the majority of inhabitants.

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Souhrn
V současném stavu řešení rekreačního využívání krajiny se prolíná snaha propojit navrhování prvků atraktivity s ekologickou rovnováhou krajiny. Tato přírodě blízká řízená rekreace přináší nový pohled na sféru rekreačního využívání převážně zemědělsky využívaných katastrálních území. I v takto jednostranně využívané krajině spatřujeme rekreační potenciál, který se snažíme rozvinout za pomoci již existujících a také nově navržených prvků atraktivity. Z tohoto důvodu musíme vymezit nebo nově navrhnout prvky atraktivity vyskytující se v katastrálním území. Dále je nutné zajistit přístup k jednotlivým (jak existujícím, tak nově navrženým) prvkům atraktivity skrze cestní síť. V této fázi je nutné podotknout, že na základě dobře funkčně a esteticky navržených a propojených stezek můžeme nepřímo ovlivňovat počet přicházejících turistů do lokality a naplňovat tak principy řízené rekreace.

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ACTIVE ANTIEROSION CONSTRUCTION

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Abstract
The paper emphasizes the significance of breakwaters as active protection of the bank toe.The essential effect of these protective structures is the prevention of origination or development of bank erosion Brno dam. Breakwaters can be an important element of water quality protection and minimization of eroded bank parts transport into the reservoir – they can significantly reduce sedimentation of reservoirs.

Key words: dam, reservoir, bank stabilization, erosion

Introduction
Bank erosion (abrasion) is a major problem in many reservoirs. When designing bank stabilization of reservoirs several possible approaches are possible. A stabilization implemented directly in the endangered (damaged) bank is the most reliable. This is passive protection which is often used only when the bank damage is revealed. This usually technical stabilization of the bank toe is supplemented with modifications of the bank higher above – mainly bank sloping of 1 : 1.5 or lower and other biotechnical modifications: humus removal, bank sowing with a suitable grass mixture, planting of woody species to form a riparian stand, planting vegetation to the stone toe, etc.
Another option is an offshore stabilization using technical or biotechnical breakwaters. The presented paper discusses this type of active reservoir bank protection against erosion.

Effectiveness breakwaters – reservoir Brno
The results presented are directed to reservoir Brno. Breakwaters have been used for bank protection on sea shores or shores of the Great Lakes for centuries. However, the application of this stabilization type in reservoir banks is much less frequent. Reservoir bank zones not always offer conditions suitable for breakwaters, mainly as regards its establishment (especially because gradually descending bottoms are suitable, areas without strong leisure utilization, “operating” breakwaters needs some care, etc.).
In spite of this, these stabilization structures used to be designed in the past, as proved by pictures in Der Wasserbau by A. Schoklitsch from 1930. The biotechnical types of breakwaters described in this book have become models for the idea to implement a similar protection to selected parts of the Brno Reservoir shore.
Very considerable erosion damage to banks of the Brno Reservoir is found in a part called Osada. The erosion walls there (the bank walls created by erosion) pose risk mainly to fishermen searching for spots without leisure traffic, but also people coming and standing at the edge of an eroded bank or directly on the overhanging platform, unaware of the fact they could fall into a more than 5m depth. We will focus

on stabilizing planting on an erosion platform – biological stabilisation - willow vegetation.

Fig. 1: The density of vegetation on erosion platform (2015)

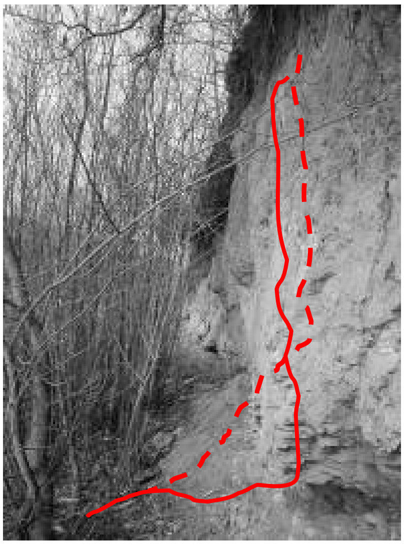

Fig. 2: Material of the shore remain for biological protection (2015)

Legend (fig. 2): Condition before planting willows
Actual status during the 2015

Conclusion

Streamside trees and shrubs, requirements for their spatial arrangement and quality of the biological function are among the basic aspects of the conception of bank stabilization.

This means the issues related to the vegetation on the erosion plateau design will be of equal importance for a designer as the issues of capacity and stability of the designed dam. The basis of the article is to emphasize the importance of vegetation on the banks of reservoir.

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Souhrn

Prezentován byl postup stabilizace abrazní plošiny a paty abrazního srubu, přičemž hlavním požadavkem bylo neumožnění působení dynamického účinku vlny v patě abrazního srubu. Toto se povedlo realizovat výsadbou pěti řad vrbových prýtů *(Salix fluviatilis) v délce cca 12 m* na abrazní plošině pod poškozeným břehem. Vrbové porosty působí jako vlnolam a při zpětném ústupu vlny zadrží materiál, který by byl jinak smyt do nádrže.

Výsledkem prezentované stabilizace je postupné ukládání opadu z abrazí poškozeného břehu a jeho následné přirozené sesvahovávání (viz obr 1).

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ANALYSIS OF THE STRUCTURE OF EXPENDITURE OF LOCAL EMPLOYEES OF THE TFE MASARYK FOREST KŘTINY

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Abstract

The article deals with partial results of the project of the Internal Grant Agency of Mendel University in Brno "Importance of the Training Forest Enterprise Masaryk Forest Křtiny for local economy", which was solved by the Department of Forest and Wood Products Economics and Policy and by the Department of Engineering Constructions, Landscape Design and Protection in the year 2015. The article explains the analysis of local expenditures of employees of the Training Forest Enterprise Masaryk Forest Křtiny (hereinafter TFE MF Křtiny) necessary for calculation of a score of the local multiplier. In order to determine characteristics of local expenditures of employees, the questionnaire survey was carried out, which quantified net annual income of every employee of the TFE MF Křtiny in 2014 with permanent residence in districts Brno-Venkov or Blansko and the structure of expenditures. The findings were subsequently used for calculation of a score of the local multiplier 2, 3. The local multiplier is a microeconomic index enabling to quantify and evaluate socio-economic benefits of a chosen subject for local inhabitants and entrepreneurs. The research in this area is reaction to still unsolved problems of local economy in the forestry sector and the nature and landscape protection sector, which result from the objectives stated in strategic documents of sustainable development with effectiveness in the national as well as international level.

Key words: analysis, economics, local expenditure, local multiplier, management

Introduction

Training Forest Enterprise Masaryk Forest Křtiny is an organisational part of the Mendel University in Brno and a special-purpose facility of its Faculty of Forestry and Wood Technology. The enterprise was founded in 1923. The total area is 10,495 ha. The forest cover is approximately 98 %. The enterprise is divided into three forest districts – Vranov (3,345 ha of forest land), Habrůvka (4,006 ha forest land), Bílovice nad Svitavou (2,920 ha forest land, 3,640 ha total land). (TFE 2014)

Local multiplier (LM) is a tool created in 2002 thanks to the British independent think tank of New Economics Foundation (NEF) under the leadership of the economist Justin Sacks. NEF deals mainly with social, economic and environmental issues, with its goal being to alter the economy so that it is beneficial for both humans and the planet. The organisation has been working continuously since 1986 (REJMANOVÁ 2014).

The local multiplier is a number whose value can be determined for any institution (company, shop, local authority, non-profit organisation, social enterprise, or even a household), which has certain expenditure and wants to know the extent to which the money spent stays in the region. (KUTÁČEK 2007A; modified)

In the Czech Republic, the calculation of the local multiplier has still not reached widespread public consciousness. The issue of local multipliers is tackled by

KUTÁČEK (2007A, B) and JOHANISOVÁ (2007, 2008). The methodology of calculation was applied in a small number of theses, such as DOŠEK (2006); JEŽKOVÁ (2008); NOVOTNÁ (2011); REJMANOVÁ (2014); SILOVSKÁ (2015). Foreign authors include SACKS (2002); CIMADOMO, BÉNASSY-QUÉRÉ (2012).
The first results achieved by the application of local multipliers 2 and 3 (LM2, LM3) can be found in the area of nature conservation in the dissertation by BŘEZINA (2014) called "The economic aspects of the Administration of Podyjí National Park". A portion of the results was published by BŘEZINA ET AL. (2015) in the scientific article "The influence of the Podyjí National Park Administration on the local economy in the Znojmo district (Czech Republic)".

Materials and methods

The local multiplier (LM) was used as a methodological tool for determining the share of the organisation in question (field districts of TFE MF Křtiny) in the economy. The calculation of the local multiplier takes place in three rounds. In the first round, the total revenue in each of the individual forest districts of TFE MF Křtiny is determined. In the second round, the expenditure of TFE MF Křtiny for employees and suppliers is determined, divided into local and nonlocal. The third round examines how the local employees and suppliers further redistribute their payments.
The calculation of the LM included the revenue and expenditure only within the individual forest districts. Other organisational components of TFE MF Křtiny were not considered.
For the purposes of research, the territory of the Brno-Country and Blansko districts was chosen.
In order to obtain the data for the calculation of the third round of LM3, a questionnaire survey was performed.
The survey for employees, which was designed to determine how the employees spend money in the Brno-Country district, Blansko district and outside these districts, was inspired by the statistic evaluation of family accounts used by the Czech Statistical Office (CZSO). The questionnaire survey for the employees in individual forest districts of TFE MF Křtiny was offered only to employees who are permanent residents of the Brno-Country and Blansko districts.

Example questionnaire for employees

Items of expenditure:

- food, beverages, tobacco
- clothing, footwear
- housing
- water, energy
- transportation, fuels
- the post, telecommunications
- real estate tax
- other taxes
- repayments (credits, loans, insurance, savings)
- recreation, sport, culture
- other goods and services

The value of the total annual revenue of the employees in thousands CZK was divided into 7 categories. The first category started at 100 – 150 thousand CZK. The

subsequent division was per 50 thousand, with the last category in the range of 400–450 thousand CZK (the calculation included the median value of the income category entered in the survey). The individual items of expenditure for which the respondents (employees) spent money were listed in percentages. A recalculation to CZK from total income had to be performed.
From the questionnaire, control samples were created – the questionnaires sent (N) and filled-in questionnaires received (n) for the estimation of the relative frequency (p) of local expenditure of local employees and the relative frequency (p) of local expenditure of local suppliers based on a point estimate. To increase the explanatory power of the result, an interval estimate of the quantity (p) was performed with the use of a correction coefficient (k) for random errors of relative frequency (O'_p).

Methods of calculation

- Dispersion of the control sample (s^2)

$$s^2 = p(1-p)$$

- Standard deviation of the control sample (s)

$$s = \sqrt{p(1-p)}$$

- Random error of relative frequency (O'_p)

$$\sigma_p = \sqrt{\frac{s}{N}}$$

- Correction coefficient for random errors of relative frequency (k)

$$k = \sqrt{\frac{N-n}{N-1}}$$

(adjusted according to SWOBODA 1977)

Results

Number of employees and labour costs by forest district:
Vranov forest district – 13 (3,907,321 CZK)
Habrůvka forest district – 46 (8,590,647 CZK)
Bílovice nad Svitavou forest district – 23 (4,537,920 CZK)
The total number of employees at each of the forest districts was established as 82 employees (total of 17,035,888 CZK in labour costs). These were local employees. The structured interview yielded 57 filled-in questionnaires from employees (69.51 %).
The distribution of expenditure of local employees of the TFE MF Křtiny forest districts in the individual items for 2014 is shown in Figure 1.
The total of 57 employees who filled in the questionnaire spent 10,800,000 CZK in 2014 (4,272,750 CZK locally and 6,527,250 CZK nonlocally). 39.56 % was spent locally and 60.44 % nonlocally. Food, beverages, tobacco constituted 31.47 % of total expenditure of the employees. Housing, water, energy constituted 22.35 %, transport, fuels 11.52 %. All these items together accounted for ca 65 % of total expenditure of employees in 2014.
From the total local expenditure of employees, an interval estimation of quantity (p = 39.56 %) was performed. The standard deviation obtained from the control sample (with a range of N = 82; n = 57; p = 0.396) was s = 0.489; random error of relative

frequency was $Ơ_p$ = 0.054 (i.e. ± 5.4 %). With the use of the calculated correction coefficient of k = 0.556, the result is $Ơ_p$ = (0.054 × 0.556) = 0.030 (i.e. ± 3.0 %). Now, the statements can be refined. With 95 % certainty, the local expenditure of local employees was between 36.56 and 42.56 %.

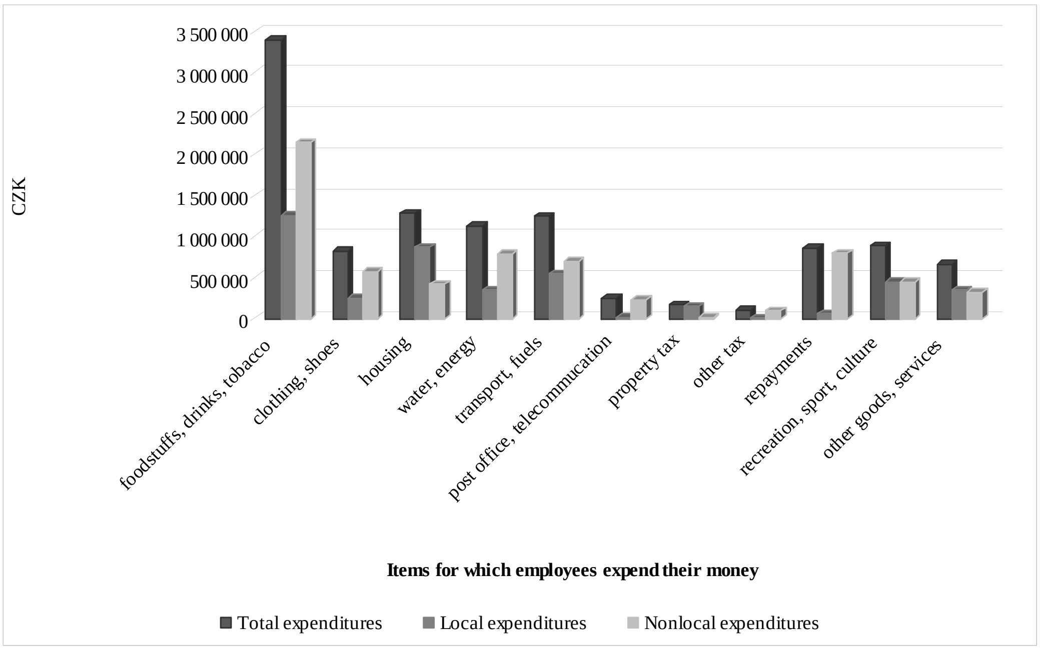

Fig. 1: Distribution of expenditure of local employees of the three TFE MF Křtiny forest districts in CZK for 2014

Discussion

The total of 57 employees of the forest districts of TFE MF Křtiny expended in 2014 31.47 % of total expenditure on food, beverages, tobacco, 22.35 % on housing, water, energy and 11.52 % on transport and fuels. All these items together accounted for ca 65 % of total expenditure of employees in 2014. This is shown in Figure 1. BŘEZINA ET AL. (2015) state that 24 employees of the Administration of Podyjí National Park expended in 2012 29.14 % of total expenditure on housing, water, energy, 27.53 % for food, beverages, tobacco and 15.02 % on transport and fuels. All these items together accounted for ca 72 % of total expenditure of employees in 2012.

Conclusion

The forest districts of TFE MF Křtiny in 2014 significantly supported the local economy in the area of interest, especially due to the employees of the enterprise, who spent their income in the districts of Brno-Country and Blansko. To increase the explanatory power of the results obtained from the questionnaire survey, an interval estimate of the quantity (p) was performed with the use of a correction coefficient (k) for random errors of relative frequency (Ơp). We can assert with a certainty of 95 % that the local expenditure of local employees of TFE MF Křtiny in 2014 was within the interval of 36.56 % to 42.56 %. The local multiplier is one of the potential tools to determining the economic contribution of entities to the local economy of a region.

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Souhrn
Článek se zabývá dílčími výsledky projektu Interní grantové agentury Mendelovy univerzity v Brně „Význam Školního lesního podniku Masarykův les Křtiny pro lokální ekonomiku", který byl řešen Ústavem lesnické a dřevařské ekonomiky a politiky a Ústavem inženýrských staveb, tvorby a ochrany krajiny v roce 2015. Příspěvek řeší analýzu lokálních výdajů zaměstnanců Školního lesního podniku Masarykův les Křtiny (dál jen „ŠLP ML Křtiny) nezbytných pro výpočet skóre lokálního multiplikátoru. Pro určení charakteristiky lokálních výdajů zaměstnanců bylo provedeno dotazníkové šetření, které kvantifikovalo čistý roční příjem každého zaměstnance ŠLP ML Křtiny za rok 2014, který měl trvalý pobyt v okresech Brno-venkov nebo Blansko a strukturu jeho výdajů. Celkový počet zaměstnanců na jednotlivých polesích byl stanoven na 82 zaměstnanců (celkem 17 035 888 Kč – mzdových nákladů). Jednalo se o lokální zaměstnance. Formou strukturovaného rozhovoru bylo získáno od zaměstnanců 57 vyplněných dotazníků (69,51 %). Celkem 57 zaměstnanců, kteří vyplnili dotazník, za rok 2014 vynaložilo na výdajích 10 800 000 Kč (lokálně 4 272 750 Kč a nelokálně 6 527 250 Kč). Lokálně bylo vynaloženo 39,56 % a nelokálně 60,44 %. Potraviny, nápoje, tabák tvořily 31,47 % celkových výdajů zaměstnanců. Bydlení, voda, energie tvořily 22,35 %, doprava, pohonné hmoty 11,52 %. Všechny tyto položky tvořily dohromady cca 65 % celkových výdajů zaměstnanců v roce 2014. Lze tvrdit, že s jistotou 95 % se výše lokálních výdajů lokálních zaměstnanců ŠLP ML Křtiny v roce 2014 pohybovala v intervalu 36,56 % až 42,56 %. Polesí ŠLP ML Křtiny v roce 2014 významně podpořilo lokální ekonomiku v zájmovém území, a to především zásluhou zaměstnanců podniku, kteří svoje platby vynakládali v okresech Brno-venkov, Blansko.

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BRINGING VEGETATION TO THE RURAL LANDSCAPE - DOING IT THE OLD WAY

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Abstract
The current situation in implementing green structures to the rural landscape has reached a point of complexity where it has never been before. The engineers have to face demands and limitations from various directions. On one side there are demands of nature protection and conservation made mainly by the Nature Conservation Agency of the Czech Republic. On the other hand specific demands often accompany various funding possibilities, most importantly the European Operational Programs. At the same time, the procurement of public contracts brings yet other specific demands to the table. So, an important question arises, where is the nature in this? It is not very difficult for nature to get lost within this complicated system. Similar to many times before when civilization reached a point of no return, the solution could be a step backwards. Back to where it all started, to the responsible landowner desiring a better tuned harmony of man and wildlife.

Key words: responsible landowner, Nature Conservation Agency, European Operational Programs, public contracts

Introduction

In the Czech Republic, even though there is no universal definition of rural landscape available in the legislative, the land of the country is precisely divided according to its supposed landuse mainly by two more main or less consistent and overlapping information sources. The rural landscape therefore can be defined according to the combination of Cadastre, which defines the type of land and urban planning. The aim of this paper is to present the current situation of implementation of green-structures in the rural landscape, the legislative background and the requirements raised by the institutions concerned. The goal is to offer a different approach based less on legislative and normative control but more on tradition and responsibility of everyone involved.

The Cadastre of Real Estate is performed by State Administration of Land Surveying and Cadastre divided into 14 cadastral offices in regions and 97 subordinated offices where complete administration of the Cadastre is provided (inventory, maintenance, updates, modernization etc.). More importantly though each parcel within each Cadastral Unit is a unique territory with defined type of land (Act No. 256, 2013; Decree No.357, 2013; viz table 1). Usually arable lands, permanent grasslands, orchards and water land are refrained to as rural landscape, while build up areas and forests are excluded. Also, inaccessible areas due to fencing or intense management (vineyards, gardens, production orchards etc.) are usually excluded. As such, rural landscape becomes very closely connected to arable land or agriculture land in wider perspective, which is very important to keep in mind for management and planning purposes. This basic definition of rural land gives an idea of where in the landscape can green structures be implemented. Agriculture land aside areas kept in the Cadastre as other land, comprise a significant part of rural landscape. Nowadays other lands are usually parcels of local field roads, barren land, former landfills, nature protection sites and parcels with undefined land use due to all sorts of reasons. Notably, these reasons include bad natural, historical or social conditions for agriculture and buildings like steep slopes, gorges, rocky terrain, inaccessible terrain etc. that limit potential sustainable economical exploitation. Interestingly enough, it is exactly these areas kept as other land that are the most suitable for implementing green structures to the rural landscape, mostly because they can be often found on common land and there are no legislative limitations to expected usage. Once you were to implement green structures on land types that do not allow so, a change towards the new expected land use type has to be processed, which is subject to various fees and a complete project documentation of its own and also is not always even possible.

Tab. 1: The type of land according to The Cadastre of the Real Estate

Type of land	**Legislative definition**
arable land	viz Agriculture Act (Act NO. 252, 1997)
hop garden	viz Agriculture Act (Act NO. 252, 1997)
vineyard	viz Agriculture Act (Act NO. 252, 1997)
garden	Land where: a) vegetables and flowers are continuously grown, usually for own usage b) fruit-trees or fruit bushes are consistently grown, usually creating a compact area together with farm buildings
orchard	viz Agriculture Act (Act NO. 252, 1997)
permanent grassland	viz Agriculture Act (Act NO. 252, 1997)
forest land	vz Forest Act (Act NO. 289, 1995)
water land	Land with watercourses, water bodies, marshes or wetlands
builded area and courtyard	Lands with buildings, pavements, courtyards etc., build up areas, also waterworks
other land	Land not described above

Urban planning in the CR deals with land use from a number of perspectives, from global to local. Most importantly it defines and coordinates land use limits in order to achieve sustainable development (Act No. 50, 1976; decree No. 135, 2000). The results of urban planning in CR are best accessible in the form of one of the urban planning tools, planning documentation. The local plan defines among others build up areas, forest areas, areas of agricultural production etc. which more or less define the boundary of the open rural landscape. More importantly areas for nature protection, recreation, greenery etc. are also defined which again similarly to the Cadastre, gives an idea of where in the landscape can green structures be implemented.

The implementation of green structures in the rural landscape is almost exclusively carried out by external donations and funds and thus is a subject to several

institutions,the most important one of them being Nature Conservation Agency of the Czech Republic (NCA). Its task is to perform the State Administration in nature conservation and landscape protection within the Czech Republic's territory, under the Act on the Protection of Nature and the Landscape. Most importantly NCA accepts and evaluates all of the most commonly used donation programs (both national and European). To do so in the most legitimate way and to ensure professional and expert evaluation of the applications, NCA created and still creates several standards and methodologies. These standards, while mostly helpful can cause serious problems for engineering practice because they use numbers and parameters to describe inherently extremely variable natural characteristics.
To summarize, the procurement of public contracts controls that the realization and engineering companies are up to the task not to waste the money of the whole population. The state administration and autonomy in the hands of local authorities controls the same and also controls whether or not the projects and realizations fulfill the requirements of the laws. Further on, the state administration in the hands of NCA controls the donation programs and use their individual calls to control which actions are supported and controls their overall quality, duplicating the control of the local authorities. Finally, the contracting authorities themselves are obliged to control the quality. Yet, for some reason this still is not viewed as enough control and additional requirements are created by various standards, methodologies and authorizations. Not to mention that the quality of work has always been the best long-term advertisementand therefore should be the inherent principle of all business as a self-controlling element with no need for external control.

Material and methods

During the last five years, the collective of authors has been active in applying for donationsfrom different possible donations and realization of green structures in the rural landscape of CRin a business company. During these activities, the potential and meaningfulness of various donations programs was revealed. Primarily, the duration of projection work and obtaining permits from involved institutions of state administration required by each program and accompanying administrative difficulties was observed. To enable a comparison of different possibilities of implementation of green-structures in rural landscape in CR, three different approaches differing mostly in the source of financingwere identified and their respective total cost and time consumption for the final customer (mostly the municipality) was evaluated.
The first option was the European Operational Program Environment. This is the option with the biggest budget. For the current Operational Program 2014 - 2020 nearly €2.637 billion from the Cohesion Fund and the European Regional Development Fund have been earmarked for applicants.From this budget 13.34 % is available for the rural landscape in the Priority Axis 4 Protection and care for nature and landscape. Funding can cover up to 85% of the total eligible costs of the project, with some specific exceptions.
The second option was a national program Supporting Regeneration of Natural Ecosystem Functions of the Landscape (SRNEFL translation: author). In this case only actions with realization costs lower than 250.000 CZK can be supported. It is financed strictly by the government of CR and funding can cover up to 100 % of total eligible costs of the project, with exceptions according to locally relevant regional office. According to our experience, the funding reaches 80 %, so this number will be used in the evaluation.
The third option was a unique approach designed by the authors based on common

will to improve the landscape shared among all participants (stakeholders, engineers and contractors alike), on tradition and on the good name and responsibility of the company. This approached has been internally called “trees without stamps” and should offer a reasonable, quicker alternative to the above mentioned donation programs.

The theoretical project that was the subject of the evaluation consisted of the planting of 200 trees (trunk 180+ cm, standard or half-standard form) and 400 shrubs (60 cm height), the installation of holding poles, individual tree protection, chemical protection (shrubs) and mulchingof each sapling. The size of the project was chosen to fit all of the three evaluated approaches and to represent common landscaping measure supported by described funds at the same time. The evaluation was done for all the parts of the project:

1.Pre-project preparation and Project documentation elaboration
(specific studies, biological evaluation, statement of the presence of technical infrastructure networks, information of land ownerships)
2. The acquisition of reports from authorities concerned (Authorities involved)
3. Initial costs - Costs that have to paid before realization works begin(The preparation and administration of the funding application,organization of tenders)
4. Additional costs (additional work not eligible for funding, site preparation, geodetic stabilization, specific requirements of the applicant, extra mulching, more stabilizing poles etc.)
5. Realization (direct eligible realization costs)
6. Maintenance for two years (20% of realization costs and additional costs)
7. Overall costs – total costs for the implementation of projected green structure
8. Co-financing – the percentage of eligible costs the funding covers
8. Municipality co-financing – real prize of the implementation of projected green structure that the applicant will pay

Results

Comparison of three different approaches of obtaining finances for the implementation of green structures in the rural landscapeexhibited significant differences between their respective time and cost consumption (See Tab. 2). The European donation program exhibited the lowest financial costs and the highest time requirement. It is caused mainly byadministrative difficulties during the application process. The program is very complex with many authorities (7) involved. The elaboration of project documentation requests involvement of specialists in different fields of nature protection and conservation like biology, geology, soil science, botanyetc., on astrict general basis, even if it is not functionally indispensable for the outcome of the project. This precaution increasesthe initial time and financial costs of the project and can often cause lack of interest for green structures of stakeholders, mainly municipalities. These costs are also invisible to public and thus secretly impede the whole process and increase the overall time and financial costs of the projects.

The national donations offer the best alternative on time to cost ratio. The biggest issue is that the amount of potential funding is limited according to the possibilities if the local relevant NCA regional office and thus can be much lower than the mentioned 250.000 CZK. At the same time the prices of items in the budget are subject to an aggregated internal budget of NCA which must not be exceeded. Oftentimes, the aggregated maximum prices do not allow the usage of extraordinary planting processes that might be necessary in certain localities (geodetic stabilization, extra mulching, grass cutting, watering, multiple poles etc.). So the

additional costs can be very high in some cases. At the same time, the funding does not cover any future maintenance, which is usually a subject to individual contract between the realization company and the municipality.
The trees without stamps approach exhibited the highest financial costs but the lowest time requirement. The administrative difficulties are eliminated and the quality of the work is controlled mainly by investor. A close investor – contractor relationship enables fast and effective communication. This ensures that the final product will be as close to initial idea as possible. For this approach to work, responsible and active behavior of all participants is crucial as well as professionalism of the realization company.

Tab. 2: The evaluation of three different approaches to financing the implementation of green-structures in rural landscape

Parameters	Different approaches		
	1 National programs	2 European programs	3 Trees without stamps
Pre-project preparation and Project documentation elaboration	2-3 months / 10.000CZK	2-10 months/ 30.000CZK	1 month / 5.000CZK
The acquisition of reports from authorities concerned (Authorities involved)	costs involved in project documentation elaboration (5)* / 1 month	costs involved in project documentation elaboration (7)* / 2 month	costs involved in project documentation elaboration (2) */ 1 month
Initial costs (The preparation and administration of the funding application, organization of tenders, technical supervision)	2.000CZK	30.000 CZK	0CZK
Additional costs (additional work not eligible for funding)	30.000 CZK	0CZK	0 CZK
Realization	170.000 CZK	200.000 CZK	200.000 CZK
Projection – realization span	Up to 8 moths	Up to 1-2 years	2 month
Maintenance two years	40.000 CZK	40.000 CZK	40.000 CZK
Overall costs	252.000 CZK	300.000 CZK	245.000 CZK
Co-financing	80 %	85%	0%
Municipality co-financing	116.000 CZK	53.500CZK	245.000 CZK

*Included authorities
1 NCA[1 2]
2 Regional office[2]

3 Environmental division of locally relevant authority[1 2 3]
4 Civil engineering department [1 2]
5 Urban planning department [2]
6 Agreement of the applicant (municipality) [1 2 3]
7 State environmental fund of the CR [1 2]

Discussion

Current situation in implementation of green-structures in rural landscape is a subject to many different institutions. All of which bring their own requirements to the table, the control is oftentimes duplicated or multiplied. The process of implementation is so complex that it slowly shifts away from its original goal which was the improvement of the environmental conditions. Rather mainly because public interests and contracts are involved, the goal seems to be primarily financial control. On the other hand the solution supported by the authorities involved seems to be an increasing stream of obligatory norms, standards and methodologies. The one big problem with this approach is its long-term unsustainability, especially during the period of global climate change, when natural conditions rapidly spiral toward the unknown. The truth is, there can never beany universal standard that can cover all the possibilities that do happen in nature and the problems that arise when the standard does not meet the requirements of the common practice highly exceed its benefits.

It should be stated that the overall strategy of current nature and landscape protection and conservation is not to support individuals but rather biotopes and ecosystems. All newly planted green-structures should be considered as an initial state of the natural element they created and not its final form. It should be left up to nature itself to develop towards the climax over time. It is not the long-term aim of the implementation of green-structures especially in rural landscape, to remain static and changeless according exactly even to the best possible project.

The “Trees without stamps” offer a unique solution to the above mentioned problems. The goal is to return backwards to the lasthealthy place when our ancestors created the sustainable cultural landscape. This cannot be done without responsible landowners and stakeholders as well as realization companies which clearly is more of a society issue than the problem of professionalism. The seeds we plant today will carry on our message through decades.

Conclusion

The current situation in implementing green structures to the rural landscape has reached a point of complexity where it has never been before. The engineers have to face demands and limitations from various directions. On one side there are demands of nature protection and conservation made mainly by the Nature Conservation Agency of the Czech Republic. On the other hand specific demands often accompany various funding possibilities, most importantly the European Operational Programs. At the same time, the procurement of public contracts brings yet other specific demands to the table. So, an important question arises, where is the nature in this? It is not very difficult for nature to get lost within this complicated system. Similar to many times before when civilization reached a point of no return, the solution could be a step backwards. Back to where it all started, to the responsible landowner desiring a better tuned harmony of man and wildlife.

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Act No. 2891995 Coll., on Forests and Amendments to some Acts (the Forest Act)
Decree No. 135/2000 Coll. on Non-statutory Planning Material and Planning Documentation
Act No. 137/2006 Coll. Government Procurement

Souhrn
Problematika výsadeb zeleně v krajině je v současnosti velmi složitá a komplexní záležitost. Projektanti musí brát při vzniku projektů v potaz na jedné straně mnoho limitujících faktorů, standardů a různých nařízení a na straně druhé přichází ke slovu požadavky Agentury Ochrany Přírody a Krajiny, jakožto hlavního kontrolního orgánu. Vznikající projekt musí dále splňovat nároky zvoleného dotačního titulu, ze kterého je projekt následně financován. Do hry dále také vstupují požadavky výběrového řízení. Nabízí se otázka – kde v tomto všem má místo sama příroda? Dosti často se v této papírové válce podstata obnovy přírodního prvku vytrácí a do popředí se dostává jen korektnost s ohledem na splnění všech nutných administrativních kroků. Už mnohokrát se četné civilizace před námi přesvědčily, že správným krokem nemusí být vždy jen krok kupředu ale nýbrž mnohdy i krok zpět.

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CONTRIBUTION TO THE STANDARDIZATION OF VISITOR MONITORING PROCEDURES IN CZECH PROTECTED LANDSCAPE AREAS

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Abstract
Automated counting devices have become routinely used as means for estimating visitor use in recreational areas. However, little research has been performed regarding collection and related calibration issues and there's a gap on standard methods to monitor visitors using automated counters. The present paper introduces a project that intends to develop a standard method to collect and calibrate automated visitor monitors through its application in three Czech Protected Landscape Areas: Blaník, Brdy and Jeseníky. The methodological approach consists of four sub-steps: (1) collection of visitor numbers from automated counters; (2) observation survey of real visitor incidences' for counters at each site; (3) on-site assessment of trails characteristics; and (4) data analysis to determine calibration coefficients for each counter in order to provide real visitor estimates and determine possible correlations with assessed trail characteristics. With the proposed research it will be possible to provide researchers and land managers with a better understanding regarding the monitoring of visitors with automated counters to estimate visitor use in recreational and protected areas.

Key words: visitor numbers; counters calibration; trail characteristics; protected areas

Introduction
Understanding visitor movements and patterns of use within protected areas areas is fundamental to protect the ecological, historic and cultural values, guarantee the quality of the visitor experience, and guide visitor facilities planning (Loomis, 2000; Manning, 2011). Unlike the many well-established programs and methods to monitor visitor-related impacts to natural resources, sustained monitoring programs documenting visitor use in protected areas are still scarce and geographically dispersed (Leung and Marion, 2000).
Visitor monitoring can generate information through counting, profiling, and surveying of motivations, preferences and perceptions (Cope et al., 2000), but the most elementary visitor-related aspects is the number of visitors to the area of concern (Newsome et al., 2013). With the technological advances in our society today, the use of automated visitor counters to estimate recreation visitation have been relatively widespread around the world (Ross, 2005; Lindsey et al., 2006; Kahler and Arnberger, 2008). This is due to the fact that such equipment require generally little maintenance, are able to operate continuously for extended periods of time, and cause minimal disturbance to visitors (Watson et al. 2000).
Despite its extensive and promising use, automated visitor monitors tend to generate some errors associated with visitor data collection and systematically under- or over-count visits (Muhar et al., 2002; Lindsey et al. 2006). There are few reasons why this happen, such as the physical aspects of the monitoring sites (e.g., width and slope) (Watson et al., 2000; Ross, 2005; Pettebone et al., 2010) and

climatic conditions (Andersen et al., 2014). Thus, direct data from automated visitor counters cannot be treated as reliable and calibration measures must be performed in order to correct data error and generate consistent visitor number (Cope et al. 1999; Watson et al., 2000; Dixon 2004).
Usually the calibration involves observing and recording accurately the number of events that pass by the sensor during a given period of time using on-site human observations, video, and time lapse-photography, and compare findings with the number of events recorded by the same device (Watson et al., 2000). The calibration process is nowadays a common procedure among researchers and protected areas managers, few published studies have extensively documented methodological procedures for calibrating recreational visitation data recorded with automated visitor monitors (Pettebone et al., 2010). Consequently, standardized methods to collect and calibrate automated visitor monitors are yet to be established, as no conformity has been established on how exactly it should be carried out. With such diversity in devices and calibration methods, it is becoming increasingly important for protected area agencies and researchers a better understanding of calibration processes (Pettebone et al., 2008).
Given the conservational value of protected areas and their increasing recreational and touristic use worldwide, it is crucial to the proper management of these valuable territories to have reliable and consistent information regarding visitors use. This is particularly important in the Czech Republic, a country with a wide network of protected areas with natural characteristics of outstanding value and a long tradition on the practice of outdoor recreation in natural areas. Thus, this paper provides an introduction to a project that intends to develop a standard method to collect and calibrate data from automated visitor counters to be applied in Czech protected areas. Practically, its aims to provide protected area agencies with a clear and objective methodology containing standardized procedures for visitor monitoring so that the appropriate management can be instigated.

Study areas
The proposed methodological approach has its application in three Protected Landscape Areas (PLAs) located in different regions of the Country: Jeseníky, Brdy and Blaník. The selection of the three PLAs follows a direct recommendation of the Nature Conservation Agency of the Czech Republic (NCACR) and their concerns regarding the monitoring of visitors and the quality of data generated in these important protected areas. All PLAs contain counters located near marked trails for pedestrians and/or cyclists, well-establish infrastructure available during summer and winter season, and natural attractiveness, making them increasingly popular tourism destinations.

Methodology
The project approach intends to broaden the understanding of trail counter collection and accuracy issues on monitoring visitors in protected areas calibration and possible influences. With it, a standardize visitor monitoring system (collection and calibration survey) that can be implemented as a part of the management routine activities will be developed.
Contrasting with several studies where automated visitor monitors were placed for the study purposes, the proposed project will be based on the data from the existing automated visitor monitors that are placed in the most popular locations within three study areas. In agreement with existent literature, a direct data collection method will be used to achieve the study objectives. Thus, direct observations of real visitor

incidences' will be performed at counters locations during certain random days (week and weekends) of July and August. For the observation sampling procedure one observer will be stationed proximate to each counter to assess each device's performance and collect calibration data (visitors passing through counters sensors). To ensure the accuracy of the assessed data, collection of information will be limited to two variables (i.e., direct observation of the number of visitor passing through device receptors and direction of movement). These are also the variables reported automatically by counters their output. Observers will provided with thumb counters and standardize forms to record visitor numbers during established calibration time intervals.

Tab. 1: Characteristics of the study areas

PLAs	Creation	Area (km²)	Small-scale PAs	Counters (N)
Blaník	1981	41	3 Nature reserves 2 Nature monuments	5
Brdy	2015	340	5 Nature reserves 3 Nature monuments 16 Sites of European importance	14
Jeseníky	1969	740	4 National nature reserves 1 National nature monuments 19 Nature reserves 7 Nature monuments	12

To assess trails characteristics (level of use; width; slope), an on-site survey will be conducted using different techniques. Level of used will be assessed during the direct observations phase and recorded in the standardized forms. To determine slope an inclinometer will be used in the middle of trail tread (between counter sensors) and at the same location, a tape measure will be used to determine site width. Post-processed data from field work will be then inserted into an Excel spreadsheet in order to synthesize the data into a single format for further editing and analyses procedures. Correction Coefficients are then determined by dividing the manual counts of each observation period by the mechanical counts for the same amount of time. After that, results are used to estimates the mean hourly, daily, monthly, and summer season for each counter. Lastly, to examine if a correlation exists between each trails characteristic assessed and correction coefficients for each counter, statistical testes (e.g. Shapiro-Wilk normality test, the Kruskal-Wallis variance test, and Spearman's Rho rank correlation test) will be performed.

Project expected benefites
This research will enrich the fields of tourism planning in protected areas and visitor management and nature conservation. Thus, the produced results will provide valuable information regarding data collection and accuracy issues on monitoring visitors with counters in protected areas. Since, standardized methods to calibrate automated visitor monitors are yet to be established and research on the present topic is still incipient, the proposed project will be an important contribution to the

current knowledge of trail counter calibration in protected areas and the effects of trail characteristics in data accuracy. The information obtained in the project will provide managers of protected areas with important findings in a standardized form to make more informed decisions on future planning, policy, and management at their sites. Besides, the practical output will be using the standard methodology that is able to provide recommended management and monitoring actions for the use of Czech protected areas in a sustainable manner

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Souhrn
Pochopení pohybu návštěvníků a vzorce jejich chování při pohybu v rámci chráněných území má zásadní význam z hlediska ochrany ekologické, historické a kulturní hodnoty. Dalším zásadním ukazatelem je záruka kvality turistické zkušenosti a plánování tras pomocí průvodce (Loomis, 2000, Manning, 2011). Pomocí monitoringu mohou být získány informace o pohybu návštěvníků prostřednictvím přímého počítání, profilování, zjišťování motivací preferencí a vnímání (Cope a kol., 2000),
V současné době se počty návštěvníků dané lokality získávají přímým počítáním, naopak získávání údajů o počtu návštěvníků pomocí automatizovaných počítačů zatím chybí. Tento článek tedy představuje projekt, jehož cílem je vyvinout standardní metodu pro sběr údajů o počtu návštěvníků pomocí automatizovaných monitoringů. Měření bylo prováděno na třech chráněných krajinných oblastech: Blaník, Brdy a Jeseníky; Konkrétně, metodologický postup je tvořen čtyřmi následujícími kroky: (1) sběr dat určujících počet návštěvníků pomocí automatických senzorů; (2) Přímé pozorování a počítání návštěvníků v místech umístění senzorů; (3) Porovnání získaných údajů z obou metod získávání dat a (4) analýza dat pro stanovení koeficientů pro každý senzor, tak aby tyto přístroje poskytovaly reálná data o pohybu návštěvníků a bylo možné určit možné korelace posuzovaných charakteristik vztažených ke konkrétní stezce.
V této chvíli ještě nejsou stanoveny standardizované metody pro kalibraci automatizovaného počítání návštěvníků. Tento výzkum je však v počátku, kdy jsou sbírána data jak z automatizovaných snímačů, tak přímým počítáním. Tyto data získávaná z chráněných krajinných oblastí by pak měla dopomoci ke zpřesnění výsledků. Praktickým výstupem by mělo být vytvoření standardní metodiky, která je schopna poskytnout návrh mangementu a monitorování pro potřeby českých chráněných oblastí.

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CRITERIA OF THE PROPOSED ACTIVITIES FOR ENVIRONMENTAL IMPACT ASSESSMENT

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Abstract

Environmental impact assessment is considered to be one of main instruments of international environmental policy of sustainable development.

Possible negative and positive impacts of water constructions on the environment are assessed in Slovak Republic according to Act No. 314/2014 Coll. Act No. 24/2006 Coll. on Environmental Impact Assessment (EIA), in Czech Republic according to Act No. 100/2001 Coll. Act on Environmental Impact Assessment as amended by Act No. 93/2004 Coll. and in European Union according to Council Directive 2014/52/EC amending Directive 2011/92/EC on the assessment of the effects of certain public and private projects on the environment.

Proposed activities which are subject to the environmental impact assessment are divided into two groups: compulsory assessment and screening procedure and the paper is aimed on both of them.
The aim of the paper is to present the issues related to the EIA process underway for water structures in the Slovakia and Czech Republic and compare these two countries with EU legislation.

Key words: proposed projects, environmental impact assessment (EIA), European union

Introduction

Possible negative and positive impacts of activities in the field of the water management on the environment are assessed according to Environmental Impact Assessment (EIA) tool. Subject to assessment of the impacts on the environment are proposed activities for the extractive industry, energy industry, metallurgical industry, chemical, pharmaceutical and petrochemical industry, wood, pulp and paper industry, industry of building materials, machine industry, electrical engineering, infrastructure, agricultural and forest production, food industry, transport and telecommunications, objective projects for sport, recreation and tourism, military buildings and water management. There, construction of dams (Šlezingr, 2013), installations for the transfer of ground water, flood protection objects (Marková et al., 2014 (a); Marková et al. 2014 (b)), protection of soil against erosion (Šlezingr, M., Foltýnová, L. et al., 2010; Šlezingr, M., Fialová, J., 2012) and many more belongs under the EIA process in Slovak Republic, Czech Republic and also according to EU legislation. EIA has been asserting in development countries already for more than 45 years and is considered as one the main apparatus in the international ecological politics for the implementation of sustainable development. EIA represents effective preventive method of environment preservation, which comes out from prognosis and an assessment of the expected impacts of planned

intents, projects and developed conception of environment (Zvijáková, L. et al., 2013)
EIA procedure in Slovak legislation is adjusted by the Act No. 24/2006 Coll. of the National Council (NC) of the Slovak Republic on the Environmental Impact Assessment as amended, which came to effect on 14st December 2005. In the Slovak Republic the assessment has been performed since 1994, when the NC SR Act no. 127/1994 Coll. on Environmental Impact Assessment came into force. That one was replaced on February 1, 2006 by the Act No. 24/2006 Coll. on Environmental Impact Assessment as amended, (EIA Act) and the Decree of Ministry of Environment SR no. 113/2006 Coll., establishing the details on professional qualified persons for the purposes of environmental impact assessment, they form the current legal framework of EIA in Slovakia.
EIA Act has been amended several times; the last amendment has been effective from January 1, 2015. The Slovak legislation on EIA ensures full compatibility with the EU law and with the international conventions by which the Slovak Republic is bounded. The adoption of the Act and its amendments on environmental impact assessment and its implementation is also an essential condition for funding the projects from the European Union (www.enviroportal.sk). The amendment also addresses the fact that the new EIA process should be mandatory. Subsequent approval should be conditional on respecting the outcome of the EIA, and the compliance of project documentation with the outcome of EIA should be officially verified. The Ministry of Environment admits that it introduces a possible financial burden for businesses, who will be required to submit more detailed documentation. However, this procedure will otherwise streamline the procedure for businesses and the authorities, and therefore will have a positive impact.
The EIA process was implemented into the legal system of the Czech Republic (CR) on July 1st 1992, upon the entry into the force if the Czech National Council Act No. 244/1992 Coll., on environmental impact assessment. At the present the EIA in CR is regulated by it is the Act No. 100/2001 Coll. on the assessment of environmental impact dated 20th February 2001 as amended by Act No. 93/2004 Coll. (Gałaś S. and Gałaś, A., 2014 (a); Gałaś S. et al., 2014 (b)).
The Directive 2011/92/EU of the European Parliament and of the Council of 13 December 2011 amended by Directive 2014/52/EC on the assessment of the effects of certain public and private projects on the environment is for the condition of European Union.
It is expected that EIA will continue to act as an effective tool to prevent the application of investments in countries which, by their degree of environmental damage, will many times outweigh their benefits (Luciak, 2012).

Compulsory assessment and screening procedure
According to the seriousness of possible negative effects on the environment, proposed activities and their changes specified in the Annex no. 8 of the Act No. 24/2006 Coll. are subject to assessments which are subject to compulsory assessment or subject to screening procedure. There are many activities which are subject to the environmental impact assessment. In the next parts, the issues related to the EIA process for water structures and activities in water management in the Slovakia and Czech Republic and EU legislation are compared.
In this paper threshold values of activities related to water management which are subject to EIA procedure for compulsory assessment are presented.

Compulsory assessment
This assessment is conducted in accordance with the Administrative Procedure Act No. 24/2006 Coll.. In the final record the competent authority shall state, in addition to the overall impact assessment of the proposed activity or its change, if it agrees or disagrees with its implementation, under which conditions it agrees with it and in which implementation alternative, as well as the desired extent of post-project analysis. The final record is binding for further authorization procedure, and it is valid for seven years from the date of its entry into force (www.enviroportal.sk).
Comparison of criteria for the EIA process in the field of water management required for compulsory assessment is presented in Table 1.

Tab. 1: Activities related to water management which are subject to the environmental impact assessment according to law and its thresholds – Compulsory assessment

	Activities, facilities and installations	**SR**	**CR**	**EU**
Energy industry				
1.	Industrial installations for production of electricity from water energy (hydroelectric power stations)	over 50 MW	over 50 MW	
2.	Geothermal power stations and heating plants	over 50 MW		
Production and Processing of metals				
3.	Shipyards			
Others project				
4.	Sludge-deposition sites with a capacity	over 250 000 m^3		
Water management				
5.	Dams, water reservoirs and other installations intended for retention or accumulation of water including dry reservoirs - with the dam height over the base line or - with total new capacity or additionally retained capacity or - with the area	over 8 m or over 1 mil. m^3 or over 100 ha	over 10 mil. m^3	over 10 mil. m^3
6.	Installations for the transfer of ground water between river basins, if such transfer aims at preventing of possible water shortage	over 10 mil. m^3/year	over 100 mil. m^3/year	over 100 mil. m^3/year

7.	Installations for the transfer of water resources between river basins where the multi-annual average flow of the basin of abstraction exceeds	over 300 million m^3/year and if the amount of water transferred exceeds 5 % of this flow	over 2000 mil. m^3/year when volume of the water transferred exceeds 5% of this rate of flow	od 2000 mil. m^3/year and when the amount of water transferred exceeds 5 % of this flow
8.	Abstraction of ground water or artificial groundwater recharge schemes	over 10 million m^3/year	over 10 mil. m^3/year and more	over 10 mil. m^3/year
9.	Long-distance aqueducts			
10.	Waste water treatment plants and sewerage networks	over 100 000 equivalent inhabitants	over 100 000 equivalent inhabitants and over 50 000 connected inhabitants	over 150 000 equivalent inhabitants
11.	Flood protection objects			
12.	Drillings for drinking water supply			
13.	Geothermal waters abstraction			
Agriculture and forestry production				
14.	Amelioration measures, mainly a) drainage, irrigation, protection of soil against erosion land arrangement b) forest-technical amelioration	over 500 ha	over 50 ha	
Traffic and telecommunications				
15.	Trading ports, piers for loading and unloading, connected to land and outside ports (excluding ferry piers)	which can take vessels of over 1 350 t		which can take vessels of over 1 350 t
16.	Inland waterways and ports including port facilities for inland water traffic	which permit the passage of vessels of over 1 350 t	which permit the passage of vessels of over 1 350 t	which permit the passage of vessels of over 1 350 t
Tourism and Leisure				
17.	Ports for water sports (including piers, storage premises, repair facilities etc.)	over 100 places for vessels		
18.	Recreation ports for yachts and small boats			
19.	Pond intended for fish breeding with fish stocking			

Table 1 aimed on compulsory assessment shows that in case of dams, abstraction of ground water, waste water treatment, inland water ways the threshold values were very similar or the same for Slovak Republic, Czech Republic and European Union. The most visible differences were found out for sludge deposition (limit only in condition of Slovak Republic) and amelioration measures mainly drainage, irrigation protection of soil against erosion land arrangement, forest-technical amelioration where the threshold values are very different in Slovak Republic (over 500 ha) and Czech Republic (over 50 ha). Contrary, this activity is not a subject for compulsory assessment in EU.

Conclusion

Under EIA Directive during the process of qualification, the undertakings which require assessment of the impact have been identified and further subdivided the types of undertakings for which EIA is mandatory – Group I (Annex I of the EIA Directive) and for which it may be required – Group II (Annex II of the EIA Directive) (Galas, 2014). Threshold limits and criteria indicating the need to carry out the EIA procedure are different in character and value. They may relate, for example, to capacity, the area covered by the project, etc. Analysis of

legal regulations of the EIA in selected countries related to the threshold limits and criteria for projects of various types of activities showed differences in compulsory assessment. Differences in the applicable threshold limits, criteria for the compulsory EIA procedure have been shown on the example of selected types of projects in the water management. The differences specified in the thresholds and criteria can therefore be considered as indicators of occurrence of certain resources which shape economic policies of particular countries.

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Souhrn

Proces posuzování vlivu staveb, zařízení a jiných činností na životní prostředí (Environmental Impact Assessment – EIA) se úspěšně uplatňuje jako nástroj environmentálního plánování a představuje účinný preventivní systém péče o životní prostředí, který vychází z prognózy a hodnocení očekávaných vlivů plánovaných záměrů, projektů a rozvojových koncepcí na životní prostředí.
Příspěvek je zaměřen na prezentaci prahových hodnot pro posuzování činností z oblasti vodního hospodářství, které jsou pro podmínky Slovenska a České republiky porovnány s platnou směrnicí Evropské unie.

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DEVELOPMENT OF NORTHERN TOURISM (CASE OF COLD SEMANTIVC TOPONYMS STUDY IN THE POLE OF COLD)

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Abstract
Two districts of the Sakha Republic (Yakutia), Oymyakon and Verkhoyansk, disputes the right to be called the Pole of Cold of the Northern hemisphere, positioning themselves as centers of tourism associated with the cold phenomena.
The uniqueness of the landscapes and extreme natural conditions of the region are reflected in the geographical names – the toponyms of "cold" semantics. Historically, geographical names of sites correspond to the natural conditions of their location and reflect spatial distribution of climatic characteristics of the territory; geographical conditions are reflected in the toponyms not occasionally, but are the evidence of the extreme climate.
The analysis of toponyms of the two districts, claiming the title of the Pole of Cold showed that Oymyakon district is characterized by colder air temperatures, and the population associates it with severe climatic conditions; a greater number of names of snow and ice semantics were found in this district.
Thus, it was revealed that Oymyakon district of the Sakha Republic (Yakutia) can be considered the center of event tourism as the Pole of Cold. The study was conducted within the academic project of the Russian Science Foundation No. 15-18-20047 "Landscape Ontology: semantics, semiotics, and geographic modeling".

Key words: event tourism, cold phenomenon, landscape ontology

Introduction
Nowadays, the world witnesses a growing interest in the northern tourism, primarily due to the fact that, compared to other areas, the north is not only a great resource potential, but also has a pristine nature. The Sakha Republic (Yakutia) is one of the rare places on the planet with the preserved primeval purity of nature and the amazing variety of flora and fauna. With its unparalleled natural resources and unique culture, Yakutia has a huge untapped capacity for the development of tourism on the international and regional markets.
The republic is creating and offering new tourist routes; thus, the range of consumers of these services is constantly growing. Yakutia currently offers the following types of tourism: cognitive, event, extreme, health and fitness, and others.
Yakutia's main brand is cold – the local residents have managed to turn the harsh climate into an attractive feature; now those go to Yakutia who have a great interest in the local brands, such as 'the Pole of Cold' and 'permafrost'. The territory of Yakutia is the coldest inhabited region in the Northern hemisphere, where the right to be called the Pole of Cold is disputed by two settlements with extremely low air temperatures: the town of Verkhoyansk and the village of Oymyakon.

Verkhoyansk became world-famous as the Pole of Cold in the 1870-80s. On January 15, 1885, a political exiles S. F. Kovalik documented the lowest temperature of the globe at – 67.8°C in the town of Verkhoyansk. The fame lasted until the 1930s. In February of 1933, Soviet meteorologists under the leadership of S. V. Obruchev registered the temperature of - 67.7°C in Oymyakon lowland, which was just 0.1°C higher the Verkhoyansk record. Since then, the fame of the Pole of Cold began to move to Oymyakon. This opinion started spreading fast when climatologists extrapolated the short-term observations to the long-term, and taking into account that the mean lowest temperature in Oymyakon were by 3.9 lower than in Verkhoyansk, they came to a conclusion that the temperature in Oymyakon could possibly go down to -70°C and below. Sergei Obruchev theoretically calculated that the likely minimum temperature at the upper reaches of the Indigirka River in Oymyakon might drop to -71.2°C. (Filippovich, 1972)

Given the above facts, as an area of research, we selected two districts of the Sakha Republic (Yakutia) – Oymyakon and Verkhoyansk – that use the Pole of Cold as a tourist brand. Further, the article considers the tourism potential of these districts.

The potential for development of tourism in Oymyakon District comes from its unique natural and climatic conditions, rich historical past associated with the GULAG camps, access via the Kolyma motorway, as well as the image and the current brand awareness. The district has a notable tourist project related to cold – the annual festival of event tourism "Oymyakon – the Pole of Cold."

Currently, Oymyakon District is intensively developing the adventure tourism project "The Pole of Cold" as a major project in the field of tourism. The Pole of Cold festival is one of the most promising tourist sites and a convenient platform for a variety of promotion activities based on the prestige of overcoming extreme conditions. It should attract a large number of travelers from around the world and become the Russian equivalent of the famous Santa Claus Village in Lapland. Every year, the festival brings together Russian Father Frost from Veliky Ustyug and Santa Claus from Lapland. Visiting of Yakutia by Father Frost and Santa Claus aims to support the Winter Begins in Yakutia action. As it is the coldest point of the Northern hemisphere, the Pole of Cold, Father Frost and Santa Claus have a unique opportunity to receive the symbolic Frost from Chyskhaan, the Master of Cold, and spread it over the world. The festival includes a motor and bike rally Yakutsk - Oymyakon.

In addition to the existing tourist projects, here are some perspective routes and tours:

1. The Golden Indigirka;
2. Climbing Muus-Khaya peak (3011 m);
3. The Labynkyr lakes Monster;
4. Rafting on a mountainous river;
5. Ethnographic tour acquainting with reindeer nomads life;
6. Snow sheep trophy hunting;
7. Reindeer Herders Camp project;
8. The Domain of Chyskhaan, the Master of Cold.

Tourism in Verkhoyansk District has a great potential, too; there are significant reserves for its quantitative and qualitative development. With due attention to the urgent problems, tourism can become one of the most promising and fastest growing industries in Verkhoyansk District.

The District enjoys all the necessary conditions for developing inbound and domestic tourism, based on effective use of the rich natural potential, dissemination of knowledge about the unique history of the area and the culture of the people living in its territory, development of new tourist routes, and creation of an attractive image of the district. To this end, there is sufficient experience in serving tourists, developed tourist routes; there have been positive changes in the development of tourism infrastructure.

Currently, the district has the following tourist resources:

- Natural tourist resources: Mother Mountain natural monument, Kihileekh natural monument, Tustaakh resource reserve, Oljo resource reserve, the geographical center of Yakutia, Kester Mountain memorable site;
- Cultural and historical resources: The Pole of Cold local history museum in Verkhoyansk, Chirikov Paleontological Museum, Yangeologiya Geological Museum, Museum on the History of Industrial Development of Verkhoyansk Area.;
- Health improving tourism resources: Kharyskhal tourism complex, Tuostaakh tourist complex, Eige camping.

As for the projects related to the Pole of Cold, Verkhoyansk district has the local history museum "The Pole of Cold", formed in 1990 with the use of funds from the Local History Museum of Verkhoyansk School. The museum is one of the best in the republic. The museum as the exhibition hall, which is constantly updated with new exhibits. The museum cooperates with many Russian and republic's museums, schools and academic institutions. To celebrate the 375th anniversary of Verkhoyansk in 2013, they inaugurated a virtual branch of the National Art Museum of the Sakha Republic (Yakutia).

In addition to the aforementioned tourist facilities, one can note the town of Verkhoyansk itself as one of the oldest towns in the Russian northeast, recognized as the Pole of Cold in the Northern Hemisphere, with a meteorological station and The Pole of Cold local history and ethnographic museum. The district runs the project "International Cultural Tourism for Children in the Pole of Cold" in order to promote the exchange of information and training materials, students and teachers from all over the world, as well as upbringing of patriotism. Verkhoyansk District promotes its symbol of the New Year - Chymaan Chygdaan.

Material and methods

Creativity and observation skills of indigenous peoples of the North, developed under the influence of the need to know conditions for pasturing reindeer, favorable places for hunting and fishing, contributed to the creation of a unique description of the nature of the region, embodied in geographical names. The recognition of toponyms reveals the local physiographic features and restores the past climatic conditions. (Seliverstov, 2012)

To justify the location of the Pole of Cold of the Northern hemisphere, we studied the toponyms of "cold" semantics related to the concept of "cold", where we included geographic names containing the words 'ice' and 'snow', as well as the words that nominate the natural processes and phenomena originating from cold.

The first phase of the study consisted of compiling a database of toponyms of "cold" semantics from the dictionaries of toponyms. (Instruktsizas, 1962, 1988; Komarov, 1964; Murzaev, 1984; Leontiev, 1989; Slovar, 1967) The dictionaries studied list 122 geographical names in Yakutia with the meanings related to snow and ice. Most of the place names of snow and ice semantics have Evenk (29.5%), Even (22.9%), Chukchi (25.4%), Yakut (15.6%) and Yukaghir (2.5%) origin.

Basing on the cold indicating words, we distributed the geographical names into groups: "ice", "snow", "winter phenomena", "winter economic activities", "permafrost", "animals and birds living in cold regions" and "others":

1. Ice, its types and states are present in 60 geographic names of sites, with 33 sites directly related to the word “ice” and 27 names indicating the existence of glaciers in the area.
2. 27 toponyms are related to the word “snow” and its other nominations in different languages, as well as its characteristics; for example, deep snow, solid snow, snow-free, a place with little snow, etc.
3. The third group is made by toponyms related to winter phenomena, such as thick fog, blizzard, frost, snowstorm, Aurora Borealis, cold, cold wind. There are 9 of them.
4. The fourth group consists of the toponyms associated with winter economic activities, reflecting the peculiarities of winter dwellings and winter fishing. In total, the group has 11 names. Notably, there are individual names for winter reindeer pastures and for the hole that is used for watering cattle.
5. In view of the fact that a large part of the territory of Yakutia lies in permafrost, there are toponyms associated with permafrost and cryogenic processes: *alaas, bulgunnyakh, tong, batan*. They are quantitatively few - 5 toponyms, but the terms *alaas* and *bulgunnyakh* are common throughout the territory of Yakutia.
6. The next group consists of the toponyms associated with animal and bird species that live at cold rivers and highlands and wintering in Yakutia – 6 names.
7. The group "Others" includes 6 toponyms with the adjectives "cold".

Results

The second phase of the study involved the analysis of the toponyms of cold semantics on topographical maps, scale 1:200,000, where we took the place names from for the database. For Verkhoyansk district we analyzed 13 sheets of topographic maps, with 19 cold toponyms revealed. On 19 sheets of the topographic map for Oymyakon district, we located 55 toponyms.

The topographic sheets include the toponyms of cold semantics of Yakut, Russian, Evenk and Even origins; a part of the Russian names may have been translated from the languages of the indigenous peoples of the North living in Yakutia. Out of 19 cold semantics toponyms In Verkhoyansk District, 68% have Yakut origin, Evenk - 16%, Russian - 11%, and Even - 5%. In Oymyakon District, Russian and Yakut toponyms make the majority, 49% and 43%, respectively, followed by 4% from the Evenk and Even languages, each.

Hydronyms make the vast majority of the toponyms in the both districts. 61 rivers, streams and lakes (10 hydronyms in Verkhoyansk and 51 hydronyms in Oymyakon district) have names of snow and ice semantics. We also identified 4 oronyms (3 in Verkhoyansk and 1 in Oymyakon) and 7 oikonyms (5 in Verkhoyansk and 2 in Oymyakon).

The most common toponyms in Verkhoyansk District are *bulgunnyakh* and its derivative *bulgunnyahtakh* – ‘a mound, hill, big hill’ – a phenomenon typical of permafrost regions; they account for 26% of the toponyms. *Magan,* a white mountain, indicating snow-covered mountain tops – 21%. The toponyms with ‘ice’ and Evenki toponym *Anmannykan,* meaning *anmanny* ‘frost’ + *kan* diminutive suffix (‘ice mound) make 10%.

Oymyakon District is dominated by toponyms denoting icefields – *taryn* – a layer of freezing or frozen water on the river ice or ground surface. They make 40% of the toponyms, primarily hydronyms; 17 of them are found in the Yakut spelling, 5 toponyms – in the translated into Russian form *naled* (‘icefield’). The second most common toponyms are "snow", "snowy" and other derivatives from the word; they make 9%, which indicates increased snowfall and/or prolonged snow periods at a certain locality. Next, in a descending order, come the Evenk and Even toponyms *Burgali*, *burgachan* – ‘blizzard’, ‘snowstorm’, ‘storm’. *Burgali* – ‘through the storm, through the blizzard, through snowstorms’ and their translated form in Russian make 7%. These toponyms may indicate intense snowdrift transport and strong winds. The toponym *lednik* (‘glacier’) makes 5%, mainly in the names of rivers and streams flowing in mountainous areas; one can assume their ice origin. At the end come the toponyms associated with the concept of "cold" – 3%.

Conclusion

Thus, out of the two studied districts, claiming the right to be named The Pole of Cold, Oymyakon District has more toponyms of cold semantics, reflecting the natural conditions of the area and characterizing the local natural features, such as snow cover duration, prolonged freezing of rivers, widespread icefields, and proactive snowdrift. Therefore, we can assume that Oymyakon District is characterized by colder air temperatures and related severe climatic conditions for the population. The historical names of geographical sites correspond to the natural conditions of their location and reflect the spatial distribution of the climatic characteristics of the territory; the reflection of geographical conditions in toponyms is not accidental, but is the evidence of the extreme climate.

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Souhrn
Území Jakutska je nejchladnější obydlenou oblastí na severní polokouli. Když se řekne Jakutsko, první, co by se vám mělo vybavit je chlad, a právě z tohoto prvku se místním obyvatelům podařilo udělat atraktivní prvek. Právě teď míří na sever do Jakutska všichni ti, kteří mají zájem o „Chladný pól" a „Stálezamrzlé" lokality. Pouze dva okresy Sacha (Jakutsko) – Oymyakon a Verhoyansk mají nezpochybnitelné právo používat označení „Chladný pól" severní polokoule. Oba tyto okresy jsou brány jako centra cestovního ruchu spojená s chladnými jevy.
Jedinečnost a extrémní přírodní podmínky regionu se odráží v zeměpisných názvech. Z historického hlediska většina zeměpisných názvů různých objektů odpovídají přírodním podmínkám, vyskytující se na dané lokalitě. Zeměpisné klimatické podmínky se neodrážejí v názvech jen příležitostně, ale jsou také důkazem extrémního klimatu dané lokality.
Jako zdroj topografických informací pro analýzu topografické mapy v měřítku 1: 200 000, z nich byly získány topografické informace (z registrovaných databází GIS). Získané topografické názvy odráží přírodní podmínky regionu a popisují zdejší přírodní vlastnosti – dlouhotrvající sněhová pokrývka, dlouhotrvající stav zamrzání řek, dlouhotrvající období mrazivých dnů, rozsáhlé sněhové bouře. Analýzou topografických názvů obou okresů bylo zjištěno, že pro oblast Oimiakon jsou charakteristické chladnější teploty vzduchu a celkově náročnější klimatické podmínky, které byly sémanticky přeneseny do názvů tohoto okresu. Studie byla zpracována za podpory vědeckého projektu ruského Science Foundation, č. 15-18-20047 „Krajinná ontologie: sémantika, sémiotika a geografické modelování".

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ENVIRONMENTAL EDUCATION: THE CASE OF INTERNATIONAL DOUBLE MASTER DIPLOMA IN TOURISM BETWEEN RUSSIAN AND FRENCH UNIVERSITIES

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Abstract
Northern oriental territories of Russia are characterised by some non exploited high potential of tourism of nature in the specific context of the little territorial development, the needs of diversification of the economic activities at the local level, under the process of regional integration with Asia, the exploitation of mineral ressources, and the global warming. Tourism is considered one of the key economic branch to develop. According to the policy issues of the North-Eastern Federal University of the Repubic of Sakha (Yakutia) to support the economic development, the creation of double diploma programs with the foreign universities is essential due to the need of best practice application and to insufficiency of local competences in this field . The joint master curriculum in tourism and environment built with Versailles Saint-Quentin-en-Yvelines University of France aims to train the future specialists of touristic development of the territory of Yakutia. The questions of distance learning and TIC as well as the integration of the environment and the nature fixing contents structuring the curriculum constitute the key-points of joint master program. The study was conducted within the scientific project of the Russian science Foundation No. 15-18-20047 "Landscape Ontology: semantics, semiotics, and geographic modeling".

Key words: touristic potential, North, Bologna process, Nature, Natural Heritage

Introduction
Republic Sakha (Yakutia) is situated in the Northeast of Eurasia, taking up a vast territory of over 3 million km². The area is both largest and richest in mineral deposits among the subjects of Russian Federation. Variety of natural landscapes, intact nature, extreme climates, vivid indigenous cultures of the North, as well as large-scale international events of the last decade draw growing number of both Russian and international tourists to Yakutia. Strategy of development of the tourist industry in the Republic of Sakha (Yakutia) till 2025 lists a number of major problems obstructing the progress of international and domestic tourism in the region. One of them is lack of qualified specialists despite active tourism programs being part of curricula offered by educational institutions of the Republic's capital. The drawbacks they all seem to suffer from are overt theoreticity of courses, lack of first-hand practical experience in the sphere on the part of faculty (and absence of professinal training in some cases), as well as sub-standard quality of facility-based training programs. As part of follow-up on Bologna process the Northeastern Federal university introduced the double diploma Master's program titled „Tourism, cultural heritage and environment". The program is aimed at meeting the urgent need for qualified tourism specialists in the Republic. The much-needed international expertise will be provided via involovement of long-time partners from Versailles Saint-Quentin-en-Yvelines University of France.

Material and methods

Nowadays tourism is considered on of the most perspective branches of the Republic's economy. Conceptual perspectives and tourism development moves have been determined on governmental level: Strategy of development of the tourist industry in the Republic of Sakha (Yakutia) till 2025 was established[1] as well as the Concept of creation of a special economic zone of tourist and recreational type in the Republic of Sakha (Yakutia)[2]. The new law „Of tourist activity in the Repulic of Sakha (Yakutia)“ was passed, and the state program „Development of domestic and international tourism on the territory of the Republic of Sakha (Yakutia) for 2012-2016“ is adopted. Tourism development in Yakutia is comparable with tourist development in the North of Canada. "The development of the tourism industry in the north of Canada is followed not only by the increasing flow of tourists and hence creation of new jobs, bigger investments, the growth of household incomes and local government budgets, but also it helps to solve the social problems of the indigenous population[3]".

"Tourism has been considered as a major factor in environmental degradation, although lately the situation has been reversed, to that of harmonizing the gap that previously existed, with greater demand for and interest in nature, local communities and their heritage but also as an attempt to escape from big urban centers. However, there is still a lack of responsibility on the part of tourists, as to the preservation of nature and tourist destinations. This urges a focus on environmental education. Within this perspective tourism should promote environmental knowledge and education, combining information and environmental actions through direct contact and / or experiences related to local natural heritage[4]".

Following the need for qualified specialists by the Republic's economy, the M.K. Ammosov Northeastern federal university came up with several educational programs developed in collaboration with international universities. Introduction of double diploma programs is an effective way of implementing the principles of Bologna process and an important step in establishing a shared educational environment among universities. The primary advantage of such approach is based on the fact that students are able to obtain a single degree program (Bachelor's, Master's or postgraduate) with two diplomas (from two respective universities). The latter provides significant advantages both in terms of further step in education and job placement perspectives. Another important advantage of double diploma programs is student's gradual introduction to international educational environment. With basic professional knowledge and expertise provided by home university as well as language skills enabling students to continue the course abroad, they suffer

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[1] Strategy of development of the tourist industry in the Republic of Sakha (Yakutia) till 2025 http://old.sakha.gov.ru/node/10821

[2] The concept of creation of a special economic zone of tourist and recreational type in the Republic of Sakha (Yakutia) http://old.sakha.gov.ru/node/10821

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[4] PADRÃO, Joana. Mediterranean Journal of Social Sciences MCSER Publishing, Rome-Italy. Vol.5 No.22 September 2014) ISSN 2039-2117 (online) ISSN 2039-9340 (print).

significantly less stress and spend much less time adjusting to new learning environment.
First attempts at implementing the double diploma programs were made in Russia before the Bologna declaration was signed in 2001. From that moment on these programs became the focus of several initiative. TEMPUS began to develop the first project aimed at drawing closer universities from different countries based on comparable programs and degrees. The first double diploma program developed jointly with a French university was introduced in Northeastern federal university in 2007.
The difference in education systems between 5-year system in Russia and Europe's system of degrees (Bachelor's (3 years) + Master's (1/2 years) + Doctoral (3 years)) caused certain problems prior to Russia's transition to level education system. However, after 2010, when Russian universities officially adopted the level system, the problems lingered due to remaining difference in length of study. One of the obvious disadvantages is expanded time period required now for obtaining , a European diploma. Previously European Diploma Supplement (EDS) allowed Russian university specialist program graduates to apply for second year of Master's programs at French universities. It was possible due to European Bachelor's programs being 3 year (4 year in some cases) long while Russian universtiy graduates obtained their diplomas upon completing a 5-year program. This prolonged period was credited as first/second year of European Master's program study whereas now Russian Bachelors are only eligible for first-year application. In spite of the flexibility of French Master's degree system (enabling students to switch programs after the first year of studying) French students obtain their Master's degree only upon completion of the second year. Thus, it takes a Russian Bachelor the whole two years of stydying in France in order to obtain French Master's degree.
As of now there is a considerable number of double diploma programs in Russia. According to the data provided by the Embassy of France, more than 90 joint Russian-French double diploma programs were active in 2011. Only 5 of them were tourism-centered and mostly focused on management.
The term „double diploma program" often refers to all types of university cooperation in the sphere of joint education programs. The certificate granted upon completion in these cases can be: 1) joint diploma from two or more universities recognized by partnering nations; 2) diploma from an abroad university as a supplement to national diploma; 3) national diploma that lists supplementary courses (as a supplementary certificate having no force or effects)[5]. Theoretical courses are usually provided in Russia with study placement taking place in partner university.
Northeastern federal university and Versailles Saint-Quentin-en-Yvelines University of France joint double diploma program was built on the principle of two state diplomas and developed in accordance with the necessity of tourism development in the Republic of Sakha (Yakutia). First year of study takes place in Russa (Northeastern federal university); second year in France (Versailles Saint-Quentin-en-Yvelines University). Distant learning technologies are implemented as well as visits from partnering university professors. The program is built on the principle of complementarity with each university offering region-specific courses absent from the curriculum of partnering university.
Double diplomas have become a key index of universities' innovative activity in Russia. The number of joint double diploma programs keeps growing every year. In

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[5] http://edurt.ru/index.php?link=225&lang=1&type=1

Europe too, according to AERES (Evaluation Agency for Research and Higher education) data, the availability of such programs is an indication of international attractibility. At the same time the program holders often have to face a number of problems mostly caused by the difference of basic principles in respective educational systems. For instance, the French ECTS credit system differs from that employed by Russian education system. One ECTS credit equals to 25-30 hours of work[6]. In Russian system one credit equals 36 hours with half of it given to independent work. Even starker difference is the absence of State Educational Standards in France.

In Russian system the whole process of education is built on an academic curriculum suggested by the Federal State Educational Standard. Academic curriculum lists all the study hours, competences formed by each course, number of credits distributed among the types of academic activity (practical training of all types, state final certification, research activity), supporting departments, hours given to administering department for provision of various academic activities. Moreover, a Standard precisely states the requirements for material security and methodological support of a given program – something that is a university's sole responsibility in France. French universities are not presented with requirements which program supporting faculty has to meet. Academic Master's programs are divided into research and professional ones (the equivalent of academic and applied Master's programs in Russia). Graduates of research programs may continue their study in Doctoral programs, while graduates of professional programs seek employment upon completion. That is why a significant number of working professionals from corresponding spheres of potential employment are involoved in teaching in order to maintain the practice-oriented approach. However, no precise percentage ratio of professional lecturers with a degree to invited specialists is given. This requirement (involvement of professionals from respecive spheres) is also mandatory within Russia's new Standards: the ratio of faculty members with a degree is to be no less than 80 % form academic programs and no less than 65 % for applied programs while ratio of invited faculty comprised of specialists in respective professional sphere should no be less than 10 % for academic programs and no less than 20 % for applied programs.

The process of follow-up on Bologna process and corresponding reforms of Russian education system and Federal State Educational standards is ongoing. Educational standard on Master's programs in tourism (43.04.02) adopted in 2015 allows Russian universities more freedom in forming the academic curriculum. To compare, the previous standard on tourism programs (100400.68) established in 2009 went as far as prescribing course titles and competences formed by the courses. Such rigidity caused problems when it came to crediting courses already taken within partnering university curriculum. Competences formed by the program, titled „results expected upon program completion" in European system and delineated by each university independently were of strictly prescriptive nature within the Federal State Standard. As of now universities are free to form their courses as well as to determine their own competences in supplement to competences suggested by the Federal standard. For instance, the new standard in tourism Master's programs does not list competences focused on environment, cultural or natural heritage. Therefore, the Northeastern federal university tourism program added these competences accounting for the regional specifics.

[6] http://ec.europa.eu/education/ects/users-guide/docs/ects-users-guide_en.pdf

All of the listed above and some other differences in higher education systems of different nations at times obstruct successful collaboration of partner universities. However, the opposite trend; that of mutual rapproachment of education systems is coming into prominence lately.

Conclusion

Master's program in tourism 43.04.02 „Tourism, cultural heritage and environment“ (double diploma jointly with Versailles Saint-Quentin-en-Yvelines University of France) is aimed at training professionals in tourism in the Republic of Sakha (Yakutia) with focus on cultural, social, economic, geographic and climatic specifics of the region; specialists who realize the meaning of Yakutia's cultural and natural heritage in both national and international contexts. Involvement of Versailles Saint-Quentin-en-Yvelines University expertise in teaching practice-oriented segments of the program focusing on tourism, cultural heritage and environmental issues is one of the program's strongest advantages. Further development of educational programs in the sphere of tourism aimed at meeting the evolving industry's demand for qualifed specialists will doubtlessly help in greatly improving the tourist services in the Republic, both on domestic and international markets.

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The study was conducted within the scientific project of the Russian science Foundation No. 15-18-20047 "Landscape Ontology: semantics, semiotics, and geographic modeling".

Souhrn

Republika Sacha (Jakutsko) se nachází na severovýchodě Eurasie, rozkládající se na území více než 3 miliony km². Tato oblast je zároveň největší a nejbohatší zdrojem ložisek nerostných surovin mezi republikami Ruské federace. Rozmanitost přírodních krajin, nedotčené přírody, extrémního podnebí, domorodých kultur ze severu, stejně jako velkých mezinárodních akcí v posledním desetiletí přitahuje do Jakutska stále rostoucí počet ruských a mezinárodních turistů. Území se vyznačuje nevyužitým potenciálem cestovního ruchu ve specifickém kontextu rozvoje lokálních území. Dále je potřebná diverzifikace ekonomických aktivit na místní úrovni v rámci procesu regionální integrace s Asií a těžba nerostných zdrojů. Cestovní ruch je považován za jedno z klíčových odvětví ekonomického rozvoje oblasti. Podle strategických otázek Severovýchodní Federální Univerzity Republiky Sacha (Jakutsko) je nutné podporovat hospodářský rozvoj, vytvářet studijní programy se zahraničními univerzitami. V současnosti probíhá převod na Boloňský vzdělávací systém a implikace odpovídajících reforem ruského vzdělávacího systému. Rozdíly ve vysokoškolských systémech různých států mohou občas bránit úspěšné spolupráci mezi partnerskými univerzitami. Navzdory tomu, vzrůstá snaha ke vzájemné spolupráci. Projekt v oblasti cestovního ruchu a životního prostředí byl vypracován ve spolupráci s francouzskou univerzitou Versailles Saint-Quentin-en-Yvelines, který si klade za cíl školit budoucí specialisty v oblasti rozvoje cestovního ruchu na území Jakutska. Studie byla zpracována za podpory vědeckého projektu ruského Science Foundation No. 15-18-20047 "Krajinná ontologie: sémantika, sémiotika a geografické modelování".

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EVALUATION OF VISITORS SATISFACTION AT THE LAKE POČÚVADLO IN PROTECTED LANDSCAPE AREA ŠTIAVNICKÉ VRCHY DURING SOMMER RECREATION

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Abstract

In the report was evaluated the visitors satisfaction at the Lake Počúvadlo near historical town Banská Štiavnica in Protected Landscape Area Štiavnické vrchy (Central Slovakia) during sommer recreation. The evaluation was conducted through questionnaire survey with fifteen questions. The survey was realized from 1 July 2015 to 31 August 2015. 117 respondents participated in the survey. Survey questions were focused on respondents satisfaction with recreation opportunities, environment and services. The results of a questionnaire survey may serve to improve the conditions of recreation in this rare area during various leisure activities.

Key words: historical mining ponds, leisure activities, questionnaire survey

Introduction

Not far from historical small mining town Banská Štiavnica in Štiavnické vrchy mountains Protected Landscape Area (Central Slovakia) is located the water reservoir (mining pond) Počuvadlo which was built between 1775 – 1779 as a part of unique water – management system with 28 water reservoirs. The history of sufficient water resources and their utilization in area of Banská Štiavnica and its surroundings begins with the era of mining and ore exploration, and dates back to 1156. In the first-known writen document from this period, the region was called the „terra banensium“ (land of miners). King Belo IV of Hungary granted free-town privileges to the royal town of Banská Štiavnica in 1238. A milestone in the history of the town was the estabilishment of the world´s first Mining Academy in 1762; the town soon became the centre of mining technology for the whole of Europe. In 1807 was created here the Forestry institute. This year is considered the beginning of the university forestry studies in Slovakia.

The first reference to the water supply reservoirs in the region was in 1510 and 1511. The mining activities in the Banská Štiavnica ore region reached their height in the 16th and 17th centuries, fallowed by a mining depression that culminated in the late-17th and early-18th centuries. The main cause of this depression was the intrusion of groundwater into the mines; because the water pumping technology and energy resources of that period were limited, the problem escalated into a very serious situation. In 1687 the situation was so bad that as many as 720 of 2,173 workers (as wel as 196 horses) were pumping water from mines (Lichner 1997, 2005). After a long and complicated development of mining and mining technology in this region, a sophisticated mining water management system was created in the first half of the 18th century. This system not only saved Banská Štiavnica´s mining industry but also served as a model for other mining district in the world. In the second half of the 19th century, the significance of mining decreased (due to limitations on and suspension of mining activity). Unfavourable conditions of the appurtenant structures of dams (as well as the fact that they did not meet current safety requirements) prevented a more extensive exploitation of some reservoirs.

Failures and breakdowns occured at some dams in the 20th century, requiring cautious operation with gates of bottom outlets. Of the 54 reservoirs existing at the beginning of the 20 th century, 28 have so far been registred. At present one of the water reservoirs (Rozgrund) is used as a reservoir of drinking water. All other are used for recreation and some for fisch breeding and fisching. The most popular and most visited in this context is the water reservoir Počúvadlo.

Materials and methods

Historic Počúvadlo Lake, which was built between 1775 - 1779, is due to their attractiveness for recreation and tourist sites most visited in the region of Banská Štiavnica and Štiavnické vrchy Protected Landscape Area. The immediate surroundings area of the Počúvadlo Lake is easily accessible for disabled people in wheelchairs, too. (JAKUBISOVÁ 2014, FIALOVÁ et al. 2015). Near the lake there are is a large number of various accommodation facilities. Počúvadlo Lake is situated at an altitude of 677.6 meters above sea level. The reservoir was generated by five independent earth dams. The main dam has a length of 195.3 meters, height of 29.6 meters and width of 19 meters. The upper width of the main dam is 19 m. The maximum depth of the lake is 10.8 m. This reservoir has the largest surface area from all of reservoirs in the Banská Štiavnica region – 12,13 hectares. The volume of the reservoir is 745,000 m^3. The collecting ditches for water supply of the reservoir Počúvadlo embrace the slope of legendary hill Sitno (1009 m a. s. l.) with the length of 16 km (KLADIVÍK, M., KLADIVÍK, E. 2000, LICHNER 1997, 2005).

The evaluation was conducted through questionnaire survey with fifteen questions (Table 1). The questionnaire was drawn up in Slovak and English language. The survey was realized from 1 July 2015 to 31 August 2015. 117 respondents participated in the survey. From the 200 distributed questionnaires returned to us 117 for processing.

In the questions 12 – 14 the evaluation is carried out according to the scale: 1 – the best (very good), 2 – good, 3 – average, 4 – bad, 5 the worst (very bad). In the question 15 the evaluation is carried out according to the scale: 1 – most lacking here; 2 – rather lacking here; 3 – mediumly lacking here; 4 – very few lacking here; 5 – at least lacking here (not missing).

Results

The questionaire survey is shown in Table 1. The survey shows that:

- the survey was attendet by 55 (47%) men and 62 (53%) women;
- most visitors were from Slovakia - 89 (76,1%);
- most visitors came from a distance of 26 – 50 km - 31 (26,5%);
- most visitors were accommodated in facilities with a capacity ≥ 11 persons – 38 (32,4%);
- most visitors prefer to board the buffet – 42 (35,9%);
- most visitors has information about the Počúvadlo on its own experience – 72 (61,5%);
- most visitors preferred bathing as the main type of recreation and leisure – 55 (47%);
- most visitors prefer as the another kind of recreation tourism and walk in nature – 42 (35,9%);
- most visitors evaluated the services as good – 66 (56,4%);

Tab. 1: The form of questionnaire survey and evaluation of responses

1. Sex	Man ♂ 55 (47%)			Woman ♀ 62 (53%)			
2. State	SK 89 (76,1%)	CZ 11 (9,4%)	H 13 (11,1%)	PL 2 (1,7%)	Other 2 (1,7%)		
3. Age	≤ 17 2 (1,7%)	18 - 25 37 (31,6%)	26-35 39 (33,4%)	36-45 22 (18,8%)	46-55 11 (9,4%)	56-65 6 (5,1%)	≥ 66 0 (0%)
4. Distance from residence (km)	≤ 10 29 (24,8%)	10 – 25 25 (21,4%)	26 – 50 31 (26,5)	51 – 100 15 (12,8%)	≥ 100 17 (14,5%)		
5. Lenght of recreational stay (days)	1 45 (38,5%)	2-3 42 (35,9%)	4-7 27 (23,0%)	7 -13 3 (2,6%)	≥ 14 0 (0%)		
6. Mode of transport	On foot 3 (2,6%)	Bike 10 (8,6%)	Car 66 (56,4%)	Public transport 38 (32,4%)	Collective tour 0 (0%)		
7. Accommodation	Tent 3 (2,6%)	Cottage (≤ 10 persons) 13 (11,1%)	Guest-house 7 (6,0%)	Hotel 11 (9,4%)	Recreat. facility (≥11 persons) 38 (32,4%)	Without accom. 45 (38,5%)	
8. Board	Own 11 (9,4%)	Buffet 42 (35,9%)	Pension 22 (18,8%)	Hotel 21 (17,9%)	Combin. 21 (17,9%)		
9. Information about area from	Own experience 72 (61,5%)	Friends and acquntances 22 (18,8%)	Radio and TV 0 (0%)	Internet 20 (17,0%)	Promotional materials 3 (2,7%)		
10. Type of recreation	Bathing 55 (47%)	Water sports 32 (27,4%)	Tourism 15 (12,8%)	Breather 11 (9,4%)	Other leisure activities 4 (3,4%)		
11.Other popular activities (order)	Culture 17 (14,5%)	History 17 (14,5%)	Technical monum. 11 (9,4%)	Bike 30 (25,7%)	Tourism and walk in nature 42 (35,9%)		
12. Services evaluation	1 (the best) 11 (9,4%)	2 66 (56,4%)	3 38 (32,5%)	4 2 (1,7%)	5 (the worst) 0 (0%)		
13. Environment and Landscape evaluation	1 (the best) 36 (30,7%)	2 78 (66,7%)	3 3 (2,6%)	4 0 (0%)	5 (the worst) 0 (0%)		
14.Environment cleanliness eval.	1 (the best) 11 (9,4%)	2 53 (45,3%)	3 53 (45,3%)	4 0 (0%)	5 (the worst) 0 (0%)		
15. In the area most lacking	1 (the most)	2	3	4	5 (at least)		
Small recreational constructions	55 (47,0%)	27 (23,1%)	27 (23,1%)	6 (5,1%)	2 (1,7%)		
Playground for childern	31 (26,5%)	49 (41,9%)	28 (23,9%)	9 (7,7%)	0 (0%)		
Toilets	12 (10,3%)	21 (17,9%)	27 (23,1%)	38 (32,4%)	19 (16,2%)		
Trash bins	19 (16,2%)	15 (12,8%)	21 (17,9%)	21 (17,9%)	41 (35,1)		
Information boards	0 (0%)	5 (4,3%)	14 (12,0%)	43 (36,7%)	55 (47%)		

- most visitors evaluated the environment and the landscape in surroundings as good (78 (66,7%) and environment cleanliness as good – 53 (45,3%) or average – 53 (45,3%);
- by the majority of visitors around the Počúvadlo most lacking small recreational constructions – 55 (47%) and playground for childern – 31 (26,5%);
- by the majority of visitors arround the Počúvadlo at least lacking the information boards 55 (47%).

Conclusion

In 1950, Banská Štiavnica was declared one of the first Urban Conservation Areas in Slovakia. The uniqueness an contribution of Banská Štiavnica´s water management system, which led to the progress of world civilization, was so recognized by UNESCO in Cartagena in 1993, when the history town and technical monuments in surroundigs was inscribed in the World Cultural and Natural Heritage List. It can certainly be assumed that the region will be interesting in the future even more on visiting for many visitors. One of the primary prerequisites for the above is a continuous improvement of all services. To the above can contribute presented research.

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Souhrn

Příspěvek se zabývá hodnocením spokojenosti návštěvníků jezera Počúvadlo v blízkosti města Banská Štiavnica (střední Slovensko) v Chráněné krajinné oblasti Štiavnické vrchy během letní rekreace. Historické jezero Počúvadlo, které bylo

vybudováno v letech 1775 - 1779, patří vzhledem ke své atraktivitě k rekreačně a turisticky nejnavštěvovanějším lokalitám v oblasti Banské Štiavnice a CHKO Štiavnické vrchy. Hodnocení bylo provedeno formou anketního dotazníku s 15. otázkami. Průzkum byl proveden od 1. července do 31. srpna 2015. Z 200 rozdaných dotazníků se nám na zpracování vrátilo 117. Otázky v dotazníku byly zaměřeny na spokojenost návštěvníků s možnostmi rekreačních aktivit, službami a okolním prostředím. Vzor anketního dotazníku s vyhodnocením odpovědí aktivních respondentů se nachází v Tab. 1. Výsledky dotazníkového průzkumu mohou sloužit jako podklad pro zlepšení podmínek na rekreaci v této cenné oblasti během různých volnočasových aktivit.

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EVALUATION OF THE BLANICE RIVER IN RELATION TO THE RECREATION DEVELOPMENT IN THE MODEL REGION OF VLAŠIM

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Abstract
The aim of the article is to present the results of a method of public preferences finding an awareness of the relation between the modifications of watercourses and recreation in the cities. Water elements and their surrounding area belongs to the living ecosystem, that provide a plethora of opportunities for a development of recreation, tourism and an entire region. The questionnaire method used has been applied in the selected region of the Vlašim city. The criterion for selecting the cities has mostly been the construction of nature-friendly modifications to watercourse while seeking to increase the recreational potential of the area. The outcome of this article is to present the original results of the public survey which have subsequently served for a further processing of drafts and measures for recreational potential in the selected locations.

Key words: restoration, rivers, public awareness, recreation, model locality Vlašim

Introduction

According to Bright, Barro and Burtz (2002) understanding of the relationships of local residents to the natural environment of the river and understanding the scope of its recovery may help to improve the implementation of revitalisation measures and their effectiveness.

Today, many cities are trying to improve their natural environment in order to improve the conditions for their populations and to make the city more attractive for tourists. The survey which was conducted in autumn 2010 among visitors to the revitalised River in Seoul, South Korea, focused on this issue. It concerned the revitalisation of the Cheonggyecheon River, which includes efforts to support green appearance of Seoul and to create a revitalised city. Visitors not only appreciated the restored natural environment but also the newly created recreation elements such as waterfalls, fountains, artwork, bridges, lighting, information boards and nightly laser shows. These results indicate that revitalisation contributed to the quality of life for local residents as well as promoting tourism (Lee, Lee, Choi, 2014).

Another survey combining information obtained from the public and the persons responsible for the revitalisation projects on rivers was implemented in England. The survey focused on opinions towards revitalisation projects, evaluation of the cost-effectiveness of work and public satisfaction with the level of consultation undertaken as part of the revitalisation. The survey results were amplified by using in-depth interviews conducted by researchers in the spring of 1998 (Tunstall, Penning-Rowsell, Tapsell, 2000).

It is possible to raise awareness regarding revitalisation by involving society in the decision-making process in restoring rivers. Such activities can increase the sense of public ownership and the importance of the river environment with locals (Eden, Tunstall, 2006). Additionally, it can therefore improve the probability of implementation and maintaining a revitalisation project (Junker, Buchecker, Muler-Boker, 2007).

Material and methods

The research in the model town of Vlašim was carried out in order to determine the awareness of the citizens and visitors concerning the completed modifications on the Blanice watercourse in relation to recreation. The questionnaire method and structured interviews were used in the town. The criterion for selection of the town was mostly the construction of the near-natural modification of the Blanice watercourse, pointing at the same time to increase the recreational potential of the area - *"Enhancing the capacity of Blanice by a near-natural way in the urban area of Vlašim".* The aim of the project was increasing the capacity of Blanice in a nature-friendly way, establishment of the maintenance roads along the river, modification of weirs, building fish ladders and ensuring flood protection areas and objects (Q_{100}).

Fig. 1: View of the modified riverbed of the Blanice River in Vlašim - newly built stone shoots in the riverbed, shore fortifications, planting of woody vegetation and landscaped walking trail (Lampartová, 2016)

The questionnaire was divided into two parts, the first of which contained identification questions and the other part contained questions for the evaluation of conditions for recreation by waterways. The questionnaire was compiled from a total of 17 items, some of which were closed-type questions (dichotomous, polyatomic, scale). The scale items included a rating scale from 1 (unsuitable) to 7 (suitable). The scale questions are considered metric - interval characters and can be evaluated by parametric methods (Budíková, Lerch, Mikoláš, 2005). These questions had a higher predictive value. The last question was opened. Here, the respondents had the space to express their opinions and suggestions for improving the revitalised areas. The questions include: Do you know any revitalised (restored, in a natural way recovered) waterways or areas in Vlašim and its surroundings? In Vlašim town centre there have been changes made to the Blanice River under the

project "Enhancing the capacity of the Blanice in a natural-friendly way in the urban area of Vlašim". Have you heard of this project? Please specify, where you learned of it? Please review the conditions for recreation near the Blanice River after the modification. What other modifications would you suggest to increase the recreational use of the area around the Blanice River?
The target group included residents and visitors of Vlašim, who know the locality near the Blanice. The research was attended by 170 people. The respondents' opinions were collected directly by the water flow in the city. With regard to 20 respondents the percentage of unfilled items in one questionnaire exceeded 10% and for this reason some of the questionnaires were excluded from the subsequent evaluation. The questionnaire was administered by paper form.
Primary data obtained from the questionnaires were evaluated using standard statistical methods. The data were analysed using frequency distribution tables, some selected issues tried to find out the depending existence through contingency tables and characteristics depending on verbal signs, mainly using Cramer's contingency coefficient. The scale questions were processed by multi-criterial statistical method - factor analysis, which aims to analyse the correlation of higher amount of variables (questions) and based on this analysis, to determine the groups of questions that statistically "have something in common." To process the received data, which were mostly qualitative, the Unistat ver. 5.6 statistical software was used.

Results

The interviewed respondents included a larger proportion of women (54.7%) than men (45.3%), the most represented age category was 20-29 (32.0%), then 30-39 (18.7%), and 60 and more years (17.3%). Most respondents had secondary education with GCSE (35.3%), then a university degree (19.3%). More than half of the respondents (58.7%) were employed, followed by students and pupils (18.7%).
56.7% of the respondents attend the river in their town regularly, 28.7% of the respondents have visited the site several times. The term "revitalisation of water elements" is known to 72.0% of the respondents, 80.3% of the respondents think that revitalisation projects generally have a positive impact on the landscape of the selected localities and 75.2% of the surveyed respondents prefer the landscape form near watercourses after the revitalisation modifications. One interesting finding is that 15.3% of the respondents can’t see any difference between the original state and customised streams and the surroundings. Women had positive opinions more often than men.
The awareness of the citizens of Vlašim regarding the ongoing adjustments to the Blanice River was quite extensive, but only on the basis of mere personal noteworthy, the respondents learned about the project mostly from the internet and print. The respondents perceive positively the revitalization modifications of the river in relation to the landscape. The residents regularly visit the locality around the Blanice and often use it for walking, jogging, cycling and fishing. As further adjustments to increase the recreational use of the area around the Blanice the respondents would welcome complementing furniture, building more rest areas directly by the river and the installation of information, educational or safety boards along the river.
Using the method of principal axes and the subsequent rotation of the factor matrix using the Varimax method, four factors were obtained - "Appearance of the river surroundings", "Leisure and recreation", "Sports", "Availability and Promotion".

Proposals for the changes to the watercourse and the adjacent neighbourhood to increase the recreational potential of Vlašim and the Blanice:

The following text describes the proposals for measures to ensure flood protection, conservation and enhancement of bio-diversity in the area and the recreational potential of the selected model locality of the Blanice River in Vlašim. The proposals for the measures are based on the results of structured interviews, field and questionnaire survey.

Increasing management, maintenance and patrols in the area - For newly constructed as well as existing buildings.

Promoting the awareness - complete the information, educational and safety boards about the area, river revitalisation project, transverse structures on the river, and others.

Building furniture and social facilities - In interviews with local residents, many respondents (mainly mothers with children) felt lack for furniture and social devices.

Cultural events - Supporting the possibilities of holding cultural and social events at the river (barbecue, watching movies in the summer months, opening the river to boaters, fishing competitions, etc.).

Ensuring accessibility to the river and the permeability of the area - Along the Blanice, there are many narrow paths and dirt-tracks, but the site lacks the ability of getting right to the water surface using non-barrier entrances and staircases.

Modification of existing fish passages and transverse structures in the riverbed - According to the majority of local opinions there are boulders used with sharp edges and which are too large and there isn't enough space in-between them. It creates a migratory barrier for aquatic animals. Within the adjustments, it would be appropriate to have bigger gaps between the stones on the fish migration, eventually use of other shapes and sizes of dressed stone. Furthermore, provide sufficient water flow over the concurrent drying weir, in which aquatic animals die (e.g. crayfish, steam mussel).

Creation of quiet zones and shelters - for waterfowl and other wildlife on the banks of the Blanice River.

Cleaning-up of the riverbed near the transverse structures – Removal of inappropriate sediments, dead wood and waste.

Fortification of the disturbed shores of the riverbed - In the areas with abrasion damage and steep slopes using e.g. a simple animated stone backfill allowing direct access to the river.

Planting and maintenance of the vegetation - Pruning and disposal of the selected riparian and accompanying vegetation whose generic, health and age composition in some places is inappropriate. The creation of resting places and vistas to the riverbed along the bank vegetation. Planting new vegetation, filling not only hygienic and microclimate functions but also the recreational function. Regular maintenance of grasslands on the banks and in the surrounding park.

Discussion

The opinions of the residents are very important when designing and implementing the rehabilitation programs of the watercourses. Alam (2011) states that current knowledge about public opinions on the revitalisation of rivers is inadequate and biased due to lack of awareness expertise of respondents.

The questionnaire and controlled interview method used was applied in this research in the selected locality near the Blanice river in Vlašim. For example, we wanted to know the respondents' awareness of the implemented revitalisation

project on the Blanice River and its surroundings. Vlašim citizens' awareness regarding the ongoing adjustments to the Blanice was fairly large, but only based on mere personal notice. The respondents learned about the project mostly from the internet and print. The same survey was also carried out in other towns and cities in the Czech Republic, e.g. Frýdek - Místek, Olomouc, Benátky nad Jizerou, Ostrava and Přerov, where we discovered minimal public awareness regarding revitalisation and flood modification projects that have been implemented on water flows in these towns and cities. Within the overall evaluation of the research a high dependence of the location impact on the knowledge of the project was proved. Visitors of all selected areas lack information about ongoing treatments. Recommendations to raise public awareness about the relationship between near-natural modifications of watercourses and resorts in cities primarily include the promotion of the awareness.
The urgent need for monitoring and evaluation of these actions also from a societal perspective increases along with the growing interest in programs of revitalisation treatments. Therefore, it is important to try to capture the opinions and attitudes of the local residents towards revitalisation actions (Aberg, Tapsell, 2013).
Public involvement in the planning process of the modifications of watercourses and the surrounding areas may even change their opinions and views on the actions already undertaken. The residents need to be motivated to cooperate, if they can see that their views are not being ignored (Bernhardt, Sudduth, Palmer, 2007).

Conclusion

This paper contains the results of research to identify and evaluate citizens' awareness of the impact of river flows for recreation in the model area by the Blanice River in Vlašim. The research methodology was based on the method of public preferences – questionnaires survey and controlled interview. The field interrogation was attended by 170 respondents. The term "revitalisation of water elements" is known by more than half of the respondents (72.0%). Most respondents from Vlašim (80.3%) think that revitalisation generally has a positive impact on the landscape. 75.2% respondents prefer the landscape character by watercourses after the revitalisation. The results of the public survey provided valuable information for the further processing of proposals and measures to promote public awareness of water elements and increase the recreational potential of the selected location.

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Souhrn
Cílem článku je prezentace výsledků metody veřejných preferencí zjišťující povědomí občanů o vztahu úprav vodního toku a rekreace ve městě. Použitá metoda dotazníkového šetření a řízených rozhovorů byla aplikována ve městě Vlašimi. Kritériem výběru města byla především realizace přírodě blízké úpravy vodního toku Blanice směřující zároveň ke zvýšení rekreačního potenciálu území. Výstupem článku je představení originálních výsledků veřejného průzkumu, které byly následně použity ke zpracování dalších návrhů opatření, podporující protipovodňovou ochranu, zvýšení biodiverzity v území a rekreační potenciál modelové lokality.

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EVALUATION OF THE INCIDENCE OF INVASIVE NEOPHYTES IN THE SKALICKÁ MORÁVKA NNM

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Abstract
National NatureMonument (NNM) Skalická Morávka is characterized by a abundant biodiversity of rare communities linked to regular overflowed alluvial gravel deposits due to increased flows. Kadubec and Švec mapped territory NNM in 2007 and 2009 along with Blahuta (2013) to determine the level of invasion in meadow Morávka by the knotweed (*Reynoutria spp.*) and other neophytes. However this study maps biodiversity of native species and their interactions with introduced species on bedloadstreams. Territory NPP was interspersed with a grid (50 x 50 m), which contained 454 nodal points. At every point was made phytosociologicalrelevés of a particular species. The summer aspect (which is in fact influenced by*Reynoutria spp.*) of 2014 has shown with 140 plants abundances expressed total coverage to57.1 % of the area, 45 tree species (56.2 %) and 18 neophytes (10.0 %) classified according Pyšek et al. in*Catalogue of alien plants of the Czech Republic* (2012). Coverage was evaluated for herbal, woody and shrub layer. The tree and shrub layers were evaluated according to theClassification of tree classesby Konšel (1931). Maps for each occurring species can be drawn based on the coverage and also disappearing species beneath the level of knotweed invasion can be determined. This is a prime study of mapping species diversity abundances after herbicide application to the surface area affected by*Reynoutria spp.*Finally, the unpleasant result of ingrown nature trails neophytes that hinder permeability along the river Morávka.

Key words: biodiversity, coverage, mapping, Skalická Morávka NNM, nature trail

Introduction

Gravelbedload streams and their surroundings always exceeded its rich diversity of other other habitats. There is nothing else that is not on today's Skalická Morávka. For centuries Beskids upland streams accompany kinds of mountain areas covered by a water-influenced habitats which are flushed to lower altitudes. In contrast, there occur ecological optimum thermophilic species extending from the lowland positions. Another phenomenon of increasing species diversity is often trasfered riverbed Morávka when almost every flood transforms the character and creates a new network of branching meandering stream together with marsland ponds character.

Territorial protection of Skalická Morávka NNM

The significance of the site demonstrates the fact, that the territory of Skalická Morávka was declared according to the Decree of Ministry ofthe Environment 543/2006 Coll. as National natural monument (NNM). Protected area consists of 102 hectares. The territory is aslo situated in the European NATURA 2000 network as a Site of Community Importance (SCI) Niva Morávky. According to the Territorial system of ecological stability (Czech ÚSES) territory belongs to the super-regional bio-corridor (NB) Odra river, regional biocentres Kamenec (137) and Skalická Strážnice (138), and local biocentres Vrchy a Žižka stream.

The object of protection specified in the plan of care (Šindlar et al. 2012) of NNM Skalická Morávka is geomorphological natural type Morávka stream in gravel sediments with characteristic communities and accompanying natural forests which are bound populations of rare or endangered plant and animal species (Šindlar et al. 2012). Priority objective of preserving the conservation of natural conditions for the dynamic development of the flow (the seasonal fluctuation of flows, bedload effect, sediment movement and deposition), providing sufficient space for the overflow of the stream. Furthermore, to maintain the characteristic natural communities gravel sediments along with their habitats and to try to secure their gradual spreading not only in the monuments.
After the flood of 1997 occurred across the Odra river basin to a massive settlement in flooded areas knotweed (*Reynoutria* spp.) and other neophytes. Knotweed grows on sites associated with human aktivity; ie.: along roads, streams, natural trails, turistic path and other (Beerling et al. 2004 Forman et Kesseli 2003). There is thus a total transformation of the ecological structure and biodiversity in advantage of neophytes (Bímová et al. 2004, Gerber et al. 2008, Maurel et al., 2010). Additionally Child et Wade (2000) describe knotweed, a plant growing danger of flooding. Knotweed eradication and subsequent recovery of the ecosystem is engaged Zavaleta et al. (2001) and Martonová (2010). Initial mapping and eradication of knotweed on the exposed gravel sediments dating from 2000. In 2007, the territory of the NNM Skalická Morávka was done the first area of mapping the occurrence *Reynoutria* spp. by Kadubecand Švec (2007). Where at the same year in relation to the project LIFE-NATURE (force 2007-2010) was launched repeated chemical eradication. Chemical spraying was realized after the retraction spring species on fully developed leaves knotweed by product Roundup bioactivity. 2009 Švec has completed a re-mapping of coverage knotweed after Roundup application. The last spraying was conducted according to the information available in the autumn of 2012. Further mapping was done Blahuta 2013 (2014) to determine the representation of the various habitats (Senzu Chytrý et al. 2010) and their level of invasion *Reynoutria* spp.

Habitat mapping
According to *Catalogue of habitats in Czech Republic* (Chytrý et al. 2010),13 habitats were determined by Blahuta(2014) on territory ofNNM Skalická Morávka.The most abundant is forest habitat L2.2 (Ash-alder alluvial forest). L3.2 (Polonial oak-hornbeam forests) occur with increasing distance from the active flow ofMorávka river.The most common habitats in river ecosystems are K2.2(Willow scrub of river gravel banks),M4.1 (Unvegetated river gravel banks)but unfortunately also X7B (Herbaceous ruderal vegetation outside human settlements with neofytes). The rarest habitat M4.2(River gravel banks with *Myricaria germanica*) has been demonstrated only at a single point.Thespecies protected by law according to*Black and red lists of vascular plants of the Czech Republic*(Procházka et al. 2001)are listed in *Management plan* (Šindlar et al. 2012).The critically endangered species which occur at the territory are: *Myricaria* germanica and *Equisetum variegatum*. Highly endangered species include: *Equisetum hyemale* and *Calamagrostis pseudophragmites*.An endangered species is *Equisetum ramosissinum*.

Objectives and benefits of work
The aim of the work was to determine the level of invasion in NNM by neophytes and to evaluate the success of eradicationcarried out in previous years. The results of this study are focused on diversitytotal coverage of various native speciesor threat

to any of them by abundance of neophytes.Map documentation is practically usable for mapping mapují expansion of neophytes and express their percentage coverage. Thus, the monitoring of the spray applicationsuccess after eredication is possible.Further work predict the dependence of the fundamental features of each habitat with regard to their level of invasion.

Materials and methods

Site description

The study was carried out on the territory of NNM Skalická Morávkawith the area 101,98 ha (Šindlar et al. 2012).This Protected Areas of Nature is located in Moravskoslezskýregion, south of the district town Frydek-Mistek. The surrounding municipalities are Skalice u Frýdku-Místku, Vyšní Lhota, Nižní Lhota, Nošovice andRaškovice. The river bed of Morávkais formed by gravel and sandy fluvial sediments (Culek et al. 1996). From the geomorphological aspects relief of NNM has an uphill character and the predominant soil types are influenced by water (Culek et al. 1996).According to Quitt'sclimatologicaldivision(1971) the southern tip belongs tomoderately warm area MT-10, the central portion is located moderately warm area MT-9 and the northernmost part belongs to the moderately warm area MT-8.Average temperature according to ČHMÚ (2007) is 7 °C. According to Culek et al. (1996) there is the high number of oreophytes a mesophytes. According to Raušerova and Zlatníkova (1966) is altitudinal zonationin zone number 3.

Preparatory work and field research

Field mapping ofgeobiocoenosis species biodiversity in NNM Skalická Morávkawas held at the turn of August and September 2013. It was approached only for mapping the summer aspect of vegetation. It is in fact subjected to intense negative impact of invasive knotweed (*Reynoutria* spp.)and Himalayan Balsam (*Impatiens glandulifera*). During the first inspection, it was found that the dense vegetation makesimpossible to use standard GPS because of low accuracy.Multi-purposemapswere created in an ArcGIS software.Tha map of NNM Skalická Morávka interspersed with a grid was created using the tool "grids". Distance of the individual nodes was 50 x 50 m. Location of the square grid was completely random and not subject to any calibration by a known point in the field.A grid was only assigned to a north-south orientation and all the nodes were numbered according to the order. The NNM buffer zone was not part of the mapping. The buffer zone is defined only on the inlet and outlet of the river Morávky, thus does not form a typical 50-meter boundary from the border specially protected area. The total number of grid points amounted to 454.

Phytosociological relevés

A list of herbal and woody potentially occurring species was created in Excel programme. Simplified phytosociological relevés was carried out in every node in accordance with the work of Vatolíková(2004) and Vinklerová(2012). Surveyed plot to describe the herb layer was spread on an area of 5 x 5 m.total coverage of woody layer,undergrowth and herb layer with a list of percentages of individual plant species was recorded. For a woody layer,dominant and sublevels species were recorded according to Konšel's classificationof woody plants (1931). The undergrowth constisted of third and fourth level, thus shrub layer occured. Wood plants up the 1 m occured.If the vegetation consists only of shrubs, was assigned to woody plants layer. Herb layer was formed among other by seedling forest up to 1 m.

Phytosociological relevés showed coverage of the species in excess of the limit of 5%. Coverage was graduated by 5% to 20%.If the species coverage exceeded the level of 20 %, it continued to be grading by 10%. Species which exceeded the level of 20% can be considered as the dominant regardless of the total coverage at a given point.If the reported coverage exceeding the limit of 20% for neophytes, this point was considered non-native and anthropogenically influenced. Within the mapping of knotweed *(Reynoutria* spp.*)*all of its occurrence was recorded And even in cases where the knotweed found outside the plot, and its coverage was less than five percent.

Data processing

Data processing was carried out in program Turboveg 1.10. (Hennekens and Scheminée 2001) and Juice 7.0. (Tichý 2002). The species diversity of each species linked to the occurrence of alien species and among themselves was compared. Interpretation of the data took place in program ArcGIS 10.2. Here all mapped species according they coverage were compared. In terms of size of these outputs,these information are not presented in this work.Results of this work include the percentage of the numerical value of total coverage of species diversity in the evaluation of individual layers.The considered and presented species have exceeded level 1% of their total coverage in the territory of the NNM.Special attention should be paid to species protected by law and non-native.

Results and discussion

Overall, the occurrence of 203 plant species was demonstrated in 2013 (45woody plants a 156herbaceous plants and grasses). According to *Catalogue of alien plants of the Czech Republic*(Pyšek et al. 2012) the occurrence of 16 neophytes was recorded.It was also demonstrated the occurrence of five legally protected species, categorized according to the decree n. 395/1992 Coll.The coverage of hervbaceous (57,1 %) andwoody layer(56,2 %) is almost identical.

Representation the individual layers and level of invasion by neophytes

<u>Tree layer</u>- The average total coverage oftree layer in the territory of NNM Skalická Morávka reached 56.2%. Tree layer is not created only at 41 points (0% coverage).The percentage coverage of all nodal points above the exceeded 5% was achieved in five species: *Alnus incana*– 6,0 %, *Salix elaeagnos*– 5,3 %, *S. fragili* – 5,4 %, *Acer pseudoplatanus* – 8,1 % and(*Fraxinus excelsior*) – 6,8 %.Non-native *Robinia pseudoacacia*occured on 0,3 % area.

<u>Shrub layer</u> – Shrub layer was presented at 203 points but in negligible representation. The average total coverage oftree layer in the territory was5,2 %. The most represented shrub species is *Prunus padus*, also *Sambucus* spp. and *Lonicera* spp. rarely appear.

<u>Herb layer</u>–The average total coverage in the territory is 57,1 %. The most represented plant is nitrophilous stinging nettle (*Urtica dioica*) with 4,1 %, next *Aegopodium podagraria* with 3,8 %, *Eupatorium cannabinum* with3,4 % and *Phalaris arundinacea*with 3,2 %. Only 11 species from 156 total recorded species exceeded 1% avarage total coverage. Frequent floods cause a disturbance of these dynamically developing communities. This phenomenon contributes to the natural secondary succession.These newly formed disturbed areas are colonized by pioneer and ruderal species, which are considerable represented and affect the total coverage of herb layer. Unfortunately alien knotweed(*Reynoutria* spp.)

andHimalayan balsam(*Impatiens parviflora*) are both R-sstrategist and inhabit these areasthe fastest.

Species protected by law- The average total coverage in the territory of these protected species is 6,2 %. The most abundant species is highly endangered (C2)*Salix elaeagnos* with 5,3 %. Critically endangered (C1) *Myricaria germanica*was demonstrated only in 10 points with a total coverage 0,22 %. Occurence of highly endangered (C2) *Calamagrostis pseudophragmites*was confirmedonly on scattered points and outside phytosociological relevés. Critically endangered (C1*Equisetum variegatum* and highly endangered(C2) *E. hyemale*failed to find.Despite the *Mangament Plan*(Šindlar et al. 2012), the occurrence of highly endangered(C2)*Salix daphnoides*and endangered (C3) *Gentiana asclepiadea*was confirmed.

Neophytes–The average total coverage of neophytes in the territoryreached 10,0 % with 16 species. Most abundant species is invasive Himalayan balsam (*Impatiens glandulifera*)the occurrence of 230 points and the total abundances 4,0 %. Knotweed(*Reynoutria* spp.) with coverage 2,4 % was identified at 276 points.On the territory of NNM occurred three individuals of *Heracleum mantegazzianum*representing the primary hazard.

Occurrence of neophytes and efficiency of surface knotweed eradication

Total coverage of neophytes reached 10,0 %. This highlights the fact that every fifth recorded species was neophyte. Neophytes can be distinguished according to their ecological requirements and their optimal habitat can be differentiated.

Species with declining coverage due to neophytes can be determined very easily. Knotweed(*Reynoutria* spp.) finds its ecological optimum in the shade in humid localities with high water level.Most affected habitat is L2.2(Ash-alder alluvial forest) andK2. 2 (Willow scrub of river gravel banks). Canopyof knotweed occured Zápoj tvoří in wet older and thinned stands. Then knotweed is located at riparian woodlands and forest edges.In direct interaction with habitats of gravel sediments knotweed creates stunted or malformed individuals. These malformed knotweeds can also be observed in surviving individuals after herbicide application.

Himalayan balsam (*Impatiens glandulifera*) covers direct riparian boundary of the river where accompanies knotweed. In these locations, even displaces knotweed and produces up to 3 m thick growths. Widely represented in the habitat K2.2. Also located in the meandering channels in forest habitats with stagnant water.On dry sunny sites not occurs.

It can be stated that even after repeated areal spraying of herbicide knot weed regeneration (*Reynoutria* spp.) still occurs on the territory of NNM Skalická Morávkamore or less in the same locations. It now occurs predominantly only in points. Dense canopy is formed only in the vicinity of high and very high voltage. However, the rate of coverage is worrisome. Knotweed is located at 62% of the surface and it assumed a trend towards resettlement of original locations.Švec (2010) mapped knotweed (*Reynoutria* spp.) in 2007 on 53,9 % of territory and in 2009 on 40,4 %the territory of NNM Skalická Morávka. Recently after the eradication of knotweed invasionof Himalayan Balsam(*Impatiens glandulifera*) occurs on open areas. This secondary invasion described by Kourtev et al. (1999).

Conclusion

The results of this study mainly assessed the level of invasion of the monitored area by neophytes with regard to overall coverage of various native species in the territory of NNM Skalická Morávka. Area of interest covers 101,98 ha in Moravskoslezskýregion. Subject of protection according to the *Management*

Plan(Šindlar et al. 2012)is geomorphologically of wild flowof Morávka river. The the occurrence of rare species of fauna and flora s bound to this river.

In 1997, Moravia suffered huge floods, during which it was transported huge amounts of natural materials throughout the watershed. However, also soil rich in vegetative parts of alien plants, especially knotweed*Reynoutria* spp.)was transported.Knotweed invaded these exposed areas. After the flood, there was a total transformation of the ecological structure and biodiversity in favor of neophytes and ruderal species. Initial mapping and liquidation of knotweed on the exposed gravel sediments dating from 2000. The first area mapping of the territory of NNM Skalická Morávkawas carried out in 2007by Kadubec and Švec(2007)to detect the presence vof*Reynoutria*spp. The same year in relation to the project LIFE-NATURE (operation 2007-2010) repeated chemical destruction was initiated. In 2009 a re-mapping of coverage knotweed after spray applicationwas completed byŠvec. The last spraying was done according to the available information, in the fall of 2012.

Mapping was carried out in 2013 by Blahuta(2014). The NNM territory was covered with grids(50 x 50m), which included contact 454 points. At every point simplified phytosociological relevé was carried out. Phytosociological relevé showed coverage of vegetation in excess of the limit of 5%.Overall, 2014 proved the occurrence exceeding 5% coverage with 203 taxa (45 woody plants and 156 vascular plants). The occurrence of 16 neophytes was proved.Total coverage of neophytes exceeds 10,0 %. Every fifth species was recorded as neophyte.Cover of herbaceous(57,1 %) and tree layer(56,2 %) is nearly identical.

In the opinion of the the researcherpoint mapping method using phytosociological relevé is suitable. To determine trends is necessary to update the new mapped points for each species. Now is possible to evaluate only trends for invasive knotweed (*Reynoutria* spp.). It wouldbe appropriate to carry out the mapping of each species (not only neophytes) within their abundances in whole SAC Niva Morávky. Seems appropriate to map every two years, or after every major flood which transformthe landscape area in NNM Skalická Morávka.

If themanagement of NNM Skalická Morávka or Povodí Odry a.s. will approached comprehensively to liquidation of invasive neophytes, we can assume their suppression andthe return of local native species to these rare ecosystems.This will improve biodiversity throughout this area.

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Souhrn

Výsledky této studie hodnotí zejména invadovanost sledovaného území neofyty s ohledem na celkovou pokryvnost jednotlivých autochtonních druhů na území NPP Skalické Morávka. Řešené území se rozprostírá na 101,98 ha v Moravskoslezském kraji. Zde je předmětem ochrany dle plánu péče (Šindlar et al. 2012) geomorfologicky typ divočícího toku řeky Morávky, na který je vázán výskyt vzácných druhů živočichů a rostlin.

V roce 1997 postihly Moravu obrovské povodně, při níž bylo transportováno obrovské množství přírodních materiálů napříč povodí. Bohužel došlo k transportu zeminy bohaté na vegetační části nepůvodních rostlin, zejména křídlatky (*Reynoutria* spp.), která tyto obnažené plochy invadovala. Po povodni došlo k celkové přeměně ekologické struktury a biodiverzity ve prospěch neofytů, či ruderálních druhů. Prvotní mapování a likvidace křídlatky na obnažených štěrkových náplavech se datuje od roku 2000. Roku 2007 bylo na území NPP Skalické Morávky provedeno Kadubcem a Švecem (2007) první plošné mapování výskytu *Reynoutrie* spp., kde téhož roku v návaznosti na projekt LIFE-NATURE (platnost 2007-2010) byla zahájena opakovaná chemická likvidace. Roku 2009 bylo Švecem provedeno opětovné mapování pokryvnosti křídlatky po aplikaci postřiku. Poslední postřik byl proveden dle dostupných informací na podzim roku 2012.

Mapování bylo provedeno roku 2013 Blahutou (2014). Území NPP bylo proloženo čtvercovou sítí (50 x 50m), která obsahovala 454 vztyčných bodů. V každém bodě byl proveden zjednodušený fytocenologický zápis jednotlivých druhů. Fytocenologický zápis zachycoval pokryvnost u druhů vegetace převyšující mez 5 %. Celkově byl roku 2014 prokázán výskyt převyšující 5 % pokryvnost u 203 taxonů (45 dřevin a 156 cévnatých rostlin). Z cévnatých rostlin byl prokázán výskyt 16 neofytů. Bohužel celková pokryvnost neofytů přesahuje 10,0 %. Tento údaj poukazuje na fakt, že každým pátým zaznamenaným druhem byl právě neofyt. Pokryvnost bylinného (57,1 %) a dřevinného patra (56,2 %) je prakticky totožná.

Dle názoru řešitele se ukázala bodová metoda mapování pokryvnosti pomocí fytocenologických snímků jako vhodná. Pro stanovení trendů je nutné provést novou aktualizaci mapovaných bodů jednotlivých druhů. Nyní lze vyhodnotit trendy pouze pro invazivní křídlatku (*Reynoutria* spp.). Vhodné je učinit mapování výskytu jednotlivých druhů (nejen neofytů) v rámci jejich pokryvností na celé EVL Niva Morávky. Přínosem se jeví mapování v intervalu pěti let, či po každé velké povodni přeměňující krajinný ráz území NPP Skalické Morávky. Dominující migrační cesta neofytů je bezesporu řeka Morávka, ale přínosem může být zmapovat abundanci křídlatky v člověkem ovlivněných plochách. Křídlatka mimo jiné zarůstá zdejší

naučné stezky, cyklotrasy a turistické trasy. Ta vytváří svým hustým porostem neproniknutelnou bariéru.
Pokud management NPP Skalické Morávky, či Povodí Odry a.s. bude k likvidaci invazních neofytů přistupovat komplexně, lze předpokládat jejich potlačení a návrat autochtonních druhů zdejších vzácných ekosystémů. Tím dojde ke zlepšení biodiverzity celé této lokality.

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EVALUATION OF THE RIVER BANK TREE VEGETATION STABILITY OF SELECTED SEGMENTS OF SPOJENÁ ORLICE RIVER, HRADEC KRÁLOVÉ

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Abstract
The article presents a part of the results obtained in frame of solving the project "Evaluation of the river bank tree vegetation stability of selected segments of Spojená Orlice river in Hradec Králové". The project consist of study surveying river banks soil conditions, hydrological and hydraulic characteristics of the river bed and basic mechanical characteristics of presented trees. Combination of these attributes serves as arguments for claiming final conclusions, namely that the presence of tree vegetation on the river banks is important not only for its ecological and aesthetical function, but also for its technical purposes.

Key words: river bank vegetation, line vegetation, Spojená Orlice

Introduction

The article presents a part of the results obtained during the solving the project "Evaluation of the river bank tree vegetation stability of selected segments of Spojená Orlice river in Hradec Králové ". The study was elaborated by the team consist of the academics of a Faculty of Forestry and Wood Technology, Mendel University in Brno, Czech Republic on the base of requirement of the Department of Environment of the Municipality of Hradec Králové.
Main focus of the study was Evaluation of the river bank tree vegetation stability of selected segment of Spojená Orlice river in Hradec Králové. Study was elaborated as the point investigation of one selected riverbank segment of Spojená Orlice river, its cross section description, description of the material of the upper riverbank and description of selected individuals of tree vegetation. The matter of the study was to find out arguments for saving the riverbank vegetation surrounding Spojená Orlice river as the crucial recreational corridor in the city.
The main hypothesis of the study are as following:
1. The riverbanks (especially embankments) is made of the material originated in the former riverbed of Spojená Orlice and was replaced to the new construction of the embankments at the begging of 20th century after the rebuilding the riverbed to have higher capacity. The embankments were not constructed as the technical ground dykes and that is why the tree vegetation on that type of embankments construction can in fact contribute to its higher mechanical stability.
2. The water cannot flow over the embankments during the extreme hydrological situations. Also the flow velocity during the extreme hydrological situations is not able to cause such compressive energy which can destroy trees located in the riverbank.

Materials and methods

The topic of flood protective dikes and river banks stabilization by the tree vegetation is included in a lot of scientific and technical papers. For example Gray (2007) in USACE (2010) claims that the flood protective ground dikes and the ground dams are not comparable especially due to different characteristics, functions and

purposes. Shields and Gray (1992) made analyses of vegetation effects on the stability of 10 km long segment of protective embankment by the river Sacramento, northwest to Sacramento city, California. The results showed that shrubs and small trees growing on the protective embankments give the benefits not only to living environment but also improve the structural integrity of protective embankments without the risks which are brought by big trees. Shield and Gray (1992) present the research of Davidson et al. (1991) which brinks results that in some particular conditions can woody vegetation provide better protection of the slopes of the embankments than herbal vegetation. The vegetation along the rivers higher than grasslands provides important living space for animals and have also an aesthetic effect (Dennis et al., 1981; Říha, 2014). Wide eliminating of woody vegetation can also lead to slope defects (O'Loughlin 1974; Gray and Megahan 1989; Gray and Sotir, 1996; Pollen-Bankhead et al. 2009).
Own field work in the locality took a place in October 2014. Locality (surveyed segment) was chosen on the left riverbank of Spojená Orlice River between the bridges called Orlicky (river km 2,000) and Steely (river km 2,630), GPS 50°12'32.4" N, 15°51'9.7" E.
At the locality were done following surveys:
1. Basic soil survey focused on the characteristics of riverbank substrate
2. Measurement of the basic characteristics of typical river cross-sections
3. Tensile test of the trees resistance against the compressive energy that can cause their destruction

Results

On the base of soil survey the material of river embankments was characterized as significantly stratified anthroposoil with permanently covering by humus layer (probably originated in former arable layer) with depth approximately 45 cm.
Upper layer is densely occupied by roots, humus and moderate to softly structural. Under the upper layer is located heterogeneous soil body where the clay and sand materials alternate irregularly. Those materials are located more less horizontally without significant mixing are skeletonless or with mild proportion of skeleton.
Table 1 presents results of hydrological modeling of particular hydrological situations in selected cross section of Spojená Orlice river with using the software HEC-RAS 4.1.0. The model cross section was determined as "average" cross section recounted from the values of three measured cross sections within the distance 40 m. Scheme of model cross section presents figure 1.

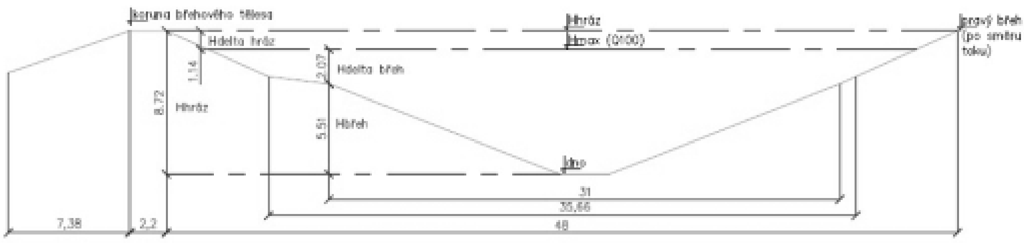

Fig. 1: Scheme of model cross section

Results presented above (tab.1) show that there is no prerequisite of over flowing the embankments in case of occurring modeled river flows in surveyed cross section (Hdelta hráz). Also show the water velocity in case of increasing water level caused by increasing river flows within defined approximates of reaching. That water

velocity is compared with critical water velocity causing trees critical bending moment which leads to trees destruction. The effect of critical bending moment measurement is located to the trees height 1 m regarding to the values in column Hdelta břeh (the middle value of water level after its rising).
Table 2 presents the results of tensile tests on the representative set of trees. The focus of the test is to determine critical bending moment and critical water velocity as the characteristics of trees stability.

Tab. 1: Results of hydrological modeling of particular hydrological situations in selected cross section of Spojená Orlice river

	Q (m3/s)	Vmax (m/s)	Vbreh (m/s)	Hmax (m)	Hhráz (m)	Hbřeh (m)	Hdelta hráz (m)	Hdelta břeh (m)
N100	542	4,42	0,78	7,58	8,72	5,51	1,14	2,07
N50	471	4,26	0,75	7,16	8,72	5,51	1,56	1,65
N20	382	4,04	0,55	6,59	8,72	5,51	2,13	1,08
N10	319	3,84	0,36	6,15	8,72	5,51	2,57	0,64
N5	259	3,62	0	5,69	8,72	5,51	3,03	0,18
N2	186	3,26	0	5,07	8,72	5,51	3,65	-0,44
N1	135	2,97	0	4,25	8,72	5,51	4,47	-1,26
NA	21,8	3,23	0	5,07	8,72	5,51	3,65	-0,44
Nakt	9,5	1,45	0	1,57	8,72	5,51	7,15	-3,94

Notice: N100 - Nakt - Model river flows with probability of reaching or exceeding 100, 50, 20, 5, 2 and 1 years and actual river flow in the cross section

Q (m3/s) - river flow
Vmax (m/s) - maximal river flow velocity
Vbreh (m/s) - river flow velocity by the bank side
Hmax (m) - maximal water level within the cross section related to particular river flow
Hhráz (m) - Height of the upper edge of the embankments
Hbřeh (m) - Height of the lower edge of the embankments
Hdelta hráz (m) - Difference between Hhráz a Hmax
Hdelta břeh (m) - Difference between Hmax a Hbřeh

Tab. 2: The results of tensile tests on the representative set of trees

Tree species	Diameter, brest height 1,3 m (cm)	Moment (kN/m)	Safe factor	Critical moment (kN/m)	Emerging moment (kN/m)	Critical velocity (m/s)
Acer platanoides	57	119	1,82	216,58	65,55	18,2
Fraxinus excelsior	54	209	1,5	313,5	56,35	23,6
Quercus robur	43,5	101	2,6	262,6	49,45	23,0
Quercus robur	25	14,6	1	14,6	28,75	7,1

Discussion and conclusion

From the biology and hydrology point of view the material of surveyed embankments could be defined as the material originated from the former riverbed (sediments with different proportion between sand and clay) recently covered by organic-mineral moderately to greatly humused layer. Generally those materials are not recommended for the flood protection dykes construction. In case of water infiltration to the embankments body caused by the flood situation the liquidity of sands can lead to destabilization of the embankments. Considering the density of tree roots inside the cover layers of embankments higher resistance against erosion can be supposed in comparison with the parts of riverbanks without trees. The critical moment of trees location in case of embankments full water saturation is their weight. Especially the trees with higher dimensions can start the destructive processes if the riverbanks.

According to used hydraulic model and software it can be stated that nor in the critical hydrologic situations (river flow equivalent to Q100) can river rise over the edge of current riverbanks. Even in the situation of reaching Q100 river flow the water level could be 1.14 m above the edge of the riverbanks. This is even more important taking account the fact that the main trees roots zone is located not deeper than 80 cm. Combination of mentioned above can prove the supposition that nor in case of critical hydrologic situation the root zone can be affected by changed mechanical characteristics of the soil caused by infiltrating water what means that the negative impact of bigger trees should be eliminated.

On the base of field tensile tests followed by the calculation of critical bending moment and critical water velocity which caused the critical bending moment it can be stated that flowing water in all valuated hydrologic situations cannot reach the flow velocity adequate to critical one and for that cannot cause critical bending moment.

All the results presented above give the mandate to state that the trees located in surveyed cross section of Spojená Orlice River are stabile and resistant against flowing water. If the embankments controlling mechanisms will be realized regularly and responsibly there is no necessity to remove the trees from the embankments and by that destroy one of the most beautiful recreational corridor in Hradec Kralove city.

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Souhrn
Článek prezentuje část výsledků studie "Posouzení stability břehové stromové vegetace vybraných segmentů břehů Spojené Orlice v Hradci Králové". Studie byla zpracována pracovníky Lesnické a dřevařské fakulty Mendelovy univerzity v Brně na základě objednávky Odboru životního prostředí Magistrátu města Hradec Králové. Předmětem studie bylo posouzení stability břehové stromové vegetace na příkladě vybraného segmentu břehů Spojené Orlice v Hradci Králové. Studie byla provedena jako bodové šetření jednoho břehového segmentu Spojené Orlice, jeho průtočného profilu, materiálu svrchní části břehového tělesa a vybraných reprezentativních jedinců stromového inventáře. Smyslem studie byla podpora zachování liniové stromové vegetace na březích Spojené Orlice, jakožto, mimo jiné, zásadního rekreačního koridoru ve městě Hradec Králové.
Výsledky studie prokázaly, že mimo nesporné estetické, kulturně-historické a ekofyziologické hodnoty stromové vegetace v břehovém tělese Spojené Orlice v šetřeném úseku, je evidentní, že rovněž technický aspekt stromové vegetace v břehovém tělese je velmi významný a zejména v případě situací jako je v řešeném území je nezbytné se jím seriózně zabývat. Je zřejmé, že likvidace vegetace na břehovém tělese šetřeného úseku bez jejího následného obnovení s největší pravděpodobností povede k destabilizaci břehového tělesa a nutnosti jeho celkové technické rekonstrukce s výhledem cca. 10 let.
Současně je však třeba konstatovat, že provedená studie se ve svých závěrech opírá zejména o výsledky experimentů publikovaných v odborné literatuře a vlastního jednorázového šetření. Zde je opět evidentní závěr, že je napříště nezbytné se danou problematikou zabývat ve větší šíři, tak, aby formulované závěry mohly být obecně akceptovatelné.

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FIRST RECOGNITION AND SURVEYING OF RESEARCH AREA FOR SUGGESTION OF BANK STABILIZATION IN GRAVELSAND QUARRY HULÍN

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Abstract

The aim of this article is description after first reconnaissance of area and design of stabilization features in gravelsand quarry Hulín (Zlín region). This quarry is using method called as “extraction from water”, where surface water level area is around 1, 19 km2. Due to big surface water level area there is a formation of waves, which has major effect for creation of bank deformations, mainly for creation of abrasion cavern

Very important for stressed banks is their proper stabilization which prevent their next degradation. This is one of important condition for integration of extraction areas to landscape.

Classification of soil samples, which were taken in selected areas, was by sieve analysis according to ČSN EN ISO 14688-2/2005. Afterwards was made precise survey of research area by terrestrial laser scanning and from measured data were made precise digital terrain model, which will be compared with future images for creation of precise time development of bank deformations made by negative combination of factors causing bank-abrasion. Standstill measures will be designed by results of measurement and assessment of conditions in research locality.

Key words: bank erosion, stabilization, wind-driven waves

Introduction

Bank abrasion is problem relating to the most of dams from whole world. Bank abrasion is process of mechanical abrading, scratching and sleeking of the surface by waves associated with relocation and deposition of loose material (Šlezingr, Fialová 2012; Šlezingr et al. 2012). Occurrence of abrasion is mostly in parts of the dam, where we can find large slope of the bottom and adjacent banks. Waves in deep water don’t lose enough energy and that is the reason why their biggest effect reflects on connections of surface water level and banks and cause leaching of big amount of ground, mostly in heels of the hillside, where is formation of abrasion recess and then abrasion cavern (Pelikán, Marková 2013). Local roads and objects are in danger from landslides of the ground and it is important to prevent from formation of abrasion cavern and stabilize banks with the most effective way (Šlezingr et al. 2010). Aim of this article is to describe research of stabilization on destroyed banks with biotechnological stabilization (Šlezingr 2011; Šlezingr, Jedlička 2010). This issues also study Šlezingr (2010, 2013).

Materials and methods

Gravel sand quarry Hulín is in Kroměříž district, about 0,7 km far away from the city Hulín. Origin of gravel sands here are from rivers, stored by river Morava in the

Quaternary. Lode is industrially used from the end of the seventies. Extraction of product is by wet extraction, which means that it happened under groundwater level, and gradually it forms one big lake (quarrylifeaward.cz).
Reconnaissance of locality was in November 2015, where the water level was very low, few meters under average water level. This condition was very helpful for terrain surveying, mostly for exposed abrasion cavern and abrasion recess. Research area was selected in the south side of gravel sand quarry, where extraction work was finished and with performed land reclamation. For surveying of terrain was bade static panoramic scanner – "Phaseshift", which determines the position of points on the continuous measurement of the phase shift between the transmitted and received laser beam. Scanning of terrain was made from six standpoints. In near surroundings of standpoints were disposed benchmarks, which were used for connection of points from all scans to one points cloud. At the same time were these benchmarks surveyed by GNSS (Global Navigation Satellite System) by method RTK (Real Time Kinematic). On these coordinates in JTSK was possible to georeferenced these point cloud. The basic data processing was made in Faro Scene. Besides this were on this area taken soil samples from two parts of abrasion cavern, area under the cavern and on the abrasion recess. Together we had six soil samples which were tested in laboratory. Laboratory test was grain particle size analysis, which will be supplemented with determination of Atterberg limits. This test will be used for categorization of soil according to ČSN EN ISO 14688-2/2005.

Results

Terrain surveying was made by multiscan method and results were processed in Faro Scene program to create digital model of terrain.
Sample Nr. 1 – heel of abrasion cavern
Using of granulometric curve (Picture Nr. 1) was soil classified as GM or GC (gravel clay or gravel loam)
Sample Nr. 2 – abrasion cavern
Using of granulometric curve (Picture Nr. 2) was soil classified as fine-grained soils M or C (loam or clay).
Sample Nr. 3 – abrasion recess
Using of granulometric curve (Picture Nr. 3) was soil classified as SM or SC (sandy loam or sandy clay)

Discussion

Precise terrain model was made by using results from terrain surveying by terrestrial laser scanner. By adding water level to all sections of terrain we can design concrete stabilization measures suitable for this locality by Šlezingr (2011). Local materials from surroundings of quarry will be used preferably.

Conclusion

First surveying of terrain, additional analyses of soil and knowledge of average water level are primary base for design of function stabilization measures of banks. This measures will be placed there in the next season, and stabilization function will be monitored. This measures are necessary in locality Hulín, because is important to prevent banks from the retreat of bank line.

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Souhrn

Tento příspěvek popisuje prvotní rekognoskaci lokality pro návrh stabilizačních prvků v štěrkopískovně Hulín (Zlínský kraj). Díky velké rozloze vodní plochy dochází ke vzniku vlnění, které má zásadní vliv na tvorbu břehových deformací, především vzniku tzv. abrazních srubů. Tyto namáhané břehy je důležité vhodně stabilizovat a předejít tak dalšímu rozrušování, což je i jedna z podmínek opětovného začlenění těžebních lokalit do krajiny.

Na vybraných plochách byly odebrány vzorky půdy, z kterých byl proveden zrnitostní rozbor, který vedl k zatřídění zemin dle ČSN EN ISO 14688-2/2005. Dále bylo provedeno přesné zaměření výzkumné plochy pomocí mobilního laser scaneru. Z toho byl vytvořen přesný digitální model terénu, který bude následně srovnán s budoucími snímky, což umožní vytvořit přesný časový vývoj břehových deformací v důsledku nepříznivé kombinace faktorů způsobujících břehovou abrazi. Na základě výsledků těchto měření a posouzení stavu řešené lokality bude navrženo několik typů stabilizačních opatření.

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GEOCACHING IN OSTRAVA-KARVINA REGION

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Abstract
This article deals with proposal of geocaching oriented educational trails in Ostrava-Karvina region on which stops are placed already existing caches or suggestions of their placement. Given that coal mining has more than two hundred year long tradition in this area, every stop on trails with caches are mining oriented. The research part is focused on draft of different educational trails with mining theme consisting either thorough description of already existing caches or newly designed ones.

Key words: turism, the nature trail, black coal, mining

Introduction
Geocaching is outdoor game. Main goal is to find treasures. This game is on the boundary between sports and tourism. By GPS system or other navigation techniques we can hide or seek box – geocache, cache. Nowadays are around the world on various web portals registered millions of caches. Caches are located on seven continents including Antarctica and in more than 100 countries around the world. Cache is usually hidden in some signification location, cultural, historical or natural monument near its location, thus players (cachers) learn new things and explore new places. Geocaching is not only about finding the „treasures", but especially about exploring new places, where the caches are hidden. Therefore is good to use this caches and trails on selected thematic areas. They can be also used for the attractiveness of the territory within recreation. Web portal Geocaching.com contains an extensive set of instruction for legal foundation of caches (Dyer, 2004). The rules for the game are to make a free registration at any of the portals dealing with geocaching and become a member. In the Czech Republic there are two the most widely used portals: Geocaching.cz and worldwide: Geocaching.com. On the website Geocaching.com is possible to search for caches by searching in the map or according to their name, coordinates, address, etc. The profile of each cache can also determine the difficulty of finding, terrain and size of cache. Important are the coordinate which are entered into the GPS. The most widespread type of cache is "traditional cache" to which is necessary to enroll for recognition of log. Furthermore, there are multicache with many variants which include two and more places while the final place is a classic cache with a guestbook. Mystery or puzzle cache includes puzzles, codes and other tasks that need to be solved to obtain the coordinates of the final cache. Earth caches feature special geopolitical place where people can learn about a unique characters of the Earth. Web pages of Earth caches contain besides the coordinate also educational and explanatory information. Visitors will be able to see how the country has been changed by the geological process, how has been treated with resources and how scientists have been gathering evidence. For registration this cache is necessary to answer the question which control its geological location. There are also a series of meetings for geocachers, for example: "Cache In Trash Out Event (CITO)", which is

meeting focused on environment and ecological behavior of cachers towards nature. Events (mega, giga) are meeting of locals geocachers or geocaching organization for information and exchanges of experiences (geocaching.com, 2015). Geocaching plays over six millions players all around the world and increase its popularity is huge in recent years. Historically, the first cache in the Czech Republic was placed in summer 2001 by three Americans in Štramberk's park. The interest in the game increases from this time. There was on our territory 2 156 caches on our territory since 2006 and their number is increasing annually. Number of active caches in the Czech Republic was over 40 thousands in the beginning of 2015, active geocacher were over 20 thousands. The number of caches in the world system Geocaching.com was in January 2014 2.3 millions, the number of geocachers over 6 millions (project-gc, 2015). The activity of geocaching is developed and improved rapidly during last 15 years. New applications for mobile phones are created and web portals which make geocaching more pleasant and easier. There are many similar activities that are based on the principle of geocaching but they have different conditions under the player is finding them. The results of these games become a basis for scientific researches. For example, Grüntjens et al., 2013; Dunlap et al., 2015; Lisenbee et al., 2015.

Materials and methods

Ostravsko-karvinská black coal basin, located in the northeastern part of the Czech Republic in the Moravian-Silesian region and in the Ostrava is called Ostrava-Karviná district (OKD) (Matěj, Klát, Korbelářová, 2009). OKD is area of 160 km^2 and it's the main coal region of the Czech Republic with reserves of more than 90% (OKD, 2012). The whole districts is divided into two large areas, on the Ostrava-Karviná, where coal mining began in the second half of 18th century and Podbeskydsko in south of the region, where coal mining began in the second half of 20th century. OKD is divided into three sub-section- Ostrava, Petřivald and Karviná. In the 90s of the 20th century, mining was in many areas due to the decline stopped and mining objects were destroyed. Only some of them have been preserved and serve to new purposes (Matěj, Klát, Korbelářová, 2009). In the OKD is registered a total of 415 coal seams, of which 141 can be described as continuous or locally quarrying (OKD, 2012).

Four routes were designed to include the most interesting stops (caches) with the mining theme, due to differences over the current state of mining coal in Ostravsko-Karvinsko. One of these trails is content of this article. Trails were designed based on tourist maps on website Mapy.cz (2015). This webpage allows planning trails for hikers or bikers with preferential use of hiking and baking trails. If it is possible, try to avoid inappropriate ways, such as first class road. In the case of bicycle path, they tried to ride this path on bike. It led to confirm or refute this path and in some cases it led to certain changes. When passing trails, it was designed the placement for new caches at selected locations with a mining theme. Accurate determination of GPD coordinates enabled mobile applications Geocaching. Caches, which were established in the past and fit into mining ,.mnthemes, have been also incorporated into the designed trails. These caches were found and logged through mobile application Geocaching to ascertain the suitability and accuracy of the location. Duration of the trail (and also duration of finding caches) is marked in application. There is written time just for passing at the end of the description of each trail. To find each cache has been calculated an interval of five minutes but some caches can take more and others less time. It always depends on accuracy of GPS device (weather conditions), season (vegetation, fallen leaves) and mainly on experience and observation skills of geocachers.

Results

Four routes were designed to include the most interesting stops (caches) with the mining theme, due to differences over the current state of mining coal in Ostravsko-Karvinsko. One of these trails is content of this article. Route 1: Karviná-Darkov – Karviná-Louky – Albrechtice – Stonava – Karviná-Darkov (see the figure 1).

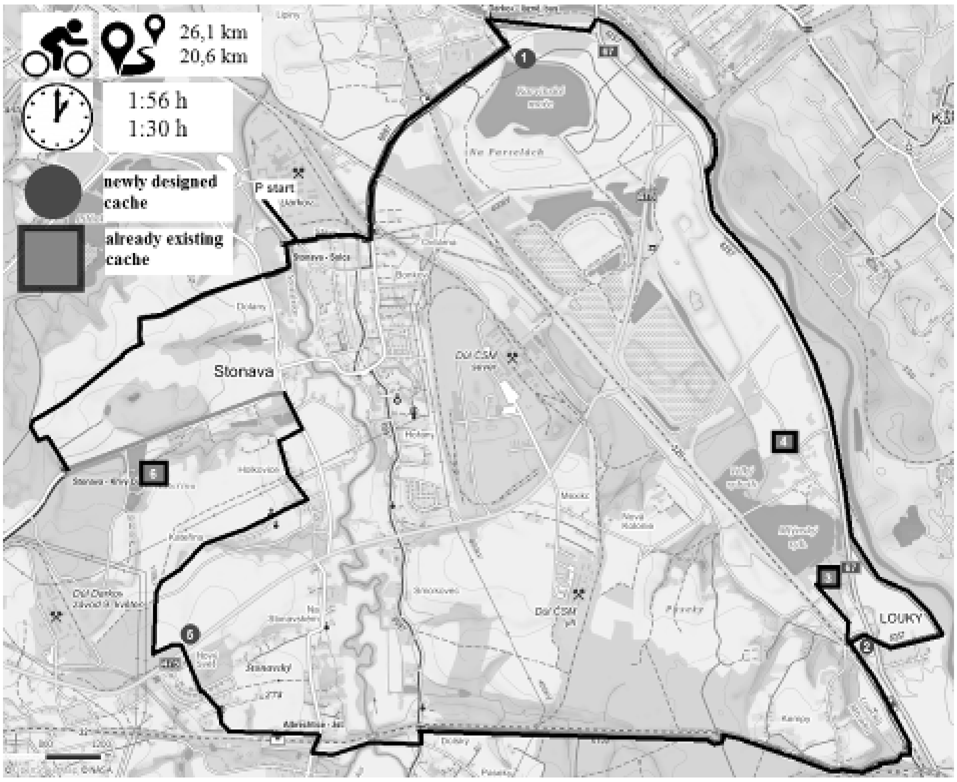

Fig. 1 : Route 1: Karviná-Darkov – Karviná-Louky – Albrechtice – Stonava – Karviná-Darkov (mapy.cz; author proposal)

The trail goes through the city Karviná – Darkov and Louky and villages Albrechtice and Stonova. It starts at Důl Darkov by the large parking lot where is possible to park vehicle. From the car park continues the trail along street Stanovská and after 200 meters connects to red tourist trail. After roundabout Důl Darkov joins to cycling rout no. 6097 (Dolní Marklovice – border crossing – Albrechtice – rozcestí). After 2 kilometers of this cycle trail on the right side is Karviná moře. Here is the first suggestion for location the new cache. Karvinské (Darkovské) sea (1. – newly designed cache) GPS coordinates: N 49° 50.199 E 18° 32.949 Difficulty: Terrain: Size: (small) Hint (help): Don’t search for me on the ground (Fig.2). By returning to cycle trail no. 6097 and continuing towards a concrete arch bridge Sokolovští hrdinové over the river Olše connects cycle trail no. 6275 (Racibórz - Krzyżanowice - Chotěbuz along the river Olše and Odra). It leads along the road I/67 and river Olše to the city Karviná – Loukay. Over the crossing of this road is located by the new

Church of St. Barbora second caches. Nový kostel sv. Barbory (2. – newly designed cache) GPS coordinates: N 49° 47.986 E 18° 35.033 Difficulty: Terrain: Size: (micro) (Fig.3). In Louky before railway crossing on the right side is the road that leads to the third already existing cache – Loucké rybníky. Recovery Loucky pond (3. – already existing cache) GPS coordinates: N 49° 48.216 E 18° 34.849 Founded: 26. 12. 2013 Difficulty: Terrain: Size: (micro). It is possible to get to the former part of village Louky nad Olší (Olzou) by continuing on the trail around the Velký mlýnský rybník of which, due to mining industry is left only the Church of St. Barbora, the predecessor of newly built church. Here is located 4th already existing cache. Starý kostel svaté Barbory (4. – already existing cache) GPS coordinates: N 49° 48.771 E 18° 34.530 Founded: 13. 10. 2007 Difficulty: Terrain: Size: (medium). The trail around the pond is quite difficult. Nevertheless, atmosphere abandoned dilapidated church is worth seeing. After returning to cycle trail no. 6257 subsequently joins the cycling trail no. 6100 (Dolní Těrlicko – Albrechtice). Along the railroad leads the trail about 4 kilometers long to the village Albrechtice to the cycle trail no. 6097. The cycle trail no. 6097 followed turn to the right on the street Pasecká about 100 meters south. It joins the yellow trail there that leads to signpost Albrechtice – train station. Street Nádražní leads from the train station up the housing estate Nový Svět. Here, after the crossing the road II/475 should be located 5th cache. Nový svět (5. – newly designed cache) GPS coordinates: N 49° 47.955 E 18° 30.888 Difficulty: Terrain: Size: (small). From there continues the local road that leads directly through reclamation land to the Holkovice. From Holkovice leads trail to the tanks Kateřenia, where is located 6th already existing cache. Kateřiny (6. – already existing cache) GPS coordinates: N 49° 48.666 E 18° 30.666 Founded: 13. 9. 2007 Difficulty: Terrain: Size: (micro). Section from Holkovice to Kateřina is one with a high degree of traffic. From Kateřina continues the trail to the signpost Stonava – Křivý Důl and the 3 kilometers red trail to signpost Stonava – Solca by Důl Darkov to starting position.

Fig. 2: Karvinské (Darkovské) sea (1. – newly designed cache, photo A.Kovářová)

Fig. 3: Nový kostel sv. Barbory (2. – newly designed cache, photo A.Kovářová)

Discussion

Trail can be completed in a shorter variant, but there are skipped caches in reclaimed sites Nový Svět and tank Kateřina. The trail is the same from Důl Darkov to Albrechtice to connect the bicycle trail no. 6100 with the cycle trail no. 6097. Than the trail leads along cycle trail no. 6097 northern through Smolkovec, Hořany (around Důl ČSM Sever) to Důl Darkov. Thus is skipped trail section of orange color (high traffic). The shorter variant can be therefore completed with children. The majority part of trail leads along marked trail and in the easy terrain. The shortest option is 7 kilometers with 4 caches from Karvinské moře to Louky, where the trail leads along the beautiful environment of the river Olše but unfortunately along the road I/67 from other side. Longer version of the trail takes to cyclists about 2 hours. However, it is necessary to count time spending with finding caches. In this case it takes about 50 minutes more (2 hours and 50 minutes). Shorter trail takes 1.5 hour and with finding cache it takes 1 hour 50 minutes. Cache-type mystery on the stop 6 – Kateřina requires homework for finding.

Conclusion

Designed trails in the territory OKR with mining theme, described above, can be used in several ways. The suggestion of 4 trails includes creation of 11 new caches that would be displayed with the other already existing cache in the database of web pages Geocaching.com. The newly formed 11 caches would be especially in Karviná, where the density of existing cache is lower, showed a very positive. For local people can be trails pleasant variegation during their walking or bike trip. Tourist and visitors, which don’t know about mining theme so much, they can learned about it and soak up the atmosphere of mining town. Local people of Karviná can valorize the development of the reclamation work. Whether the local landscape is changing to better or perhaps worse condition, or whether they will appreciate newly created nature location or sports resorts incurred after reclamation. Another, who can use the results of this work, is district and statutory cities of Ostrava and Karviná, town Orlová, municipality Stonava and Doubrava, etc. In the case of realization of the designed trails would have benefited all nearby cities and towns because it could mean an increase number of the tourists and interest in their immediate locality. Although the city of Ostrava and Karviná provide official information on official web pages about cycle trails or nature trails (in the case of Ostrava), they could extend the offer about trails with mining themes. I see benefit in connection designed trails with geocaching, thereby expending target groups (not only to tourists but also to the cachers). The trail may be applied in education, as a form of education. Since the 20th century were founded in OKR mining schools and in 1905 was based vocational school for miners by town Mariánské hory.

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Souhrn

Článek se zabývá návrhem geocachingových tematických naučných tras v ostravsko-karvinském revíru, na jejichž zastaveních jsou umístěny již existující keše nebo návrhy na jejich založení. Důlní těžba černého uhlí má na tomto území více než dvousetletou tradici, jsou všechny zastavení s keškami hornického charakteru. V závěru článku jsou formulovány návrhy na využití těchto naučných tras.

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HRANICE ABYSS IN THE HRANICE KARST – THE INCREASED INTEREST IN THE NEW WORLD RARITY

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Abstract
A relatively small karst area named after the nearest town of Hranice, this karst is located approximately between the municipalities of Hranice, Teplice nad Bečvou and Černotín, on both sides of the River Bečva. The territory of Hranice Karst is located about 40 km east of Olomouc. Zbrašov Aragonite Caves form the largest cave system in the region. Hranice Abyss is another unique formation. Hranice hydrothermal Karst is developed in the sequence of Paleozoic limestones as a result of deep influx of thermal water charged with subcrustal carbon dioxide.
The water table levels of the Hranice Abyss, Zbrašov Aragonite Caves and some hydrogeological wells were observed in a pilot study. The acquired data were analysed using neural networks and mind maps in Matlab, Weka and Agiel neural networks. The article presents the results from the above mentioned programs and about used algorithms whose task was to predict according to the measured values and based on that find out the connection between the acquired data or choose suitable values so that it would be possible to display links between the acquired values. The best results were achieved by neural networks.

Key words: Teplice nad Bečvou spa, hydrothermal karst, mineral water, Carbon dioxide, neural networks

Introduction
A relatively small karst area named after the nearest town of Hranice, this karst is located approximately between the municipalities of Hranice, Teplice nad Bečvou and Černotín, on both sides of the Bečva river. The karst area consists of several patches of limestone rising from surrounding rocks of younger age. Karstifying rocks come to the surface in the form of a wedge extending from the southwest towards the northeast; it is 5.5 km long and 4 km wide. The Zbrašov Aragonite Caves are the largest known cave system in the karst. The Hranice abys, the deepest abyss of the Czech Republic, is another outstanding formation.
Hranice Karst is found at the line of contact of the units of European importance: the Bohemian Massif and the Western Carpathians, which differ in terms of geological age and the rock filling. Karst units are formed in the Devonian and lower Carboniferous limestones of Líšeň and Macocha formations of Givetian to lower Visean age (Dvořák, Friáková 1978, Dvořák et al. 1991, Hladil et al. 2006) The whole karst area was gradually formed by two distinct processes. First, it was a conventional karstification followed by hydrothermal karstification probably at the turn of the Tertiary and the Quaternary. The thermal process reflected through increased corrosive capacity of karst water acidified with carbon dioxide. The rise of these gas-charged mineral waters referred to as acidulous waters relates with the opening of the deep structures which allowed fluids to escape from the mantle toward the surface. (Geršl 2009, Kodym 1960, Panoš 1964.)
Mineral waters were a significant factor taking part in speleogenesis of the karst objects of Hranice karst. They are also drawn from wells and used as an important

treatment resource in Teplice nad Bečvou Spa. All these facts make the Hranice karst a truly important phenomenon, which deserves the protection of our society.
Hranice Abyss has been known since time immemorial. The author of its eldest description is Tomáš Jordán of Klauznburk (1539-1586), a physician and provincial doctor in the Moravian Margraviate, who also explored the healing springs in the nearby spa resort. In 1580, he published his observations in Olomouc as part of a publication entitled “Kníha o vodách hojitedlných neb teplicech moravských“ and subsequently in one of a Latin name “De acquis medicatis Moraviae commentariolus” which was released in Frankfurt, 1586. In 1627, Hranice Abyss was reported by JA Comenius in his map (Moraviae nova et post omnes priores accurratis: sima delineatio). Plotting a hill designated as Propast (abyss) in a river bend of the River Bečva made this place this country’s first karst formation located in a map.
Nowadays, Hranice Abyss is the deepest abyss and at the same time lake in the Czech Republic (in April 2016, 384m deep, the total confirmed depth 453,5m). The abyss is also the deepest freshwater flooded cave in the world and the second deepest flooded cave in the world. Pozzo del Merro, 392m deep, is the only cave which is deeper.
In spite of these exceptional facts, the hydrogeologic regime of mineral waters of Hranice karst has not yet been made clear. The aim of our study was to set a model of groundwater behaviour and their influence by the surface water flow of the Bečva River.
To set up this model, we have used the data collected by measuring in
1) Zbrašov Aragonite Caves
2) Surface water flow of the Bečva River

Methodology

The water level heights were measured manometric sensor with automatic recording. The collected data represent the level of the Bečva River (pic.1). The frequency of measurement is three times an hour (the data are recorded in steps of 20 min to an accuracy of 1 mm). The water level in the Cave of Death (shown in the second picture) is measured with the same frequency and accuracy. Both graphs consist of 2135 values, which represent the period from 1.5.2005 to 31.5.2005. From the graphs, you can at first sight clearly see the connection which will be proved using various methods of the artificial intelligence.
The first analysis has been carried out using Matlab R2014 and Neuralfitting tool, which serves for solving problems if there is a group of numbers in the input as well as the output. Another analysis has been carried out in the Weka program, which is considered to be a very strong tool for data mining because it is for free. Agielneural network has been the last used program.

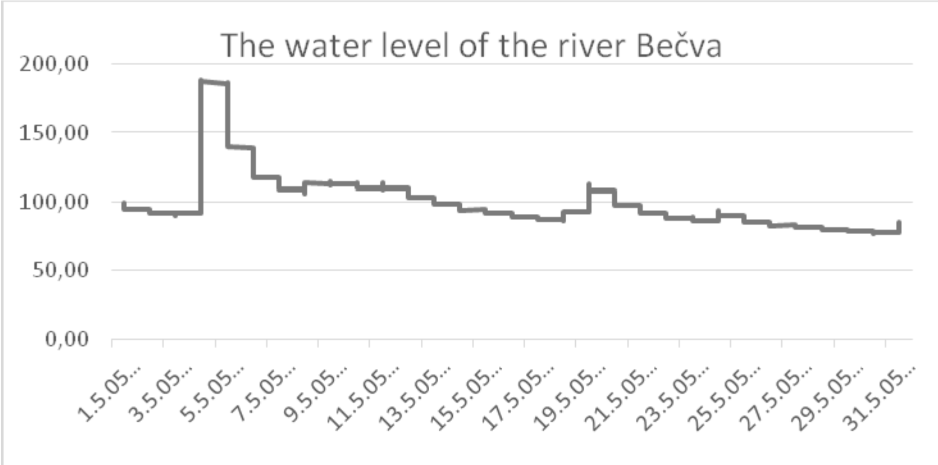

Fig. 1: The water level of the river Bečva

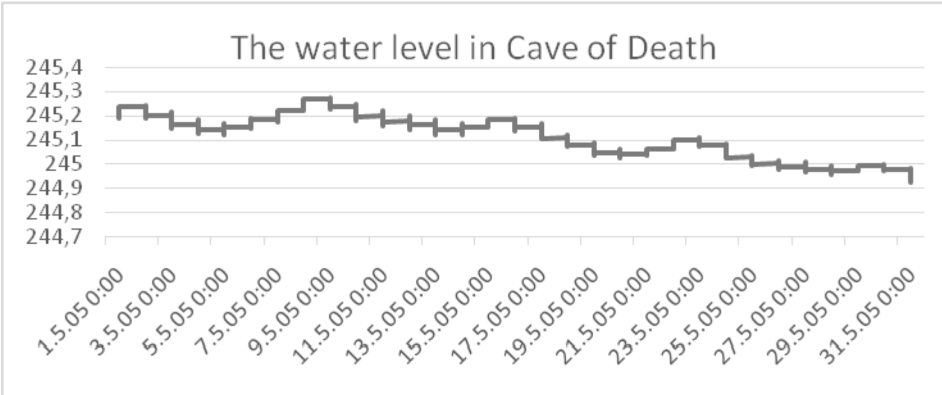

Fig. 2: The water level in Cave of Death

Results

In this chapter, you can find a summary of the acquired results from the three above mentioned programs. Matlab R2014 and Neuralfitting tool have been used first. The latter is a feedforward 2-layer neural network with sigmoid hidden neurons and linear output neurons.

The analysis settings were the following: 1280 values have been used as training data, 320 as validation data and 533 as test data. In the following graph, we can see what samples have been chosen. The first layer of the neural network contained 10 neurons

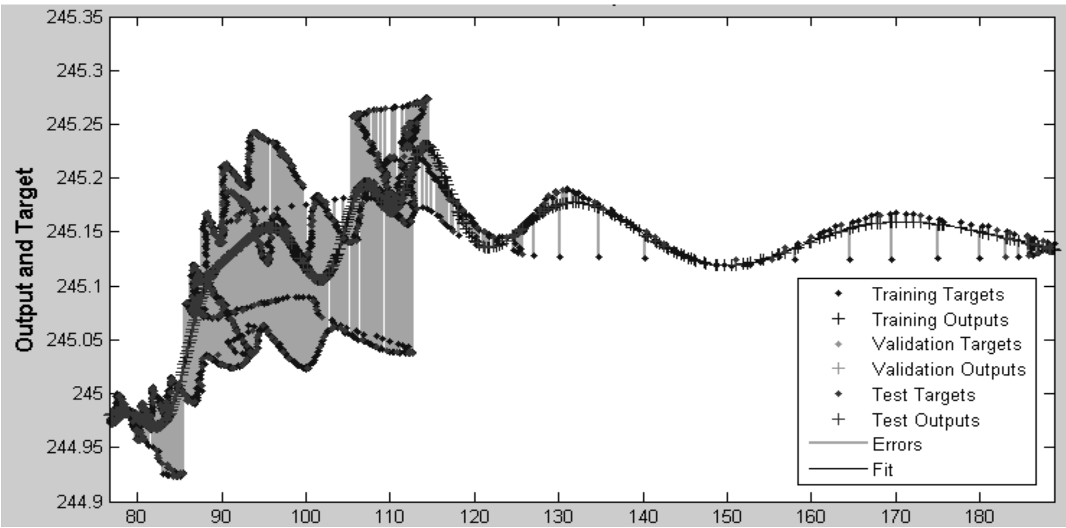

Fig. 3: Summary of samples used for training, validation and test purposes

The picture above also represents the acquired data. As we can notice in picture 3, at the beginning of the month, where there was a deviation of the water level of the Bečva River, the error rate was high, whereas later on, the error rate of the prediction significantly drops.

Weka was another program that has been used. For our analysis, it was necessary to make adjustments to the acquired data, which needed to be converted into the required format shown below:

@relation hladina
@attributebecvareal
@attributejeskynereal
@data
147.30,245.826

Several methods have been used for analysis: desizionTable, ZetoR, linearregresion, etc. but the results were unsatisfactory. The M5Rules Method led to the best results. It generates the list of possibilities for problem regression and it uses the divide and conquer method. The following chart shows the result of this algorithm.

Tab. 1: Results of the algorithm

Correlation coefficient	0.732
Mean absolute error	0.0921
Root mean squared error	0.1295
Relative absolute error	54.6723 %
Root relative squared error	67.8213 %

The last used tool was the Agielneural network program. Linear regression was the most convenient setting as input and output functions. The training algorithm FANN_TARIN_RPROP has been used. We can see on the acquired data that this algorithm was not able to fully adjust to the changes and find the relevant clue.

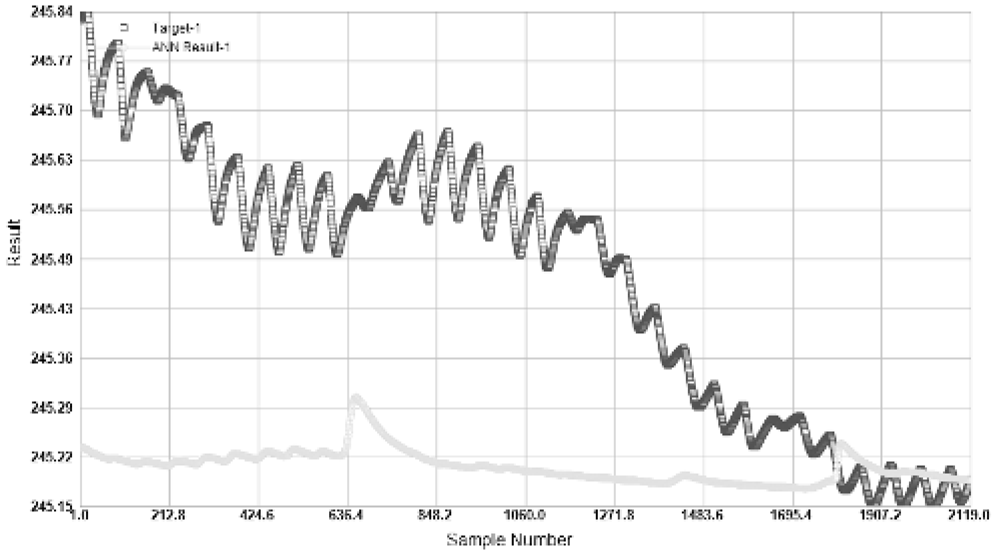

Fig. 4: Results of the Agiel Neural Network programe

Conclusion

Three programs, which have been used for data processing and prediction, have been compared. It has been found out that some programs were not able to evaluate required data correctly and therefore were not able to predict the right water level in the Cave of Death.

MATLAB proved to be the most convenient program, which was able to predict, with only a slight error rate, the water level in the Cave of Death based on the changes in the water level of the Bečva River. However, all algorithms fail in case of unexpected and quick changes in the water level of rivers because the water level in the cave is not able to respond so quickly.

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Souhrn
Předmětem práce je měření velikosti hladiny řeky Bečvy a výšky hladiny ve Zbrašovských jeskyních. Tato data byla analyzována poté analyzována a následně vyhodnocována pomocí 3 predikčním program: Matlab, Weka a Agiel neural network. Tato práce shrnuje výsledky z výše zmíněných programů, kdy se snažíme dosáhnout co nejlepší predikce výšky hladiny ve Zbrašovských jeskyních na základě dat získaných z výšky hladiny řeky Bečvy.
Nejlepších výsledku je dosahováno pomocí neuronových sítí a při použití SW Matlab s nástrojem Neuralfitting, který slouží k řešení problémů, kde se na vstupu nachází skupina čísel a na výstupu taktéž.
Nastavení analýzy bylo následující - 1280 hodnot bylo použito jako data trénovací, 320 hodnot jako data validační a 533 hodnot jako data testovací. Na následujícím grafu je vidět jaké vzorky byly vybrány. První vrstva neuronové sítě obsahovala 10 neuronů.

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LOCALIZATION ASSUMPTION OF TOURISM ECOLOGICAL MODELS DEVELOPMENT (THE CASE STUDY OF BRATISLAVA IV)

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Abstract

The research and the extension of tourism structures is faced with quite a wide range of factors. The character of tourism and landscape interactions is very complicated as it requires complex landscape-ecological approach and environmental limits consideration. It could be solved thrue the development and the application of new quantification methods for natural localization assumptions, what is the aim of our study, using Bratislava IV as a case study. In our approach landscape-ecological evaluation of landscape structure and appropriate tourism forms and activities taking into account the landscape diversity, genofond significance, generic rarity and biotope vulnerability is considered as the essence of tourism ecological model creation.

The basis for spatial representation of ecosystems was the processing of secondary landscape structure map. The representation of landscape cover classes was processed in vector format as it was based on a synthesis of thematic and relevant layers contained in ZB GIS (Esprit, 2012) and EUROSENSE database (2014). Elements mapping units were proposed under the legend of CORINE LAND COVER Technical Quide – Addendum on the 3rd and 4th mapping level and verified fieldwork in the 2015 year. As the attractive and important landscape segments were identified elements representing the 1st (e.g. alluvial forests, oak - hombean forests, wetlands), 2nd (e.g. bank growth) and 3rd (e.g. vineyards, recreational areas) category of landscape-ecological significance.

Key words: natural assumptions, landscape-ecological significance, ecological forms

Introduction

The basic definition of ecological tourism is the characteristic of the UNWTO (United Nations World Tourism Organization). In their view, is an ecological tourism, responsible travel to natural areas that conserves the environment and improves the living conditions of local population.

Approaches to the research of recreational services of the landscape may be different. One of authors are also McIntosh, Goeldner, Ritchie (1995), which share approaches to the research of the tourism to institutional, historical, organizational, economic, sociological, geographical and interdisciplinary as those accessing through tourism products.

Another group consists of authors who accentuated composition-aesthetic, historical and cultural value of the landscape, and for landscaping tools preferentially consider vegetation elements (Neef et al., 1973, Supuka, 1998, Bukacek, Matejka, 1999, Nohl, 2001, Feriancova, 2003). Another group emphasizes architectural features, technical works and artifacts in the landscape (Gal, Kodon, 1981, Marencak, Jancura, 1996, Stepankova, 2002).

The evaluation of recreational potential of landscape ecosystems primarily from the geographical point of view, dedicated writers Warszynska, Jackowski (1978), Mariot (1983), Kopso, Gucik (1992), Healy (1994), Kaspar (1995), Otrubova (1996), Benthien (1997), Krnacova, et al. (2005), Krogmann (2005, 2006), Hall, Page (2006), Novakova, Frantal (2007).
Slovak Spatial Development Concept is the basis and starting point not only in the coordinated development of the whole territory of Slovakia, but alsofor the spatial planning of smaller territorial units. This document is based on the basic principles of sustainable development. The text states that "the basis for the development of tourism remains natural and civilizational potential, the state of transport network and material-technical base - facilities". In the binding part of the document sets out regulatives which can be from the perspective of sustainable tourism development in the Bratislava Self-Governing Region perceive as follows in the Table 1.
Ecological environment is basic assumption for tourism development. Slovakia is unique in terms of the diversity of natural beauties, which creates conditions for its use for the purposes of the tourism, while respecting criteria and conditions for sustainable development. It also requires the fulfillment of one of important objectives of Agenda 21 and the Strategy of Tourism Development in Slovakia (2014-2020).
Natural conditions have relatively stable time, sustained character and belong to determining factor of the attractiveness of an area. Natural attractions of the territory is determined by geomorphological, climatic, hydrological and biological conditions. From biological phenomena are attractive for the tourism comprehensive and sprawling forest areas, mountain and lowland vegetation nature, wetlands, peat lands and biotopes of protected species of plants apperance, protected plants, relict locations mammals and rare birds.
The character of the interaction between the tourism and the landscape is very complex and requires complex landscape-ecological approach and environmental limits consideration. The aim of the contribution is the development and the application of new quantification methods for the evaluation of natural localization assumptions of the landscape (landscape-ecological importance of natural, semi-natural and artificial elements of the Secondary Landscape Structure (later as “SLS”). The basis of ecological tourism model is landscape-ecological evaluation of landscape potential ann the proposal of appropriate tourism forms and activities taking into account the landscape diversity, gene pool significance, generic rarity and biotope vulnerability.

Methods

Analysis and Synthesis

The basis information database of landscape-ecological research is land cover - secondary landscape structure (SLS). The mapping of actual state and characteristics of secondary landscape cover (land cover) elements was based under the legend of CORINE LAND COVER Technical Quide – Addendum 2000 (Bossard, Feranec, Otahel, 2000) on the 3rd, 4th and 5th hierarchical level. The representation of land cover classes was based on vector format and created by the synthesis of thematic and relevant layers obtained in ZB GIS (2012) as by the licensed up-dated databases from derived from orthophotos from aerial photography in 2014 year (Eurosense, ltd., 2014). They were fulfilled by the fieldwork in the 2014 - 2015 years. SLS database (land cover) contains valuable information on biotic conditions in the area, on anthropization level, on social-economic manifestations of the man in the landscape as on existing tourism infrastructure. Mentioned database of updated LAND COVER also allows the selection of natural, semi-natural and social-economic and artificial cultural-historical resources, providing complex characteristic for the evaluation of landscape-ecological significance (later as "LES") of ecosystems.

Tab. 1: Regulatives and their possible application in the field of tourism development (Capital City - Bratislava and Bratislava Self-Governing Region)

Regulatives	***Bratislava Self -Governing***
To encourage types and forms of the tourism that are the subject of international concern and that in terms of the potential belong among the most important forms in Slovakia	The most important forms: cultural, cognitive, summer, congressional, rural
To establish on international tourism especially by monitoring of tourist flows and traffic routes passing, respectively. ending in Slovakia	Water routes (Danube, Moravia), rail routes, bike routes (Eurovelo 6 and 13)
Consistently tie targets of recreational and cognitive tourism	The spreading and creating of new thematic routes
To create functional spatial system of recreation and tourism at the national level by creating the network of recreational territorial units, the network of recreational areas influenced by large cities and the network of integrated rural settlement areas	In all sub-regions of Bratislava Self-Governing Region
To bind the localization of services for the process of recreation and tourism provision in the preference into settlements in order to avoid unjustified expansion of recreation units in a free landscape utilizing the renewal and revitalization of historic urban and rural units and objects of cultural monuments	Zahorie and Podunajsko
To support conditions for a suburban recreation of the urban population in their area of interest	Mainly in Bratislava City surroudings
For the support of tourism development directions use the rail or road transport, the development and interconnection of bike routes as well as the completion of the relevant infrastructure	The development of bike routes in a connection on Eurovelo routes and complex system of integrated traffic in the Bratislava Self-Governing Region
To provide in the network of nature protection areas in the territory of the European Union functions associated with the development of the tourism and recreation in order to prevent the protection degradation of those areas and scope of their protection	Protected areas on 4^{th} and 5^{th} level, Special Protection Areas (SPAs) for birds

The evaluation of objective landscape function for the tourism development by using QN-techniques

Landscape-ecological significance is an objective landscape function which comes from the interpretation of secondary landscape structure elements features. It is characterized as naturalness feature of ecosystems represented by SLS elements with their levels of naturalness. These arise from the operation of biological and ecological processes in ecosystems. They are represented by elements of land use, which assign levels of naturalness determined by the degree of hemeroby of vegetation under study of Jurko (1990). By the methodological approaches by using the QN- techniques determination of landscape-ecological significance of the area are the decisive criterion: the degree of the naturalness and the upkeep of vegetation cover, overall biodiversity, the gene pool significance, species rarity and the endangerment.

Tourism ecological model proposals

The last step of our work was the creation of ecological model of territorial development which takes into account on the basis of existing tourism infrastructure and landscape-ecological research the using and making unique and attractive natural environment and cultural-historical monuments.

Model territory of Devin

Devin – city district of Bratislava - is deemed to be one of the most beautiful locations in the city. Its vicinity provides exquisite natural sceneries, interesting cycling routes, touristic paths, proximity to Small Carpathians. Among tourist attractions belongs Devin castle. Apart from the chance to visit the castle itself, it offers opportunities for walks on the riverside of the Danube under the castle rock, beside Moravia and across adjacent streets of Devin.

Secondary Landscape Structure

Devin – city district of Bratislava – covers forest ecosystems of Protected Landscape Area Small Carpathians and lies at the confluence of the Danube and Moravia rivers. Among the important biotopes include BcPV Devinska Kobyla, BcRv Devin, BcRV Slavic Island. Among BcPV Devínska Kobyla is the belt of vineyards, gardens and singulars buildings. This area can be considered as ecoton, lined with valuable biotopes functioning as a buffering zone. Center area consists of cultural monument Devin, Slavic fortress, which document prehistoric settlement site.

From an agricultural view, the preferred use are vineyards and gardens, so the area is less suitable for family build-up areas. It is important to maintain the original character of the landscape which is connected to the cultivation of vine slopes. The district is characterized by a high recreational, ecological, gene pool and landscape potential, precisely in a connection with the vineyard and cultural-historical potential.

Secondary landscape structure of the Devin is worked in scale: 1:2000, 1:2500 and 1:5000 and makes the basis for the determination of landscape-ecological significance (Fig. 1)

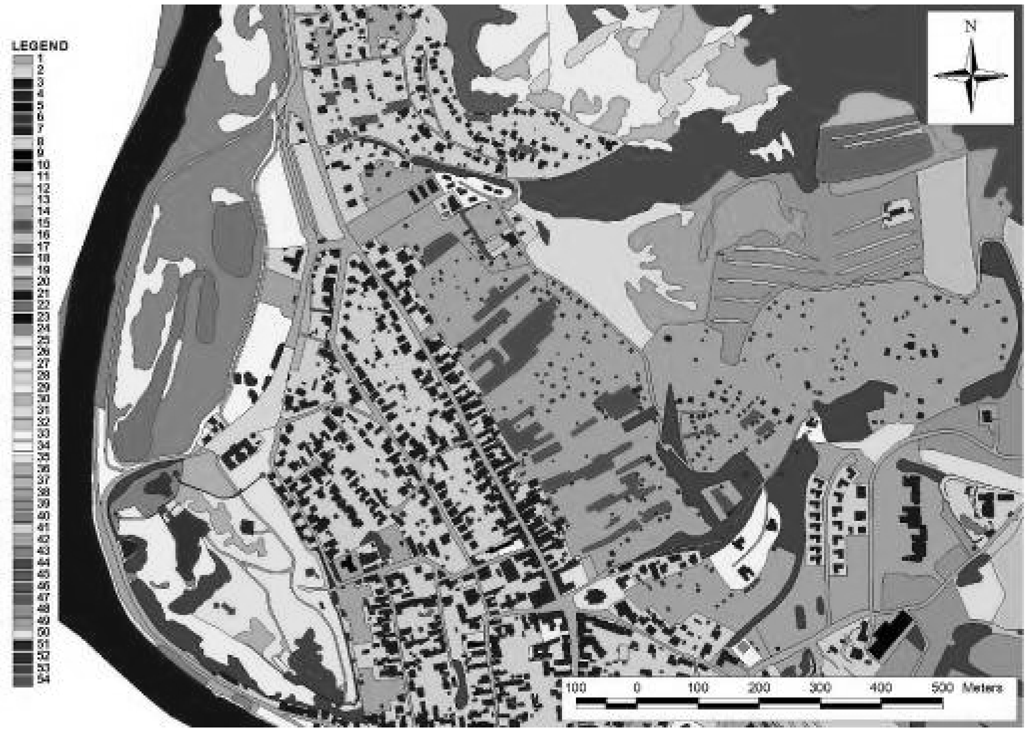

Fig. 1: Land cover in Bratislava - Devín (M: 1: 5000)

The legend
1 roads (asphalt – road I., II., and III. class, local road, semi-paved roads); **2** paved areas (parking, concrete areas, loading ramp); **3** individual housing construction; **4** cottages, garden cottages, private garages, small constructions, shed, greenhaus in garden; **5** public housing construction; **6** cultural monuments; **7** objects of services, administration, education, health service, culture, religious buildings, etc.; **8** cemetery; **9** industrial and store objects; **10** small technical constructions; **11** playgrounds – grassy; **12** tenis courts with clay; **13** gardens near the houses; **14** gardens, gardening settlements; **15** vineyards; **16** abandoned vineyards; **17** abandoned orchards and gardens; **18** small vineyards; **19** abandoned small vineyards; **20** backyards; **21** water stream; **22** water area, dead arm of the river; **23** swimming pool; **24** water source; **25** artificial gravel banks; **26** wetland; **27** reed and flood-meadows; **28** meadows (slope); **29** xero-termophilous grassland vegetation; **30** forest-steppe vegetation; **31** overgrown grasslands; **32** grassy overgrown unmowed bounds to bounds with non-forest vegetation; **33** ruderal grasses; **34** grassy flood control dam; **35** pakr grasses with minimum of woody plants; **36** park grasses with non-forest vegetation; **37** grasses on banks near roads and railways; **38** devastated areas with ruderal vegetation; **39** outfield, meadow outfield; **40** roks, rock reef; **41** rocks and scree with vegetation; **42** waterside undergrowth – natural woods or grasslands; **43** soft alluvial forest; **44** oak-hornbeam forest; **45** xerotherm oak forest; **46** pine forest; **47** spruce forest; **48** locust coppic; **49** young unspecified forest; **50** cut down forest; **51** non-forest vegetation – solitery trees; small group of woody plants; **52** non-forest vegetation - linear vegetation, treelines; **53** non-forest vegetation – areal, various species composition; **54** non-forest vegetation – woody plants vegetation on banks and on cut down areas.

Landscape-ecological significance of landscape elements

Landscape-ecological significance of land use is resulted from the operation of biological-ecological processes in ecosystems. It is represented by elements of land use, which assign levels of naturalness determined by the degree of hemeroby of vegetation under study of Jurko (1990).

The significance was determined on:

- the character of areas in terms of their anthropogenic origin (man-made, artificial landscape elements without natural parts were evaluated negatively, natural, original or close nature elements were evaluated positive);
- the proportion of elements in terms of the originality, significance or nature conservation importance, etc. (natural forest with original species composition is better than the forest with altered composition, or natural meadow is better than the recultured meadow);
- the fact, that by the determination of the significance it was not taken into account whether the area falls or does not fall within protected areas or NATURA 2000 areas (xerothermic vegetation in protected areas and also outside it has the same value);
- the fact, that it was partly took into account the cultural-historical nature of anthropogenic elements that would be more visible in the detailed breakdown (historical features, the area around the castle and so on do more than the housing or industrial buildings).

Among the most important elements of the territory (1st and 2nd level of LES) belong mainly natural forests (alluvial and oak - hombean forests), groves, woods and all the larger or more planar or liner elements of non-forest woody vegetation, natural and semi-natural grasslands biotopes, riparian vegetation, all biotopes of wetlands and all natural sections of the Danube River, Moravia river and their tributaries with aquatic biota. The best preserved parts of these areas together represent the gene pool localities of flora and fauna, or localities of European or national importance of biotope occurrence. Into the category of 3rd LES were included anthropogenically generated or influenced semi-natural elements of SLS such as various permanent crops, vineyards, allotment, recreational and sports facilities. These elements covers quit significant amount of nature-friendly areas or components that increase their significance in a comparison to typical technical or urban elements falling within categories 4 or 5 of LES. Areas included in the 1st, 2nd and 3rd category of LES are attractive and important landscape segments also from the point of view of the development of selected forms of tourism (Fig. 2).

The proposals of tourism development

Ecological appropriate proposals of tourism development were based on the determination of landscape-ecological significance of Land cover elements updated in 2014 – 2015 years. The overview of appropriateness of Land cover elements for ecological forms of tourism development is presented in the table 2.

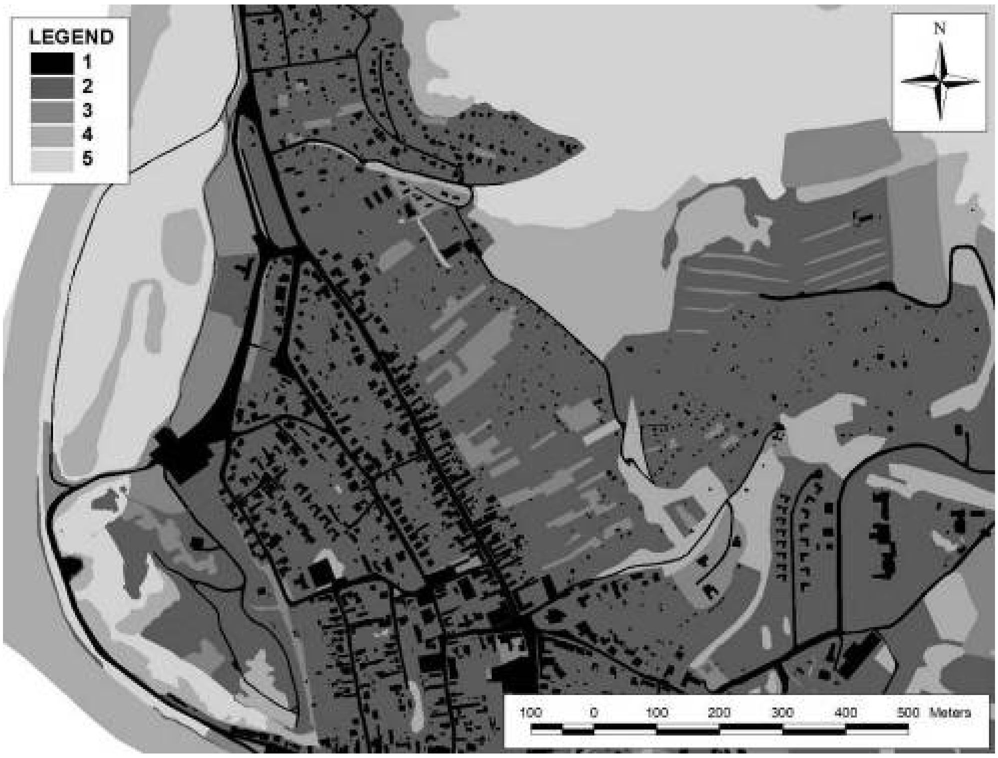

Fig 2: Landscape-ecological significance of Land cover elements in Bratislava - Devin

The legend:
1 – unimportant territory, 2 – less important territory, 3 – moderately important territory, 4 - important territory, 5 – very important territory

Conclusion

In the contribution was used functional-chorological approach for the evaluation of natural assumptions for the tourism which allows more accurately organize territorial tourism model. It is creating a comprehensive view of the system of relations between the tourism and the landscape. It is methodological basis for the development of ecological tourism development models. Ecological approach is in the selection and application methodologies of potential development evaluation, so in the proposal of appropriate forms and activities selected of tourism for selected natural and cultural-historical valuable landscape segments. The essence of ecological tourism model is landscape-ecological assessment of landscape potential and the design of appropriate forms and activities of the tourism, taking into account the diversity of the landscape, the significance of the gene pool, species rarity and the endangerment of biotopes.

Tab. 2: Proposed forms of tourism based on Landscape-ecological significance of Land cover elements

SECONDARY ELEMENTS OF LANDSCAPE STRUCTURES	(LES)	TOURISM ECOLOGICAL MODEL PROPOSALS
BUILD-UP AREAS		Cultural tourism form, subgroup Cognitive focusing on cultural-historical monuments and tourism infrastructure
cultural monuments – castle	3	
services - restaurants, cafeteria, coffee bar	1	
religious buildings - church, chapel, funeral home	1	
culture – museum, library	1	
SPORT and CULTURE		Leisure-sports form, subgroup Tourist
playgrounds – grassy	2	
playgrounds – concrete, asphalt	1	
tennis courts with clay	1	
tribune	1	
open shooting gallery	1	
playgrounds - kids	2	
racecourse, show jumping	2	
AGRICULTURE LAND		Recreational form, subgroup Suburban recreation
kitchen gardens	3	
gardens, gyrdening settlements	3	
vineyard	3	
abandoned vineyards	3	
orchards	3	
abandoned orchards, gardens	3	
crofts	2	
large-scaled arable land	2	
small vineyards	3	
WATER		Leisure-sports form, subgroup Tourist
watercourse	4	
water area	4	
GRASSLAND		Cultural tourism form, subgroup Cognitive focusing on natural attractions
reeds and underflooded meadows	5	
alluvial meadow – recultivated	4	
alluvial meadow	4	
meadow on slopes	4	
weeded grasses	3	
park grasses with minimum of wood	3	Recreational form, subgroup Leisure-recreational activities
park grasses with non-forest vegetation group	4	
rocks, screes with vegetation	5	Cultural tourism form, subgroup Cognitive focusing on natural attractions
xero-thermophilic grasslands vegetation	5	
steppe vegetation	5	
encrusted grassland	4	
rocks, clift	5	
sand (Sandberg)	5	
FOREST		Leisure-sports form, subgroup Tourist
bank vegetation – with the domination of non-native species	4	
bank vegetation – native tree or grass species	5	
soft alluvial forest	5	
hard poplar-ash forest	5	
alder forest	5	
monoculture (mainly poplar)	4	
beech forest	5	Leisure-sports form, subgroup Tourist
oak-hornbean forest	5	
xero-thermophilic oak forest	5	
pine forest	4	
spruce forest	3	
locust forest	3	
young unspecified forest	3	
windbreaks, clearings, light in the forest	3	

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Souhrn
V článku byl použit funkčně-chronologický přístup k hodnocení přírodních předpokladů cestovního ruchu, který umožňuje výstižnější uspořádání teritoriálního modelu cestovního ruchu. Vytváří tak komplexní pohled na systém vztahů mezi cestovním ruchem a krajinou a zároveň je metodickým východiskem pro tvorbu ekologických modelů rozvoje cestovního ruchu.
Mapování prvků SKŠ a jejich biotická charakteristika (mapování reálné vegetace, resp. živočichů), kteří nejsou legislativně chráněni. Stupeň krajinoekologické významnosti SKŠ je dán stupněm hemeróbie vegetace ve smyslu Jurka (1990), taktéž přítomností významných biotopů s vysokou biodiverzitou, genofondovou rozmanitostí a výskytem vzácných a ohrožených druhů. Kromě biotické charakteristiky byli částečně brány do úvahy i kulturně-historické charakteristiky a povaha antropogenních prvků, která by byla víc viditelná při podrobnějším členění (historické prvky, plochy v okolí hradu apod. mají větší význam jako IBV nebo HBV nebo průmyslové stavby).
Podstatou tvorby ekologického modelu cestovního ruchu je krajinoekologické hodnocení potenciálu krajiny a návrh vhodných forem a aktivit CR, zohledňujících diverzitu krajiny, genofondovou významnost, druhovou vzácnost a ohrožení biotopů.

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LOWERING THE WATER LEVEL AT THE DAM RESERVOIR BRNO

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Abstract
The article deals with water quality issues in the Brno Reservoir in 2009–2010. The reservoir was drained with the purpose of improving the water quality – reduction of the level of water was one of essential conditions for this. Decrease the level in the reservoir allows you to: Liming (change ph), Freeze, Extraction of sediments Modification banks and other. Basic information - see the following text.

Key words: reservoir, dam, reduction of water

Introduction

Reservoir fouling is a major problem today. The second major problem is the quality of the water in the reservoir. The valley above the Brno dam was first filled with water from the Svratka River in autumn 1939. The dam was not finished at the time but it was able to perform its function – hold a flood wave. It was put in full operation in 1940. Since then it had never been drained until 2008. The deteriorating quality of water had been the main reason for the decision to clean it made by the stream management institution - Povodí Moravy, s.p. (Paulo et al., 2014; Soldo et al., 2010; Šlezingr, Zeleňáková, 2010)

Procedure

Long term decrease in the level (approx 1 year or more) is one of the possibility of modification of water quality.

In this situation, we can realize:
- Liming (change ph)
- Freeze
- Extraction of sediments
- Modification banks (Fig.1) and other

The Brno Reservoir has over 4 mil. m^3 of sediments. About 15% of these come from eroded banks, the rest is mostly the material washed from fields along the stream above the reservoir. Strong eutrophication is the main cause of cyanobacteria proliferation. As the reservoir is very popular for leisure activities, water quality is one of the main prerequisites for the development of the area (Junáková, Bálintová, 2011; Pelikán, Marková, 2013; Šlezingr, Zeleňáková, 2010)
After the water level reduction, the uncovered sediments were limed several times because the change in their Ph is vital for fighting cyanobacteria
Another important part is leaving supporting sediments for weed growing (weeds use up some of the nutrients), their mowing and removing outside the reservoir. Freezing the sediments is another procedure hostile to cyanobacteria populations (Pelikán, Marková, 2013; Šlezingr, Zeleňáková, 2010). The reservoir was left drained over winter so that the sediments could freeze. (Zeleňáková et al., 2014, 2015)
Water level reduction also allowed for taking stabilization measures in the bank zone

Fig. 1: Perhaps modification of Bank – Breakwater

Fig. 2: Draining the tank Brno - running through river Svratka

Conclusion

Four years after filling the water quality is greatly improved.These procedures considerably helped to improve the water quality in the reservoir; however, they are not sufficient to maintain the water quality. (Korytárová et al, 2007; Linhart, 1954; Šlezingr, Fialová, 2012; Zeleňáková, 2014)
Currently, the influx of sediments (and nutrients) to the reservoir is minimized by water aerating using a set of aerators during the recreation season and dosing coagulants at the end of backwater.

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Souhrn

Údolní nádrž Brno byla jednou z nádrží, které byly postižený výrazným přemnožením cyanobakterií (sinic). V rámci boje proti těmto mikroorganismům byla nádrž na cca 1 rok částečně vypuštěna. Mráz v zimním období výrazně decimuje kolonie sinic v substrátě bahnitého břehu, který bzm několikrát vápněn (změna Ph sinicím škodí), kromě toho došlo k částečnému odtěžení nánosů v místech přístavišť. Po napuštění probíhá v “jezerní” části nádrže aerace a na konci vzdutí pravidelné dávkování koagulantu.

Všechny tyto zásahy by měly výrazně napomoci zlepšení jakosti vody v nádrži.

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MEMORIAL LANDSCAPES & OUTDOOR RECREATION: EVIDENCE OF LANDSCAPE MULTIFUNCTIONALITY BY THE CASE STUDY JANKOV VŔŠOK, SLOVAKIA

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Abstract
Contemporary cultural landscapes represent multilayer systems rich on historical, cultural, social and natural qualities. Many landscapes reflect also religious, sacral or reverential values manifested by physical structures such as monuments or other architectural landmarks. However, these landscapes might not be understood as conserved outdoor scenes or reserves, but rather as vivid landscapes providing people with all the mentioned values and qualities to perceive, experience, learn and enjoy. Outdoor recreation is, besides meditation and reverence, one of the possible uses that can create another functional layer in memorial landscapes. This manifestation of landscape multifunctionality has been discovered, analysed, documented and interpreted by the case study Jankov vŕšok in Slovakia, which will be more thoroughly elaborated and developed within this paper, answering thereby the research question, whether recreational use can fit into peaceful settings of memorial landscapes.

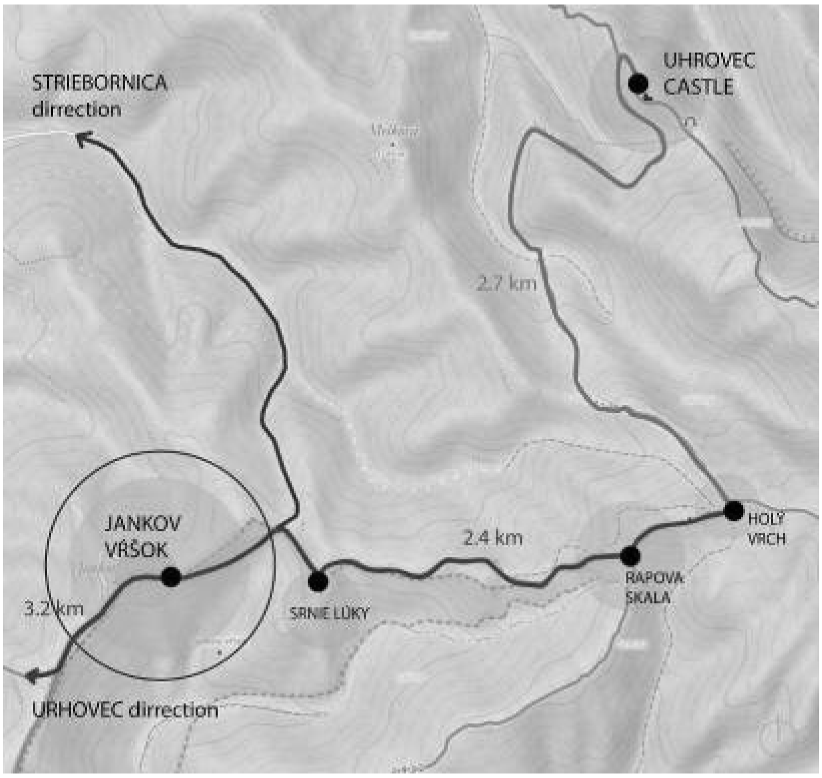
Key words : cultural heritage, memorial landscape, military memorials, reverence, Jankov vŕšok

Introduction
Every landscape is changing in the course of the historic development and this is expressed mainly by its character and the areal share of secondary landscape structure components. In different time periods, these landscape components are influenced by human activities and history of the society (Supuka et al, 2013). The objects recognised as cultural monuments, with particular legal regulations of their protection are part of the cultural or natural landscape in Slovakia. There are several objects representing the Memorials of Heroes of the World War II located within the urban environment (Bratislava-Slavín) or in the open landscape (Jankov vŕšok, Dukla). Some of the monuments are included in natural reserves, which have specific conditions in terms of their protection and use (according to the rules of the national Act No. 543/2002 on Nature and Landscape Protection). It is important to preserve whole landscapes, as well as their particular structures. Protection of objects and areas has to be compatible with the comprehensive protection of the landscape as a unity. Jankov vŕšok belogs to areas with the highest level of nature protection (level 5). It is necessary to ask the regional authority of landscape protection for permissions, such as for the establishment of tourist, educational and cycle trails and for the organisation of public events. There are much more restrictions and limits, listed in the above mentioned act, but those mentioned above are conected with the recreational activities. Interpretation of cultural heritage could be done by exhibitions and trails, which should be well-planned and which are supposed to help the visitors to discover the meaning and importance of the site. Gross (2006, p. 6) defines the heritage interpretation as a communication process

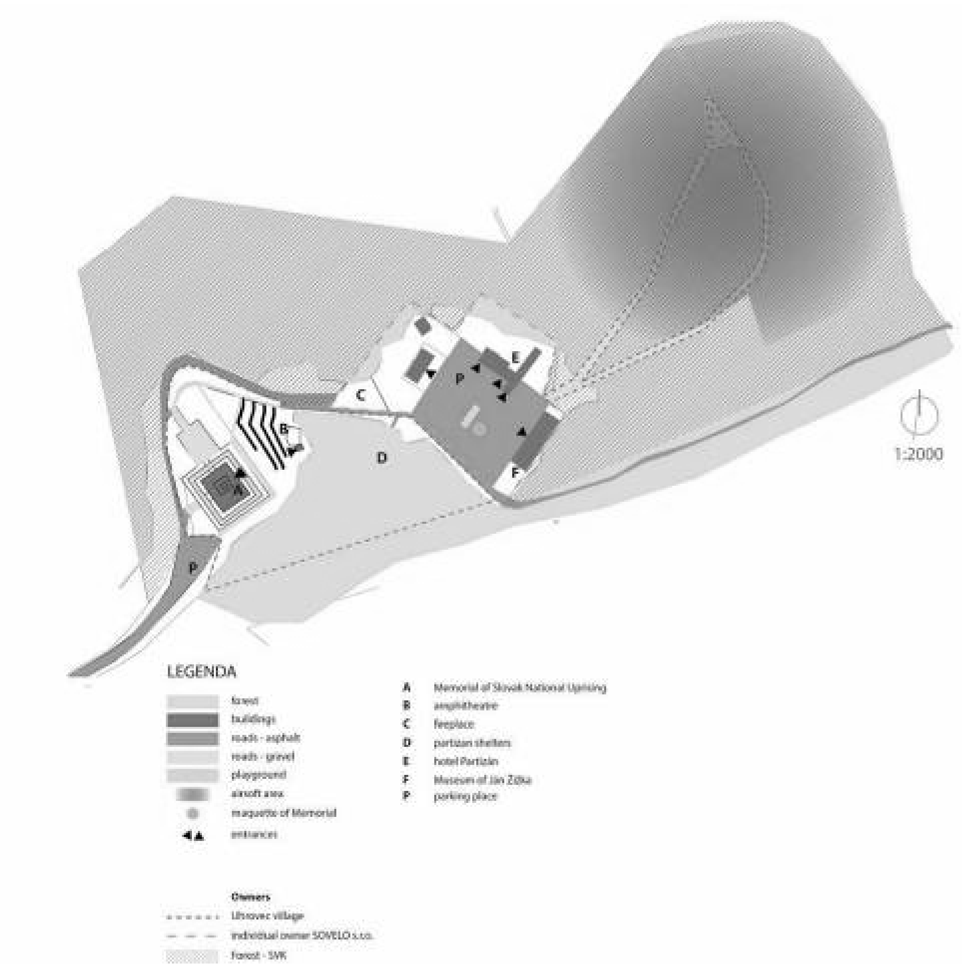
that guides visitors in their search for meanings in objects, places and landscapes. It is neccessary to start with the facts, but the 'lesson' for the visitors is not the facts, but their significance. Meanings are more important to people than mere facts. Good interpretation helps the visitors to find personal connections between tangible places, objects and events and their own lives and values.

Material and methods

The Monument of the Slovak National Uprising (SNU) on Jankov vŕšok is located in the cadastral territory of the municipality Uhrovec, in the district Bánovce nad Bebravou of the Trenčín Region in Slovakia (Map 1). It is located in the southwestern part of montains Strážovské vrchy at an altitude of 533 metres above sea level. Nearby, there are historically significant objects, such as the Uhrovec castle from the 13th century, a renaissance mansion in Uhrovec from the 16th century and the birth house of Ľudovít Štúr and Alexander Dubček, important historical personalities of Slovakia. The memorial complex consists of a cairn, a symbolic cemetery, an amphitheatre and guerrilla bunkers (Map 2). Based on the analysis focused on the natural, historical and cultural values of the memorial complex, as well as on its historical development and current situation, measures and proposals on outdoor recreation at the memorial complex Jankov vŕšok have been determined.



Map 1: Hiking trails connection with the interesting points and villages in the surrounding and potential connection with the holiday resort in Striebornica.



Map 2: The current state of the memorial site Jankov vŕšok

Natural conditions

The current vegetation is represented by thermophilic species as well as mountain species, which is significant for the limestones of Strážovské vrchy Mountains. On the steep southern slopes, there are dominant xerotherm oak woods represented by thermophilic and xerophilous species such as Downy oak (*Quercus pubescens*), Austrian oak (*Quercus cerris*), dogwood (*Cornus mas*). At the foot of the slopes, there are beechwoods on screes with perennial honesty (*Lunaria redivia*). Since 1993, the southern slopes of the Jankov vŕšok have been a nature reservation with an area of 1.0342 km^2 of protected oak forest on limestone - dolomite surface. In the natural reservation, there is the fifth degree of protection in effect and the whole territory falls under the protection of Natura 2000.

The history of the partisan movement in Jankov vŕšok

During World War II, on 29 August 1944, an armed rebellion of citizens broke out - the Slovak National Uprising. In the rebellion, also people from all the villages under Jankov vŕšok were involved. From a local guerrilla group the partisan brigade of Jan Žižka was formed. The Partisan Brigade had initially 900 guerrillas, later it's number increased up to 1600. The village Uhrovec was partially burned down by fascists on November 4, 1944. At the beginning of February 1945, the fascists discovered seven wounded guerrillas in partisan bunkers on the Jankov vŕšok, whom they burned alive.

History of the construction of the Memorial of SNU on Jankov vŕšok

The SNU monument on Jankov vŕšok was built in place of significant partisan fights in the Slovak National Uprising and now it is a national monument. In honour of victims of the SNU, a monument and a symbolic cemetery were built between 1948 and 1951. In 1962 also the original guerrilla bunkers were renovated. Later, it has become necessary to build facilities for the annual regional celebration of SNU. From 1966 to 1969, there were conducted major landscapings for an auditorium and a stage with a cloakroom was built. In 1972 a study of historical restoration and art completion of the memorial area was elaborated by the architects Petr Gál and Milan Kodoň. On the occasion of the 30th anniversary of the SNP in 1974, a wide asphalt road was built from the direction of Uhrovec and a new hotel Partizán was opened. The memorial complex was supplemented by a relief map of the memorial complex, flags, resting places with fire pits and lighting. The Amphitheatre has been supplemented by benches in the auditorium, some relief walls and a backdrop for the stage. In 2014, on the occasion of the 70th anniversary of the SNU, the Memorial and the Amphitheatre were renovated and a new museum of the Partisan Brigade of Jan Žiška in 1944 -1945 was established in the Cultural House of Jan Šverma (Figure 1 and 2).

Fig. 1: The cairn with the monument is the main dominant of the Jankov vŕšok landscape design

Fig. 2: The cairn itself is an important viewpoint to the surrounding with a beautiful panorama of Strážovské Mountains. Its significant value is due to visual connection with the Uhrovec castle.

Results

Analysis of architectural and landscape design of the memorial site

The cairn with the monument is a dominant element of landscape design at this memorial site (figure 1). On the cairn, two compositional axes are based, in direction to the the symbolic cemetery and the amphitheatre. The cairn dominates also the view from the access road. It is therefore an important landmark. The cairn itself is an important outlook to the surrounding countryside with a beautiful panorama of the Strážovské vrchy Mountains. A significant value is especially represented by a visual connection with the Uhrovec castle (figure 2). In the design project of the memorial site from 1972, interventions were planned in forest stands in order to create views on the village Uhrovec. Nowadays, these view connections are not visible in the surrounding forests around the cairn, thus probably they have not been implemented.

Analysis of architectural and art value of the memorial complex

From the point of view of architectural and art values, the cairn, the monument and the symbolic cemetery built in 1951 are the most valuable features and landmarks in the memorial complex. The cairn, the memorial and the symbolic cemetery were proclaimed as national cultural monument in 1963. The second most valuable is The Road of SNU with sculptures and milestones, placed along the way from Uhrovec between 1966 and 1969. Valuable elements are also relief sculptural walls made of sandstone with themes of partisan fights in the amphitheatre from 1972. An interesting element is a relief map of the complex on the square in front of the Hotel Partizan, as a part of the orientation system, based on the design project from 1972.

Analysis of history and current state of recreation in the area of Jankov vŕšok

A big audience of the monument from the 50s to 70s, especially during the anniversary celebrations of SNU, called for creating recreational facilities for visitors. In the design project of the complex from 1972, large scale recreation facilities were planned. Besides the hotel, a cottage settlement and service buildings were intended to be built. The cableway and the new road connection from the recreational area in Striebornica should reduce the intensity of traffic on the access road from Uhrovec. After the change of the political situation in 1989, any further constructions at the site were stopped and the attendance of the monument for the purpose of reverence has decreased significantly. Nowadays, visitors come to the Jankov vŕšok especially for the purpose of recreation and sports (mainly hiking and cycling) (map 2) and during sports events (motor sport, airsoft) and cultural events (celebrations and reconstruction of partisan fighting). The most important annual event is a car uphill racing.

<u>Opportunities and threats of the future development of memorial site Jankov vŕšok (tab.1)</u>

The area of memorial is currently owned by three owners, which is significantly related to maintenance quality and use of the area. The memorial, amphitheatre and partisans bunkers are owned by the municipality Uhrovec. The recreation area with the square, the hotel Partizán, the hostel and the museum is privately owned. The surrounding forests are administered by a state organisation, but also owned by private persons.

The current state of the memorial site is strongly influenced mainly by the lack of maintenance of several objects of the complex. At present, the best preserved elements in the memorial complex are buildings of the memorial and the stage of the amphitheatre, which have undergone renovations in 2014. Small buildings, paved areas, roads and sidewalks, furniture, lighting and the orientation system of the 1980s are slowly becoming ruins. The maintenance of the memorial place by state organisations has significantly decreased after 1989, along with the change of the political system. The maintenance of the monument is currently conducted by the municipality Uhrovec from its own budget or through various grant schemes.

The pious atmosphere and operation of the memorial complex is to a great extent affected by activities associated with the hotel Partizán, such as airsoft, driving armored vehicles, the free movement of ponies in the entire area of the monument, inappropriate playgrounds built on the square, by construction of the ramp before entering the square and other inappropriate interventions.

Among the positive factors, the establishment of the Museum of Partisan Brigade of Jan Žižka SNP in 1944 - 1945 should be mentioned. The most valuable elements in the memorial complex are especially art elements – cairn with the memorial and relief sculptures placed along the access road and in the amphitheatre. Highly valuable elements are the views from cairn on the panorama of the Strážovské vrchy Mountains and also the natural environment, which is partially a natural reservation.

The risk factor in terms of protection of the natural environment is represented by the ownership situation and the way of management in the production forests. In terms of connections between the memorial area and the hiking trails, the major disruption is represented by fences in the private forest in the direction to Holý vrch and Striebornica. In terms of vegetation, there are negative elements, such as unmaintained trees around resting places and bunkers. The partisan bunkers are the most endangered elements in the complex because of their bad technical condition. The plastic map of the area, located on the privately owned square, may be moved from its original place in future.

Tab. 1: SWOT analysis of memorial complex Jankov vŕšok

Weakness	**Opportunities**
lack of maintenance	tourism and recreation
character of the use	education
Strengths	**Threats**
natural reservation	private ownership
history of the site	underfunding
landscape views	negative recreational activities
architectural and art values	

<u>Proposals for outdoor recreation in the memorial complex Jankov vŕšok</u>
In terms of recreational use of the memorial complex, it will be difficult to find appropriate solutions for a sensitive use of the territory so that its cultural, historical and natural values will be maintained. It will be also difficult to satisfy the requirements of users of private recreational facilities in the area. Therefore, we propose to regulate negative recreation activities, such as horse riding, motor sport and playground. It is necessary to regulate their quantity, as well as to allocate a better place in the area of the memorial complex. Because it is a place of reverence, it is necessary to consider the character of certain activities also from the ethical point of view. Especially activities such as the military camp, airsoft or ride on armored vehicles are ethically questionable at this memorial site. The recreational potential of the territory is based on the promotion of its history, in a more significant connection to the surrounding cultural sites (The Uhrovec castle, the Uhrovec renaissance mansion, the birthplace of Ľudovít Štúr and Alexander Dubček) and in a potential connection with the holiday resort in Striebornica. There is a great potential of building educational paths with different themes, either history or nature. For a better accessibility of the area, it is necessary to ensure supplementation of existing walking trails and building of new bicycle trails. In terms of the attractiveness, it is necessary to equip the area with appropriate site furniture, rest areas and playgrounds in a suitable design.

Conclusion

Military memorials of World War II in Slovakia have becomeinteresting historical attractions in the process of time since the war. With the change of the political system, memorials have gradually lost their political undertone of promotion and now they are attractive mainly for fans of military strategy and history. A significant quality is represented by the architectural and artistic values of World War II memorials, which have at the same time become important monuments of the socialist regime and architecture in Slovakia in the second half of the 20th century. The use of this type of memorial sites for recreational purposes, requires however sensitive solutions and a regulation of diverse forms and intensity of recreation. The main priority should be the preservation of the reverent atmosphere of the place and its cultural values. Therefore, it is important to consider the ethical and moral aspects of recreational activities. The weakness of memorial sites consists mainly in an insufficient financing of protection and maintenance of memorial sites, which is transferred to municipalities. In terms of protection of monuments, which are part of the landscape composition, not only a protection of architectural elements is needed, but also a protection of the surrounding designed landscape. This means for example preservation of views by the maintenance of forests and by protection from inappropriate land use.

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Souhrn

Součástí kulturní nebo přírodní krajiny na území Slovenska je celá řada objektů v podobě kulturních památek podléhající zvláštním právním předpisům. Tyto památníky a to zejména památníky obětem padlých za druhé světové války se nacházejí jak v městském prostředí (Bratislava – Slavín) tak ve volné krajině (Jankov vršok, Nemecká Dukla a další místa).
Například památník Slovenského národního povstání (SNU) na Jankově vršku se nachází v katastrálním území obce Uhrovec v okrese Bánovce nad Bebravou v Trenčínskym kraji na Slovensku. Nachází se v jihozápadní části hor Strážovských vrchů v nadmořské výšce 533 m n. m. Tento památník na Jankov vršok byl postaven na místě významného partyzánského boje v Slovenském národním povstání a dnes je národní kulturní památkou. Památník a symbolický hřbitov byly vystaveny v letech 1948 – 1951 na počest padlých obětí Slovenského Národního povstání. V roce 1962 byly také obnoveny staré partizánské bunkry.
V článku jsou uvedeny výsledky analýzy, která měla za úkol hodnotit přírodní, historické a kulturní hodnoty památného komplexu, opatření a návrhy pro rekreaci v blízkosti památníku na Jankově vršku. Nejcennějšími prvky památného komplexu jsou umělecké prvky – mohyla s památníkem a reliéf sochy nacházející se v těsné blízkosti příjezdové cesty v amfiteátru.
Z hlediska krajinných prvků jsou nejcennější právě výhledy z místa památníku na Strážovské vrchy a blízkou krajinu, která je částečně přírodní rezervací. Současný stav památníku je ovlivněn nedostatečnou údržbou některých objektů památníku. Pietní atmosféra a celkový provoz památníku je negativně ovlivněn provozem hotelu Partizán a jeho rekreačními aktivitami.
Pokud jde o rekreační využití památného komplexu, jak z hlediska ochrany historické, kulturní a krajinné hodnoty, tak z hlediska požadavků majitelů soukromých rekreačních objektů, bude velmi těžké najít nějaké řešení vyhovující všem. Je třeba se podívat na rekreační charakter pietních míst i z etického hlediska. Slabinou pamětních míst spočívá v nedostatečné finanční podpoře a zajištění ochrany, které jdou na úkor obcí.

Z hlediska ochrany památek, které jsou součástí krajinné kompozice, je nutné chránit nejen architektonické prvky, ale také okolní krajinu.

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MICROCLIMATIC SPECIFICS OF MOHELNO SERPENTINE STEPPE – PRIMARY RESULT

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Abstract

Obtained measurement results (the years 2014 to 2016 so far) enable formulate more precise conclusions about topoclimate and microclimate of Mohelno Serpentine Steppe (MSS) protected area and its specifics. The measurement brings data that may play a crucial role in the subsequent evaluation of implemented management interventions. Woody central parts of MSS, affected by vegetation, shows ground air temperature during the hottest days even about 8.5°C lower than typical steppe areas. Marginal, continuously forested parts of MSS, are cooler even about 15°C. Also extremity of the environment, strongly affecting the species composition and plants habitus, is significantly lower in the parts of continuous or at least sparse woody vegetation (up to 15.6°C). Differences in relative humidity during the episodes of high air temperature in the central steppe part are not so noticeable. The role would probably play rather longer effect of smaller differences. Only one exception comprises an environment where the relative humidity is strongly affected by the largest thermal amplitude and a larger active surface area (dried plants) – what represent suitable conditions for increased night dew condensation. Higher air humidity of continuously forested parts of the steppe is predictable and is given, among other things, by the plant transpiration.

Key words: land-use, management plan, air temperature, air humidity, surface temperature

Introduction

The paper is focused on evaluation of topoclimatic conditions of Mohelno Serpentine Steppe (MSS). The natural uniqueness of the steppe is given by unusual climate conditions based on a combination of specific geological substrates – serpentine (a rock of volcanic origin not only attracts and accumulates heat but also releases magnesium, iron and other heavy metals into the soil, causing unique phytocoenoses and zoocoenoses), the orientation of the majority of the steppe to the south and the terrain morphology. These factors greatly contribute to the creation of topoclimate (Středová et al., 2011). The emergence of topoclimate is most affected by extremely rugged relief which leads to a different climate in lowlands than on slopes or in valleys. The size and shape of the relief consequently influences the horizontal and vertical extent of the climate. Topoclimate is also a mode of meteorological phenomena that are on one hand formed by the influence of morphology, prevailing structure and composition of biotic and abiotic components of the active surface and on the other hand under the influence of microclimates located in its range. Due to the mentioned phenomena the steppe temperature reaches up to 10°C higher than the surrounding areas. To preserve the high natural value of the steppe, regular care and management is necessary. The trees and shrubs that grow over the areas with the valuable vegetation are removed because this is the only way of preserving their natural habitat which requires free sunlit space for their survival (Knotek and Štefka, 2015; Středová et al., 2015).

Materials and methods

Long-term climatic conditions of wider area:

Climatic characteristics were evaluated as climate diagram of Walter and Lieth (Fig. 2) based on climatological data from Dukovany station from 1961–2014. Dukovany is a professional climatological station operated by trained staff of the Czech Hydrometeorological Institute (CHMI) and their methodical guidance. It is situated at 400 MASL about 4 km far from the MSS.

Topoclimate monitoring:

To evaluate the topoclimate conditions (Rožnovský et al., 2010) the meteorological stations are placed in the area of interest to identify spatial difference of whole locality. Thus purpose-built stations (main climatological station marked I, seven ground air temperature and humidity HOBO sensors in the radiation shield marked II–VIII, rock surface temperature sensor OS210 marked Surface temperature and two ground air temperature sensors DS18B20 marked Tair Inf 1 and Tair Inf 2) were established in MSS in 2014. They were located on rocky slopes, steppe area of the valley and wooded hillsides (see Fig. 1). Measurements (in 10-minute step) were carried out from July 2014 up today. The evaluation deals with the data from August 2014 to November 2015. The distribution of the individual stations is shown in detailed description of measurement sites bring Středová et al. (2015).

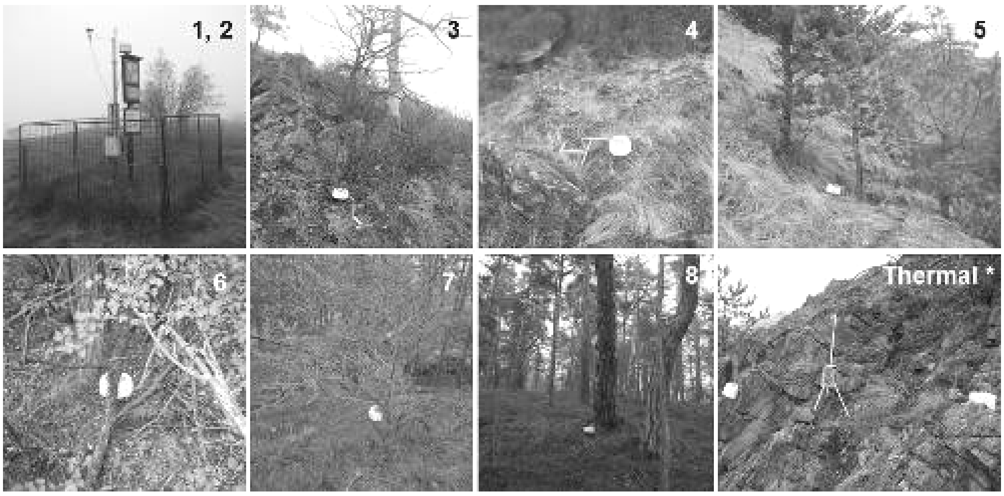


Fig. 1: Position of individual measurement sites on Mohelno Serpentine Steppe

Note: 1: main climatological station

2–8: HOBO sensors

THERMAL*: sensor of rock surface temperature + additional ground air temperature measurement (Tair Inf 1, Tair Inf 2); steep rocky slope with southern to southeastern exposition, almost bare surface

Sensor No	GPS
I, II	49.109022°; 16.187336°
III	49.107956°; 16.182994°
IV	49.108208°; 16.183553°
V	49.108372°; 16.184303°
VI	49.103028°, 16.193144°
VII	49.103269°; 16.191328°
VIII	49.103444°; 16.190967°
THERMAL (surface temp. and Tair Inf 1, Tair Inf 2)	49.107910°; 16.183433°

Results

Basic macroclimate characteristics:

Mean (1961–2014) annual / monthly values of air temperature and precipitation total of climatological station CHMI Dukovany are given by Fig. 2. The average air temperature is 8.6°C. Average total precipitation amounted to 491.5 mm.

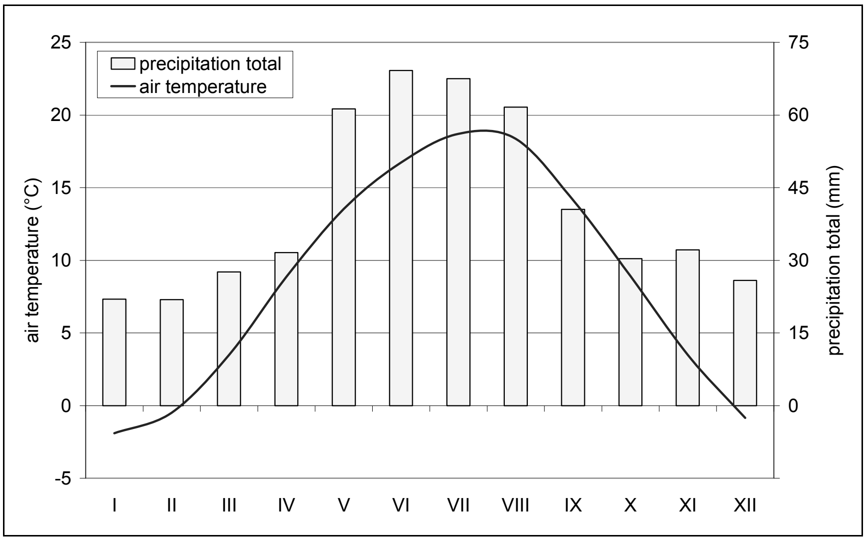


Fig. 2: Climate diagram of Walter and Lieth; Dukovany climatological station, 1961–2014

Topoclimatic evaluation:

The air temperature and relative air humidity across the steppe differ from site to site (Fig. 3).

Comparison of 10-minute values of air temperature during the hottest day of monitoring (22. 7. 2015) at individual sites is presented in Fig. 4. The maximum daily ground-level air temperature was reached at the monitoring point sensor II, as well as the minimum values of the night. This site therefore recorded the biggest daily amplitude. This is a site located on a plateau covered with a continuous grass cover. Generally, the vegetation decreases temperature amplitude and through evapotranspiration increases air humidity and cools their surroundings. At this date, however, this grass canopy (fescue) was completely dry and did not transpirate at all, which pretty much describes the steppe habitat conditions.

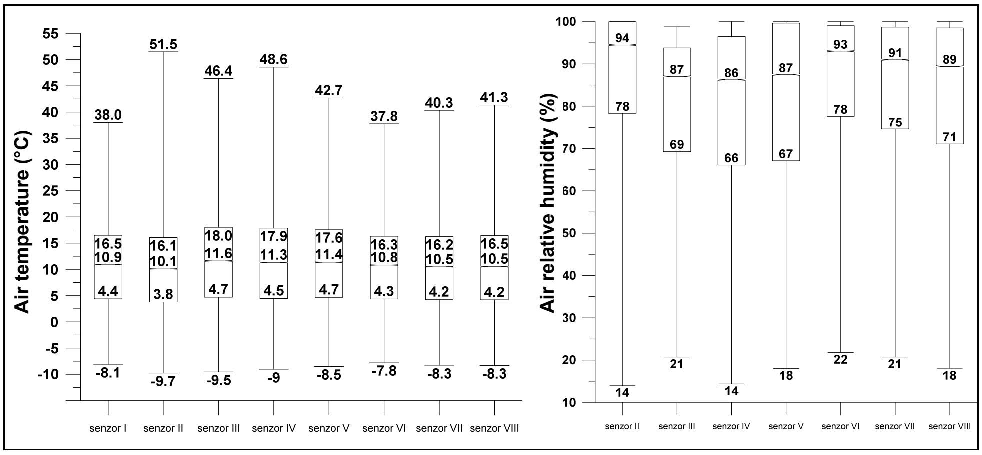


Fig. 3: Boxplot of air temperature (left) and relative air humidity (right) for entire period (August 2014 – November 2015); minimum, maximum, median, I. and III. Quartile

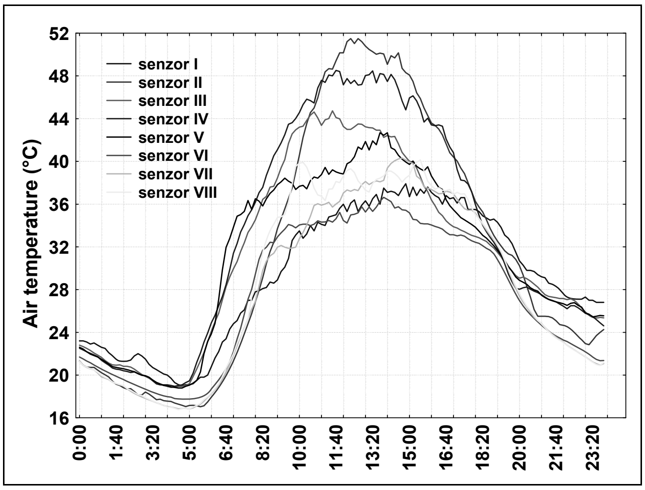
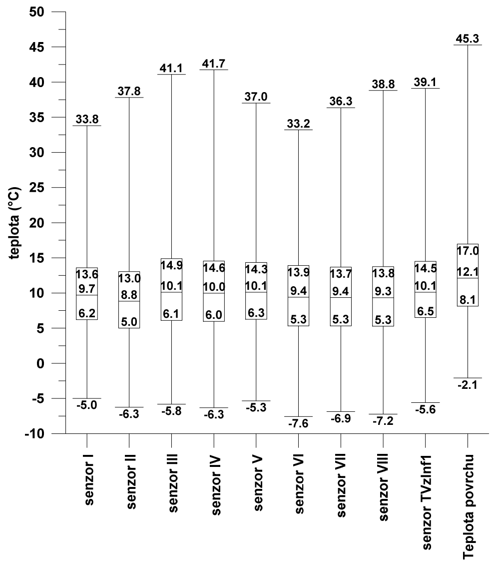


Fig. 4: 24hour course of air temperature during the hottest day of monitoring 22. 7. 2015

The results of parallel monitoring of ground-level air temperature and rock surface temperature bring Fig. 5 – left. The hottest day of this parallel monitoring was 1. 9. 2015 (Fig. 5 – up).



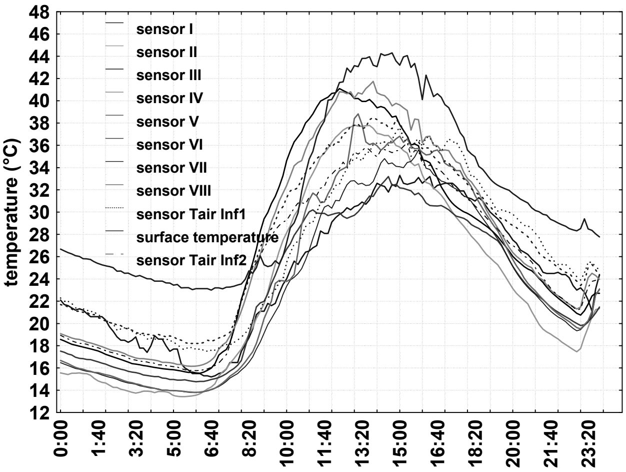


Fig. 5: Boxplot of ground air temperature and rock surface temperature, September to November 2015 (period of parallel monitoring), maximum, minimum, median, I. and III. Quartile (down);

Conclusion

The highest maximum and lowest minimum air temperature was measured at the location on the plateau (2 sensor) which is probably caused by the presence of dry grass canopy (fescue) with limited transpiration. Surface temperature of dark-colored rocks serpentines is given by the heating and their surface, that contains a lot of cracks, reduces thermal conductivity. Direct sunlight therefore heats the surface of these rocks to high temperatures. In winter, the surfaces of these rocks get very quickly cooled and results low temperatures.

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Souhrn

Stromová a keřová vegetace se na mikroklimatických poměrech stepi projevuje nejen přímo prostřednictvím zastínění, ale i prostřednictvím své fyziologické aktivity (transpirace). Pokud se však jedná o netranspirující porosty uschlých travin, uvedené procesy neprobíhají a přítomnost takového vegetačního pokryvu se projevuje naopak zvýšením extremity teploty vzduchu, zejména v přízemní vrstvě a v přilehlé vrstvě půdy. Suché rostliny omezují odvod tepla do povrchových vrstev půdy a způsobují tak zvýšení přízemních teplot vzduchu během tropických dnů. Teplotní režim partií stepi, kde vystupuje na povrch skalní podloží, je dominantně formován tím, že během dne proniká povrchem skalního masivu vedením přijatá tepelná energie v závislosti na jeho tepelné kapacitě a vodivosti (podrobněji v Středová et al., 2014). Tato energie je pak v průběhu noci přiváděna zpět k povrchu a noční teplota skal je tedy zpravidla vyšší než teplota nad povrchem půdy a to zejména v případě, že se jedná o suché písčité půdy. Taková půda se naopak ve svrchních vrstvách během dne ohřívá velmi rychle, s hloubkou však v důsledku špatné tepelné vodivosti vzduchu vyplňujícího jednotlivé póry rychle klesá a v noci v důsledku efektivního vyzařování dochází k markantním teplotním ztrátám. Je zřejmé, že na dřevinnou vegetací ovlivněných centrálních partiích Mohelenské hadcové stepi jsou přízemní teploty vzduchu během nejteplejších dnů i o 8,5 °C nižší, než na typicky stepních plochách. Okrajové, souvisle zalesněné partie Mohelenské hadcové stepi, jsou chladnější i o 15 °C. Také extremita prostředí, výrazně ovlivňující druhovou skladbu a habitus flóry, je výrazně nižší v partiích se souvislou nebo jen rozptýlenou dřevinnou vegetací (až o 15,6 °C).

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MINING OF SAND AND GRAVEL – NATURAL AND RECREONATIONAL POTENTIAL

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Abstract

The contribution deals impact of mining in the floodplain of the river Morava. On the case study it is shown how to use the excavated area for the formation of the landscape, promote biodiversity and at the same time for recreational purposes.

Key words: floodplain, restoration, biodiversity, recreation

Introduction

Gravel quarrying is usually located in the floodplains of large rivers. The alternative forms use of the exploited areas for the interest of nature protection or for the recreational purposes, usually brings great benefits

Materials and methods

Resource extraction is happening mostly on farm land, in a very small extent on forest land. Feedback reclamation of mined areas is there governed by Act no. 334/1992 Coll. on the protection of farmlands and related legislation. The amendments to the Act no. 41/2015 Coll. permits, under certain conditions, alternative forms of reclamation.

Practical experience shows that feedback reclamation to agricultural land is most efficient in the case fertile soils with high level protection, for example specially protected like black earth. On land with low fertility seems to be a very effective alternative forms of reclamation.

Results

Natural and recreational potential of the exploited areas is demonstrated in a case study of mining in Napajedla - Spytihněv.

<u>Characteristic of sites</u>

The area of interest is located in a wide floodplain of Morava River, south of Napajedla. Along the Morava river is traced supra-regional biocorridor (basic part of territorial system of ecological stability) with water and alluvial axis. The whole mining area is located at CHOPAV Quaternary of the Morava river and close to the current northern border protecting zone 2b to water resouces Kněžpole. General view of the site is shown in Fig.1.

Surrounding areas are represented by the intensive agricultural land with a dominant share of arable land. Billabongs of the Morava and traditional pastures of horses by Napajedla stud create genetic reservoir for revitalisation of mining areas.

<u>Revitalizing goal</u>

The aim of the project is to restore harmonious alluvial landscape. The area of interest is divided into three basic zonas: natural, recreational and educational. Natural zone is designed as a quiet zone with limited acces. Otheres are accessible through system of paths and sidewalks, supplemented landscape inventory.

The project proposes creating of natural and seminatural biotops (especially water and wetland) with a streamlined anticipated succession, which would significantly contribute to restoring the nature and function of the original alluvial landscape. Reclamation is going to increase the biodiversity of the area and improve its ecological stability.
In the long term it is expected to create stable communities of alluvial plains (Fig.2) and meadows. Grasslands is expected to increase species diversity in a natural way. Landscaping non-forest vegetation creates a suitable habitat for a wider range of specie. Fruitive shrubs improve food options on site. Diversification of the banks (Fig.3) and bottoms establishe appropriate conditions for wetland and aquatic biota.
Revitalized area has positively higher retention than the previous agrocenosis. A significant benefit is the dispositional retention capacity of mining lakes. The revitalized area also fulfills an important function of flood.
Step by step there is expected wide recreational use of the area in relation to attractive activities like cycling, horse riding trails, water sports , fishing, sailing on the Baťa canal etc.

Economic hedges
Reclamation gravel Napajedla is economically gauaranteed by the mining company. Implementation of the various stages of biological reclamation, however, does not represent the end of project. Aftercare is based on the mining company, local fishing association and volunteers are participated. Successfully develops cooperation with the mayor, councilors and municipality.

Discussion
Floodplain area is heavily exposed. Extraction of raw materials is there in conflict with agricultural production, development of settlements, transportation and other human activities and needs. On the other side revitalization of mining areas represent a huge potential which can contribute to restoring the natural functions of floodplains.
However, this objective cannot be achieved by a one-off intervention, but systematic cooperation of all partners. Monitoring of locality pro locations from project to its full implementation is necessary.

Conclusion
Recultivation of gravel and sand pit Napajedla represents a new type of reclamation prefering the natural values of the territory from the originally contemplated purely production functions.
Implementing projects are processed for different stages and respect the conclusions of previous studies and monitoring sites. Ongoing revitalization of areas affected by mining minimizes the adverse impacts of mining on the surrounding nature and landscape and contributes to the creation of a full-fledged floodplain landscape. The renewed landscape alongside a production function also allows development of ecological stability and biodiversity. Subsequently will develop sports and recreational potential of the area.
Proposal for revitalization is more demanding on the extent of exploration, design and monitoring, but in overall the aggregate cost of revitalization are significantly less costly because it uses the spontaneous colonization of organisms from the environment or from initiating plantings and largely operate on the principle of self-regulation.

Fig. 1: General view of the site - at the forefront going mining, in the background revitalized area

Fig. 2: Establishment of forest communities

Fig. 3: Diversified rugged shores of the mining lake

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Souhrn

Rekultivace štěrkovny Napajedla představuje nový typ rekultivace preferující přírodní hodnoty území před původně uvažovanými ryze produkčními funkcemi.

Projekt technické i biologické rekultivace vychází z multioborových průzkumů území a následných studií, na nichž se podílela široká škála odborníků. Prováděcí projekty jsou zpracovávány po dílčích etapách a respektují závěry monitoringu území. Průběžná revitalizace ploch dotčených těžbou minimalizuje nepříznivé dopady těžby na okolní přírodu a krajinu a přispívá k vytvoření plnohodnotného úseku moravní nivy.

V návaznosti na těžbu štěrkopísků vzniká plnohodnotná krajina, která umožní i rozvoj turistických, rekreačních a sportovních aktivit.

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MOUNTAIN VEGETATION RESPONSES TO TOURISM ACTIVITIES – CASE STUDY FROM PLA JESENIKY AND KRNAP

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Abstract

The study showed the influence of several types of tourism activities on mountain plant communities. There have been observing three intensities of simulated trampling and sod removal for 4 years. After this period the experiment was terminated and subsequently we monitored succession on plots. There was the regeneration of alpine grasslands 4 years after the end of intervention, which seemed to be the most resistant to all types of interventions and fastest in the regeneration. Conversely, the biggest impact of interventions has been observed on communities of alpine heathland, there was significant reduction in the cover of *Calluna vulgaris* on the experimental plots, and its recovery was very slow. Some plots even directed to the development of new communities in their compositions. It is necessary to choose a different management of individual activities to protect each particular types of communities.

Key words: mountain ecosystems, tourism, trampling, subalpine vegetation

Introduction

Mountains ecosystems are the most endangered ecosystems over the word due to specific conditions (Takahashi et Miyajima 2010). In the High Sudeten Mts. in the Czech Republic some endangered species is directly dependent on the existence of alpine areas. Those areas existed in Sudeten Mts. even during The Medieval Warm Period (MWP, also Medieval Climate Optimum) thanks to the functioning anemo-orographic systems (Jeník 1961, Rybníček et Rybníčková 2004).

Although human activities could increase local biodiversity in mountain ecosystems (Galvánek et Lepš 2008), the most popular touristic activities such as climbing or hiking could have a negative influence on environment (Moravec et al. 1995, Liddle 1997, Petříček et al. 1999, Van der Duim et Caalders 2002, Vítková et al. 2012). Hiking caused trampling of vegetation near touristic trail (Hejcman et al. 2005) or spreading of non native plants (Málková 1994, Vítek et Vítková 2000). Trampling reduces the height of the vegetation, the amount of biomass, plant fitness (number of flowering plants or number of seeds) or directly destroys reproductive structures (Pickering et Hill 2007). The damage of vegetation could cause irreversible changes in the plant association (Bureš 2005).

Much of the work deals with the assessment of changes along existing hiking trails (Štursová 1985, Bureš 2005) but manipulative experiment was never based in this area. To manage these ecosystems properly it is important to know the response of communities to different management even in a long time period. We established a manipulative experiment in order to monitor the impact of trampling and sod removal on three selected plant communities in High Sudeten Mts. in 2005, and the intervention was repeated every year to 2008. Than the plots were left to a spontaneous development. The main aim of the study was to bring new knowledge about succession development in areas after cessation of experimental interventions.

Materials and methods

Study sites

The experiment was established in two similar areas in the High Sudeten Mts.: on the Mumlavska louka in The Giant Mountains (50.7695N, 15.5296E) and closed by the top of the Petrovy kameny mountain in the Jeseniky Mountains (50.067N, 17.233E). The locality in The Giant Mts. is 1250 – 1360 m above sea level in southwestern exposure, in the Jeseniky Mts. it is between 1330 and 1400 m above sea level in northern exposure.
There is a porphyritic medium grained granite to granodiorite at the Mumlavská louka according to geological maps of the Giant mountains (Chaloupský et al., 1989), the Petrovy kameny mountain is built by paragneisses phyllite and quartzite layers (Demek et al. 2006).
Both mountains belong to the moderate climate - cool area (Quitt 1971). The climate reminds localities in the Nordic tundra especially by its temperature conditions (Jeník 1961).

Sampling

The experimental plots were established in 2005, the first interventions were made in 2005 after first cover monitoring. Experimentally mechanical operations simulated various human activities were repeated till 2008. The sod removal was realized only at the beginning of the experiment. The plots were left to spontaneous succession since 2009. The plots were located in three plants communities: alpine heathlands, subalpine vegetation dominated by *Calamagrostis villosa* (alpine grassland) and subalpine heathlands dominated by *Vaccinium myrtillus* (Chytrý 2010).
We chose three blocks consisting of five plots in every plant association. Each plot in the block was randomly assigned to the intervention type. There were three types of trampling intensity (50, 100 and 200 of trampling on one square meter), sod removal and control. The vegetation cover was monitored on 1 m^2 plot (Venn et al. 2012) in the middle of the growing season between the end of July and beginning of August. We used Braun - Blanquet scale for cover monitoring (Wikum et Shanholtzer 1978).

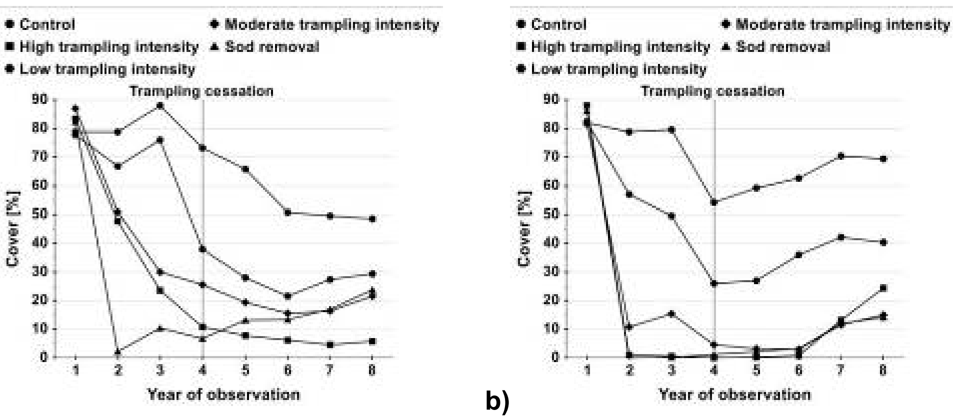
Data analysis

Calculations were performed using NCSS 2007 program. Plot means were compared by Analysis of variance (ANOVA). We tested the significant effect of intervention,time and intervention – time interaction. Block design was used as a randomization factor, intervention and time as fixed factors. Cover changes of the dominant plant were tested by using generalized linear models (GLM) for the dominant plant, test significance was tested using Monte-Carlo permutation tests.

Results

All data are significantly homogenised, data normality was confirm by Shapiro test. There is a significant difference in the interventions among years in vegetation cover in each plant association.

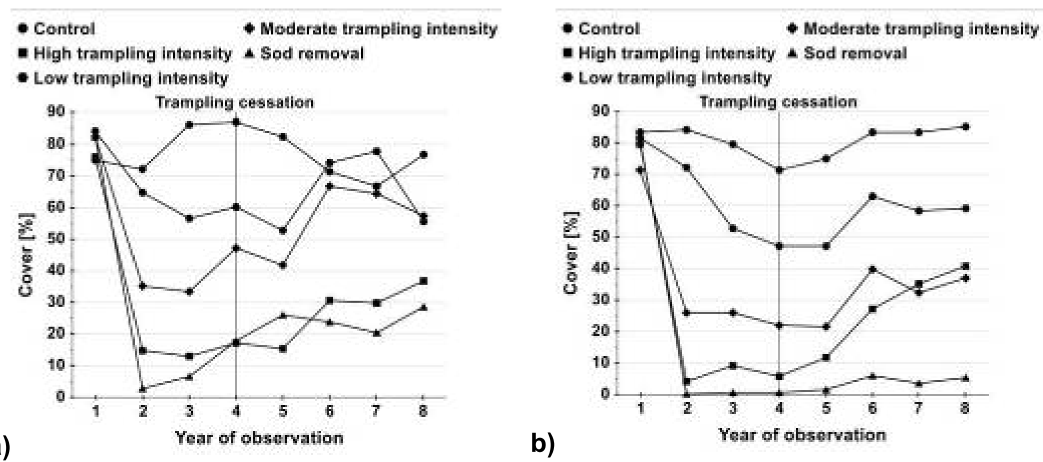
Calluna vulgaris strongly negatively reacted on two highest intensities of trampling and sod removal (Fig. 1). The vegetation recovery was fastest after sod removal, on the other hand it did not regenerate as fast after the highest intensity of trampling. Regeneration occurred 2nd or 3rd year after the ending of the experimental trampling. The reduction of cover of heather occurred even if the lowest intensity trampling.



a) b)

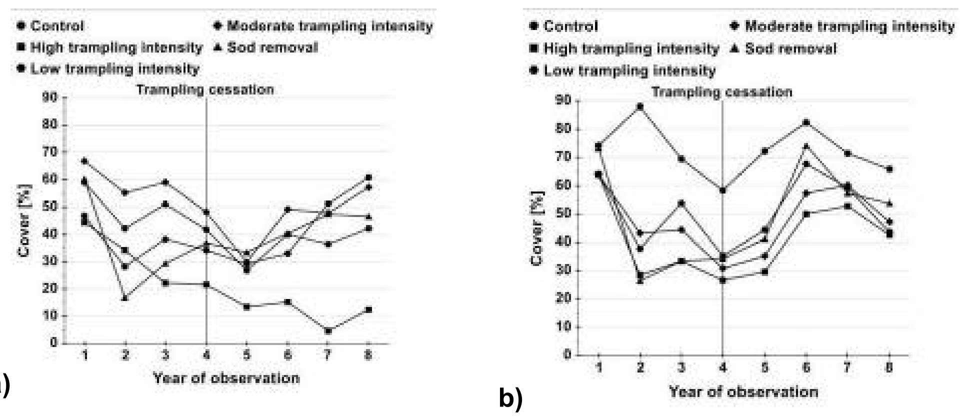
Fig. 1: Cover development of heather (*Calluna vulgaris*) in Jeseniky Mts. (a) and the Giant Mts. (b). There is observed the development of vegetation on plots with 4 types of intervention and control plot. 1 year = year of establishment of experimental plots in 2005 (before the first intervention), by 4 (2008) there was a mechanical disturbance, after 5 year (2009) the areas are left without disturbance. Vegetation cover is recorded as the average cover of the dominant plant (heather).

The impact of the intervention was significantly different among both Sudeten High Mountains, (Jesenik Mts. F-ratio = 6.88, p = 0.01; for The Giant Mts. F-ratio = 14.30; p = 0.001). Significance was tested for interaction intervention – year. Interaction has been proven for Jesenik Mts. (F-ratio 4.18, p<0.005) and the Giant Mts. too (F-ratio = 5.54; p<0.005).
The growth of *Vaccinium myrtillus* varied significantly in response to the sod removal (Fig. 2). Trampling intensity directly influenced coverage of *Vaccinium myrtillus* on plots. It cover gradually returned in sod removal plots in Jesenik Mts, while in the Giant Mts. the cover return observed wasn't as intensive. Both mountains differed significantly in both individual interventions among themselves and in the development of cover in different years (Jesenik Mts. F-ratio = 2.99, p <0.005, The Giant Mts. (F-ratio =9.90; p <0.005).
The lowest changes in vegetation cover were observed in alpine grasslands (Fig. 3). We can say that the total cover of *Calamagrostis villosa* in plots was on the same cover in the control surface and in sod removal plots one year since the end of mechanical interventions. There was a significant difference in intervention in both mountains (Jesenik Mts. = F-ratio = 21.21, p <0.005, Giant F-ratio = 4.17; p = 0.041), while the dependence of changes in plot cover in different intervention during years has not been proven in Jesenik Mts. (F-ratio 1.32, p = 0.342), but only in the Giant Mts. (F-ratio = 3.36; p = 0.025). In the Jesenik Mts. no statistical difference should be caused by the decline of *Callamagrostis villosa* cover in areas with the highest intensity of trampling even after the ending of mechanical interventions.



a) b)

Fig. 2: Cover development of blueberry (*Vaccinium myrtillus*) in Jeseniky Mts. (a) and the Giant Mts. (b). There is observed the development of vegetation on plots with 4 types of intervention and control plot. 1 year = year of establishment of experimental plots in 2005 (before the first intervention), by 4 (2008) there was a mechanical disturbance, after 5 year (2009) the areas are left without disturbance. Vegetation cover is recorded as the average cover of the dominant plant (*Vaccinium myrtillus*).



a) b)

Fig. 3: Cover development of *Calamagrostis villosa* in Jeseniky Mts. (a) and the Giant Mts. (b). There is observed the development of vegetation on plots with 4 types of intervention and control areas. 1 year = year of establishment of experimental plots in 2005 (before the first intervention), by 4 (2008) there was a mechanical disturbance, after 5 year (2009) the areas are left without disturbance. Vegetation cover is recorded as the average cover were the dominant plant (*Calamagrotis villosa*).

Discussion

Vegetation responses on mechanical disturbance were demonstrated in all three vegetation types of experimental plots in High Sudeten Mts. Different grade of disturbance influenced not only resistance but also the resilience of different vegetation types.

Alpine heathland
Alpine heathland vegetation was the least resistant to all intensities of trampling compare to the other plant communities. *Calluna vulgaris* was reduced even in the low intensity trampling plots, in heavily trampling plots it almost disappeared. Vulnerability of heathlands to trampling also documented (Gallet et Roze 2001, Gallet et Roze 2002). Grasses subsequently penetrated into plots of alpine heathland, especially *Avenella flexuosa. Calluna vulgaris* regenerated only partially three years since the last intervention, mainly from old nodes.
Calluna vulgaris regenerated generatively and vegetatively from the remaining nodes after sod removal. While in Jesenik Mts. seedlings germinate more often, in the Giant Mts. they grew only slowly. According to the work Sedláková et Smart (1999) *Calluna vulgaris* recovery after sod removal depends primarily on the abundance of seedlings. For its successful regeneration and to prevent the invasion competitively stronger species there is important enough seeds for the recovery (Mitchell et al. 1998). But with sod removal seed bank in soil was also removed, seeds had to be added by the surrounding vegetation (Pywella et al. 1997). The differences in *Calluna vulgaris* recovery can be explained as a combination of two fundamental processes: firstly alpine heathlands are too small to recover faster after sod removal and a smaller number of plants and seed rain was limited. Secondly shrubs were overgrown and reduced fitness causes lower seed production (Barclay-Estrub et Gimingham 1994). We weren't able to say with certainty whether there will be recover of heathland at both locations the High Sudeten Mts.

Subalpine heathlands dominated by *Vaccinium myrtillus*
Although *Vaccinium myrtillus* is considered as a low resistant species to the trampling (Cole et Trull 1992, Cole et Monz 2002), its recovery was not as obvious as in the alpine heathlands. Other researches showed that these communities were one of the least resistant in terms of mechanical disturbance among alpine vegetation (Chilcott et Whinam 1999, Whiman et Chilcott 2003). *Calluna vulgaris* started to recover rapidly on heavily trampled plots after completion of trampling. Although grasses penetrated into the vegetation, we assumed that all *Vaccinium myrtillus* vegetation would recover in the same vegetation structure to the experimental plots.
The regeneration after sod removal differed between the mountains. The recovery in Jesenik Mts. was faster with generative and especially with vegetative regeneration. There should has been a small amount of seedlings in the Giant Mts. and the following recovery has been slow. Ritchie (1956) showed that generative regeneration was less frequent than the vegetative, growth of seedlings and at higher altitudes decreased the number of flowering. Slow regeneration could be due to a combination of climate, runoff seeds (the plots are located in a steep river bed) and the absence of soil profiles in the Giant Mts.

Subalpine grassland with *Callamagrostis villosa*
Subalpine grasslands were more resistant to trampling than the shrub vegetation. *Avenella flexuosa* spread at both locations at the expense of *Calamagrostis villosa*. This grass is considered a trampling more resistant than *Calamagrostis villosa*, which did not create tussocks and was of taller structure (Scurfield 1954, Cole 1995, Klug et al. 2002 Whinam et Chilcott 2003). It is evident that *Callamagrostis villosa* from the nearby hiking trails can be replaced by more resistant grasses.
After sod removal there was a quick restoration of *Calamagrostis villosa* in both localities. Sod removal has not been done sufficiently deep to prevent regeneration

from nodes growth deeper. The ability of the rapid spread of *Calamagrostis villosa* using underground nodes was demonstrated by Prach (2003). Sod removal on the other hand had a negative effect on *Avenulla flexuosa*. The underground nodes of this species were located in less depth (Scurfield 1954) and that was why all parts of this grass were completely removed. The regeneration of this species had to be done mostly by generative spreading or by vegetative nodes from the surrounding vegetation.

Conclusion

Different grades of disturbance affect differently individual types of subalpine vegetation. As most resistant and resilient communities to simulated tourist trampling seems to be grasslands, the least communities of evergreen shrubs with *Calluna vulgaris*. The original vegetation composition has been showed within 5 years from sod removal ad within 2 years from the completion of trampling in grasslands. On the contrary, alpine heathland development indicated that there would not be original structure of vegetation reached. Communities with *Vaccinium myrtillus* negatively react mainly to trampling, but they recover after the end of trampling to the original species composition under good conditions.

Based on our experiment the PLA administrations can appropriately select a new hiking trails or aimed tourist activities. These activities should be primarily aimed to areas with highly resistant grasslands communities rather than in the bush communities.

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Souhrn
Studie se zabývala vlivem několik typů turistických aktivit na vybraná horská společenstva rostlin. Po dobu 4 let byly simulovány tři intenzity sešlapu, z některých ploch byl stržen drn. Následně byl experiment ukončen a byla sledována sukcese na plochách. Po 4 letech od ukončení zásahů došlo k regeneraci ploch alpínských trávníků, které se tak ukázaly jako nejvíce odolné všem typům zásahů i nejrychleji regenerující. Naopak největší dopad měly zásahy na společenstva alpínských vřesovišť, kde došlo k výraznému snížení zastoupení vřesu na pokusných plochách a jeho regenerace byla velmi pozvolná. Některé plochy dokonce směřovaly svou kompozicí k vývoji nového společenstva. Pro ochranu jednotlivých typů společenstev je proto potřeba volit rozdílné přístupy při povolování jednotlivých aktivit.

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NATURE CONSERVATION AND BIKE TOURISM (CASE STUDY IN GERMANY)

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Abstract
Bike tourism belongs to the permanently increasing tourism sectors. There suggests itself to bet on the renaissance of local and regional uniqueness in Germany as a counterweight to globalization and low cost fly tickets. Nowadays, the bicycle represents a symbol, which can demonstrate a particular way of life and especially a responsible conscious attitude to an environment (Steinecke, Hallerbach, 1996). This change accompanies a general change in tourism, which is observed.
Tourism is changing evermore from an overnight society towards a culture of experience. The increase of attractiveness is an unconditional requirement, which should be achieved through new products and marketing strategies, particularly in the area of socially and environmental friendly, so called soft or sustainable tourism (Borkenhagen et al. 2004).
At first, this article describes the general consequences of road transport infrastructure from a nature conservation viewpoint. Then, it focuses on bicycle paths, especially asphalt surfaces and disturbances resulting from bicycle paths, which can affect species communities in many ways. Therefore, criteria and indications were developed to determine concrete compensation factors, which contribute to the comparable assessment of bicycle paths in Germany. In principle, a financial compensation is also possible beside the allocation of land.

Key words: bicycle paths, sustainable tourism, disturbances, impervious surfaces, compensation

Introduction
Even despite of mass tourism, there can be observed split into different segmental trades. The interest in regional holiday stands in high contrast to global trend. At the same time, the interest of tourists in body motion increases, which is connected with increasing interest in bike tourism (not only) in Germany. This new trade segment can be understood as the form of ecologically and socially sustainable tourism.
Due to the fact that bike tourism is considered as unconditionally healthy and environmentally conflict-free tourism form, the tourism associations and decision makers misunderstand, when the experts on nature conservation express their doubts about building new bike road or the covering of older road with an asphalt cover.

Influence of transport infrastructure
Soil conservation and barrier effect
Impervious surfaces are one of the key problems in soil conservation. More than 115 ha per day are taken for transport and residential infrastructure in Germany. These areas cover more than 15 % of the total area in Germany, while protected areas cover only 3.4 %. The concept of wildlife corridors belongs to the base strategies of nature conservation. But again, there is obvious antagonistic trend – the fragmentation and building-up of biotopes. The Central European fauna lives in the middle of dense road network, which makes barriers from different viewpoints.

On the one side, there are deaths as a direct consequence (e. g. European otter, Eurasian eagle-owl). On the other side, expressively different and inappropriate surface structure for animals appeals as a stress factor. It can even change microclimatic conditions. Country roads with an asphalt cover are more effective barriers than unpaved country roads (gravel or sand roads), where the number of species and individuals was 10-times higher according to faunistic studies (Mader, 1989).

Disturbances

Nowadays, free time and sport activities belong to main threat factors from the nature conservation viewpoint, especially in nature close sites. A causality between some free time activities and their influences on free living animal species is often only hardly notable for laics. These influences are only rarely considered or they are rated as negligible by originator (Georgii, 2001). Avifauna is affected mainly by optical disturbing effects. It can mean that animal keeps a large distance from transport communication, which means the notable restriction of its habitat/biotope. Western marsh Harrier keeps the distance of 240 m from bike and tourist roads. This unused corridor notably restricts the hunting area of the species (Kruckenberg et al. 1998).

Bike roads

Knowledge, that the building of new bike roads or the modernization of the older ones does not seldom result in the disturbing of natural environment, is not new. Ziese and Heydebrand (1989) draw attention to it 20 years ago. Despite of this, the bike roads are considered as unconditionally environmentally suitable and a critical discussion about the building of new bike roads or the modernization of the older ones encounters misunderstanding.

Asphalting of bike paths

Public pressure on the asphalting of all bike paths is enormous in Germany. The most often used argument in relation to the already existing bike paths is “but these are also asphalted”. The question of asphalt covers is often used as a main argument for the acceptance of the bike road from public side. The influences of asphalt bike roads may cross the interests of nature conservation, ergo they are much brighter. It was an interesting argument, which was frequently heart by farmers during land reforms in Germany. The framers have to use uncomfortable and technologically out-dated gravel roads every day, while bikers may use asphalt bike roads. The building of new asphalt roads in natural landscape would be fatal not only form the viewpoint of impervious surfaces, but it would be notably supported a tendency to isolate animal species populations.

Bike paths as the source of disturbances

The bike roads are not used only by bikers, but also by inline-skaters, runners etc. It matches various optical and acoustic disturbing impulses. However, it was proved some learning ability of animals, which can also concern anthropogenic disturbing effects, if they occur at the same place and at the same time (Ulbricht and Klenke, 1999). The building of new bike roads interferes still new, untouched localities as the result of increasing landscape aesthetic importance. Therefore, the disturbing effects reach new regions with all their consequences on biotopes and biota. The fragmentation or the dividing of nature close biotopes by bike road leads to the ruderalisation of border areas and it eases the intersection of allochtone, also invasive, species. A predation pressure increases in the fragmented biotope (Grabher, 2007). These indirective influences are only hardly notable and difficult analyses are needed.

Results and discussion

Following criteria should contribute to the transparent, simple and understandable assessment of bike roads from the nature conservation viewpoint. The location and surrounding environment of bike road belong to the most important criteria (Table 1). If the close surrounding consists of nature close biotopes, the demands of nature conservation are important as well. But if the bike road passes through intensively used landscape, even more close to another road, the importance of nature conservation demands is minimal. Very strict criteria are settled in protected areas and in the NATURA 2000 areas, including environmental impacts assessment in the NATURA 2000 areas. In such areas, there will have priority the demands of nature conservation over the demands of tourism. Comparable strict criteria are necessary also in the case of species, which are sensitive to disturbing (e. g. bird species breeding on meadows such as corncrake).

As it is before every intervention into natural environment, the requirements of nature conservation have to be considered. But it does not necessary mean, some other requirements will not have higher weight within criteria. In such case, the demands of nature conservation can be fulfilled in the process of compensatory measures. But the experience show that this rule is not fully applied in the praxis.

Tab. 1: Criteria for the assessment of bike road from the nature conservation point of view

Criteria		Weight function
Location of the bike path	along road	-
	free landscape	+
	protected area/ NATURA 2000	++
Environment of the bike path	intensively used by agriculture or forestry	-
	nature close biotopes	+
Disturbance effect of the bike path	no disturbance effect	-
	areas sensitive to tread	+
	areas sensitive to disturbing	++

The area of future (asphalt) bike road (bright x length) has been used since several years as a basis for the quantification of needed compensatory measures. At the same time, it is determined a compensatory factor according to the touched biotopes and expected disturbing effect (Table 2). Then, the total range of compensatory measures is the result of area size and compensatory factor. This process is not new and it was approved by the building of the road communications and other interventions into the natural environment. It is complicated to find suitable localities for compensatory measures. Critical voices come also from agricultural sector and they claim that too many areas were taken out from agricultural use.

Single disturbing effect cannot be compensated only by the allocation of area for compensatory measures. Financial compensation can be considered as an alternative solution, e.g. just as it is in the case of the negative influence of building-up on the landscape image.

The justness of bike road assessment form the nature conservation viewpoint was proved by several studies (Wagner, 2010; Osswald, 2006; Ohlhorst, 2003), which assessed the bike roads and their influence on the nature conservation, regional development and the improvement of the economical situation of marginal regions through the development of bike and water tourism (Biedenkapp and Stührmann, 2004).

Tab. 2: Compensatory factors according to the touched biotopes and expected disturbing effect

Biotope type and species in surrounding	Surface able to intercept water and/or insignificant disturbing effect	Asphalt surface and/or significant disturbing effect
- arable land/intensively used permanent grassland - non-indigenous forest	0 – 0,5	0,3 – 0,6
- vegetation in the farming landscape - extensively used grassland - river flood-plain	0,5 – 0,8	0,6 -1,0
- nature close forests - brush biotopes - species sensitive to disturbing - protected areas	0,8 – 2,5	1,0 – 3,0

Conclusion

Knowledge, that the building of new bike roads or the modernization of the older ones does not seldom result in the disturbing of natural environment, is not new. Despite of this, the bike roads are considered as unconditionally environmentally suitable and a critical discussion about the building of new bike roads or the modernization of the older ones encounters misunderstanding. The fragmentation or the dividing of nature close biotopes by bike road leads to the ruderalisation of border areas and it eases the intersection of allochtone, also invasive, species. A predation pressure increases in the fragmented biotope.

As it is before every intervention into natural environment, the requirements of nature conservation have to be considered. But it does not necessary mean, some other requirements will not have higher weight within criteria. In such case, the demands of nature conservation can be fulfilled in the process of compensatory measures. But the experience show that this rule is not fully applied in the praxis. We present two packages of criteria/factors: Criteria for the assessment of bike road from the nature conservation point of view and Compensatory factors according to the touched biotopes and expected disturbing effect.

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Souhrn
Cykloturistika patří ke stále se rozšiřující části turistiky vůbec. Díky tomu je vhodné se zaměřit na renesanci místní a regionální jedinečnosti v Německu jako protiváha globalizace nízkonákladových letů.
Vzhledem k tomu, že cykloturistika je považována za zdraví prospěšnou aktivitu a ekologickou formu cestovního ruchu, sdružení cestovního ruchu zastává špatný názor, kdy odborníci na ochranu přírody zastávají názor, že je nevhodné zbudování nových cyklotras či překrytí starých tras novým asfaltovým povrchem.
V první řadě tento článek popisuje obecné důsledky silniční infrastruktury z hlediska ochrany přírody. Následně je pozornost věnována cyklistickým stezkám zejména s asfaltovými povrchy a jejich poruch, které mohou mít vliv na prostředí v širších ohledech. Z toho důvodu byly stanoveny kritéria pro hodnocení kompenzačních faktorů, které přispívají k vyhodnocení stavu cyklistických stezek v Německu.

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NATURE PROTECTION IN GHANA AND THE CZECH REPUBLIC FROM SOCIOECONOMIC POINT OF VIEW

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Abstract

The article is focused on the nature protection in Ghana and the Czech Republic. Considering the nature protection in both countries, there were varied observations from many points of view. One of them is the category of protected areas, the second is the legislative, and the third one is effort to harmonize the interests of businesses and residents with conservation requirements in specially protected areas and establishing a system of compensation for the injury etc. The total area under protection in Ghana is approximately 16%, in the Czech Republic it is 16.2 % of the territory. The rate of degradation and loss of habitat in Ghana doesn't seem to be decreasing in recent times; this can be attributed to increasing social and economic pressures. Comparatively in the case of Ghana, sustainability has not been achieved, with plenty of unsustainably harvested products putting severe pressure on wild species of plants and animals, resulting in deficiency and in some cases, proof of threat of extinction.

Key words: environmental economics, recreational function, natural resource management, protected areas, Czech Republic, Ghana

Introduction

Preservation of the natural environment is crucial for maintaining sustainability of ecosystems. During the last two decades conservation ideas have shifted to a sustainable use approach, which works through people's wise use of resources (Brandon, Redford & Sanderson, 1998). Although the establishment of Protected Areas (PAs) has for a period been identified as the key strategy for the preservation of biodiversity, the claims to reducing poverty still continue to attract rising numbers of literature in the field of conservationists on one half and social advocates on the other (Mohammed, 2015).

A landlocked country with no maritime claims and coastline, Czech Republic is located in Central Europe between Germany, Poland, Slovakia and Austria. It has a total area of 78,867 km^2; comprising 77,247 km^2 of land and 1,620 km^2 of water. It has land boundaries totalling about 2,046 km. As a temperate country, Czech Republic is often cold with cool summers, cloudy and humid winters. Bohemia in the west usually consists of rolling plains, hills and plateaus which is surrounded by low mountains. Hilly country best describes Moravia which is located in the eastern part. There is the existence of health risk as air and water pollution in areas of northwest Bohemia and northern Moravia are most affected. There is a threat of acid rain which damages the forests as a result of domestic pollution (CIA World Factbook, 2015; CSO, 2016).

Ghana is located in the western part of Africa, bordering the Gulf of Guinea and between Ivory Coast and Togo. It has a total area of about 238,533 km^2; which is made up of 227,533 km^2 of land and 11,000 km^2 of water. Total land boundaries are approximately 2,420 km and 539 km of coastline. A tropical country, Ghana is often warm and comparatively dry along the southeast coast; hot and humid in southwest; hot and dry in the north. The terrain is mostly characterized by low plains with dissected plateau in the south-central area. About 20.12% of land is used as arable land, 11.74% for permanent crops and 68.14% used for other purposes. On environment, agriculture in mostly the northern and other parts are severely affected by recurrent drought, deforestation, overgrazing as well as poaching and habitat destruction which threatens wildlife populations (CIA World Factbook, 2015; GSS, 2016).

The Czech Republic and Ghana; two countries of diverse geographical locations were selected for the analysis of this research. This paper compares some designated socioeconomic aspects relating to natural areas protection focusing on the PAs management and issues of financing in respective countries, alongside the aspects regarding the interaction between nature conservation and local communities.

Material and methods

The main approach to this paper is the use of replicated secondary research, on the idea of an analysis of accessible scientific literature addressing the socioeconomic value and merits of protected areas. Data were obtained from the following sources; AVIBASE, United Nation List of Protected Areas, Global Biodiversity Information Facility (GBIF), Afromoth, Czech Statistical Office (CSO), Digital Register of Nature Conservation Czech Republic (DRNC), Ghana Statistical Service (GSS), Ministry of Land and Natural Resources (MLNR) and Ghana Wildlife Society (GWS). Analysis was based on simple comparison of the two countries and main differences in the European nature protection legislations as well as socio-economic policy development were addressed. In order to obtain the relevant results, data processing involved the application of scientific methods such as regional analysis, synthesis, comparison and economic analysis. Microsoft Office Excel was used in the graphical and statistical analysis.

Results

Presently, legally constituted wildlife in Ghana amounts to 16, this represents about 5.3% of total surface land area. These reserves have been grouped into: one strict nature reserve, six National Parks, two wildlife sanctuaries, six resource reserves and one biosphere reserve. Areas declared as Ramsar sites amounts to six. More often than not, budgetary allocation for these protected areas are not enough to provide the necessary protection for the wildlife populations, this has led to its gradual decline as a result of habitat fragmentation and bush-meat trade. In addressing these challenges in Ghana, the following key policy strategies have been identified: maintaining and enhancing the Protected Area system; and strengthening the legal framework on protected areas (Ghana: Poverty Reduction Strategy Paper, 2012).

The Forestry Commission’s wildlife division in Ghana has the sole responsibility of managing sixteen protected areas, which includes three coastal wetlands, 12,585 km^2 or 5.5% of the country (see figure 1). Protection of wildlife is catered for by legislation nevertheless, a resource constraint undermines the potential power to implementing conservation legislation (Jachmann, 2008).

Figure 1 shows a map of Ghana, with protected areas illustrated with green. It is quite disturbing to note that there is already pressure on protected areas in Ghana. As of independence in 1957, Ghana had a population of about just seven million, presently the population has nearly quadrupled. Illegal farmers and encroachment especially on the edges on reserves are still a danger to the future of these PAs.

The Czech Republic of nature and landscape protection is strongly regulated by legislation and groups protected areas by size: large-size areas are national parks and protected landscapes, small-size areas, national nature reserves, nature monuments and nature reserves are all considered small-sized. The Ministry of Environment has assigned Nature Conservation Agency of the Czech Republic (NCA) to oversee the protecting and conservation of nature as well as landscape on the whole territory of the country. State administration in nature conservation is carried out by the NCA across twenty three regional offices. These offices are in addition are mandated for managing protected areas with regards to their territorial competency with the exception of national parks which on the other hand are managed by autonomous authorities (NCA, 2016). PAs are illustrated on the map of the Czech Republic above in figure 2.

At workshop held in 2004 on the preliminary results of Rapid Assessment and Prioritization of Protected Area Management (RAPPAM) implementation in the Czech Republic, some major identified pressures and threats on PAs included: forest management, tourism, visitors and recreation, agriculture, invasive species, water pollution and mining. The main strengths identified were planning of protected areas, more specifically relating to design and management processes. On the other hand, poor community relations, land use conflict and inadequate social research were some of the weaknesses outlined. Main pressures on PAs in the Czech Republic and Ghana see in figures 3 and 4. According to IUCN (2010), illegal gathering of wild plants and animals (poaching) is a major threat in Ghana and this practice exist in all PAs with different degrees of severity. There is a high demand for bush meat, rattan and chewing stick in the PAs. Usually rattan is poached for the use of craft, whilst tusk is sort for in elephants and leopard for its skin. This trend has led to the reduction in wildlife population outside of these parks since PAs are the main source of bush meat for the local market.

Usually people living in surrounding communities of PAs are in a dilemma between their dependence on resources from these areas to supplement their local development needs and pressures from the international community to protect PAs (Van-vliet, 2010).

According to Kušová, Těšitel (2014), local communities in the Czech Republic do not feel socio-economically handicapped due to the fact that they live close to PAs, and generally they do not intend to resettle elsewhere. Locals attributed the long-term base of their economy to tourist attraction in the area this has encouraged the administration of PAs.

There is growing prominence globally for the relevance of PAs, however their socio-economic impacts on surrounding communities is perhaps the most contentious debates in conservation policy. Efforts to conserving the environment for future generations, the necessity for the institution of PAs has been adopted as a key strategy towards which all levels of national conservation efforts are sought (Pimbert and Pretty, 1997; Davenport and Rao, 2002). Communities near PAs benefit directly from employment opportunities in Ghana because most of the staffs are from the same locality. Their roles usually involve; boundary cleaning, community tour guides, patrolling of trails, constructional works among others. According to International Union for Conservation of Nature (IUCN) (2010), as a policy about 33% of the staffs in Kakum Park are locals. The importance of PAs shows the figure 5.

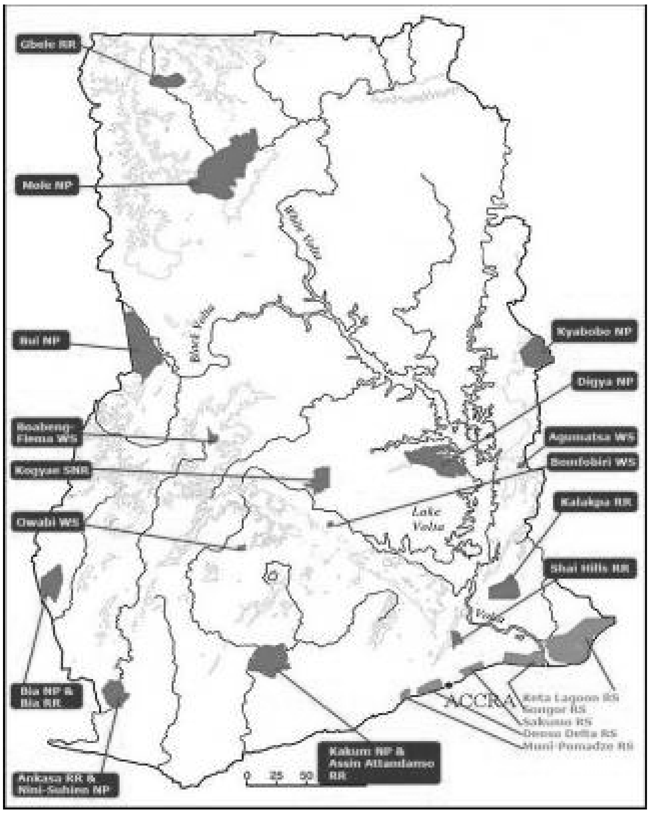

Fig. 1: Protected areas in Ghana (Source: Ghana Wildlife Division)

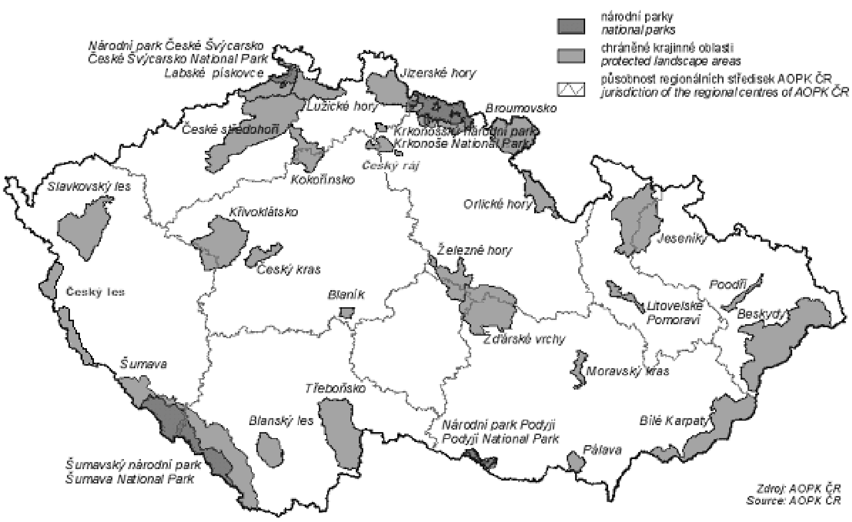

Fig. 2: Protected areas in the Czech Republic

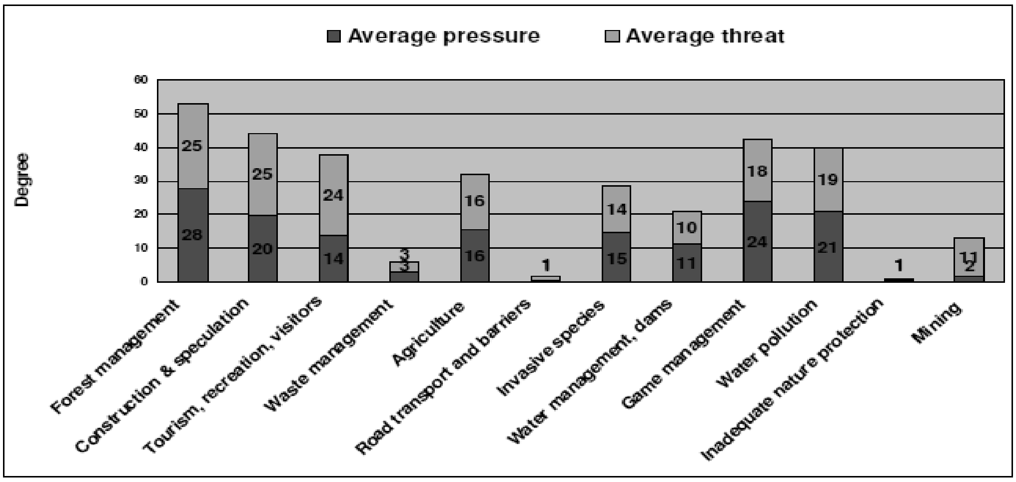

Fig. 3: Analyses of overall degree of pressure in the Czech Republic
(Source: Ervin, J. (2004))

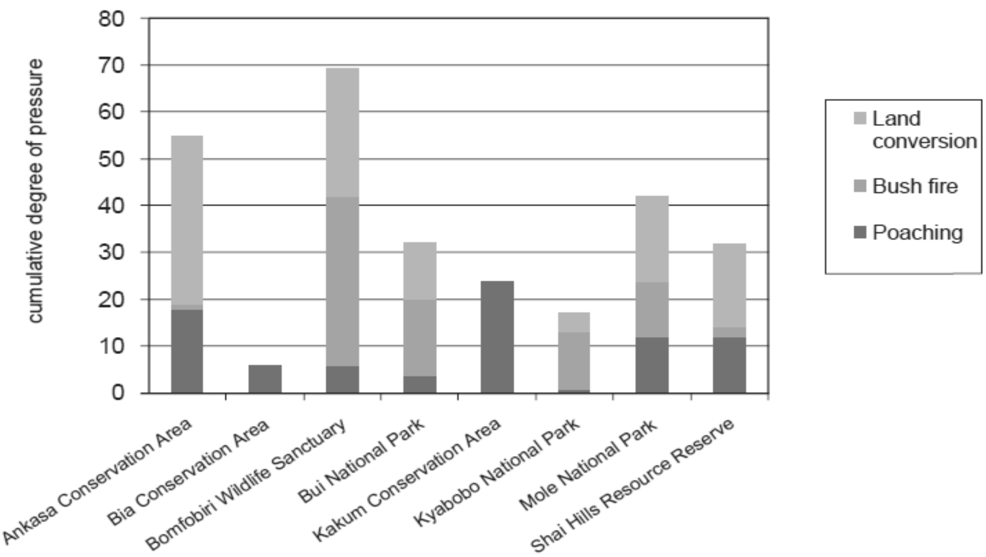

Fig. 4: Pressures on PAs in Ghana (Source: UICN/PACO (2010))

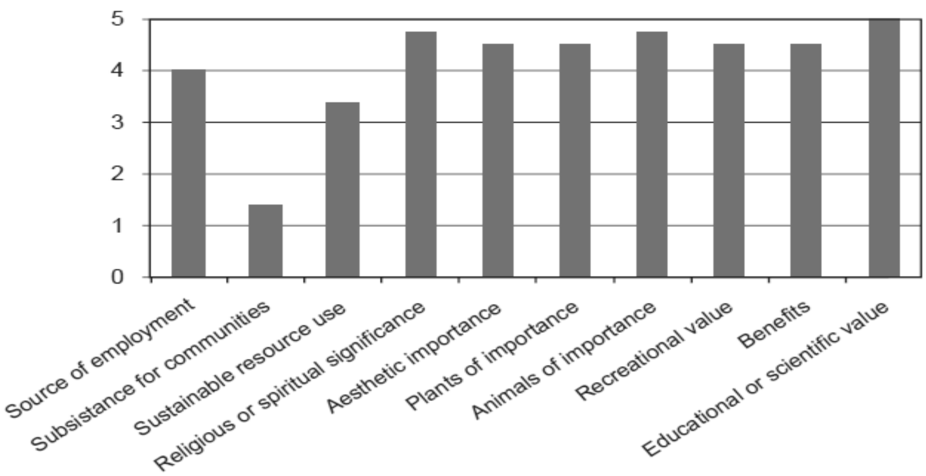

Fig. 5: Socio-economic importance of PAs
Source: UICN/PACO (2010)

Discussion

While many within the conservation community view sustainable use as a necessary element of biodiversity conservation, it has become more and more apparent that everyone wins in the win-win combinations. In the first place, what resources used and who gets to use them, are choices typically based on political expediency rather than biological knowledge (Brandon et al., 1998). The debate over what kinds of use are appropriate in protected areas and whether sustainable, has been described by Stachell (1996) as “the most volatile and divisive conservation issue of the decade”. Tourism for enhanced local economic development was observed in both countries as well as the socio-economic impact of PAs. There were also both positive and negative pressures exerted on PAs in both countries however, the rate of illegal activities on PAs in Ghana is comparatively on the high especially poaching and bush meat trade.

Conclusion

There is an urgent need to address the threat of mining in areas such as Beskydy in the Czech Republic since it imposes an eminent danger to the area. Staffing in PAs should also be amended to ensure fair distribution to other areas in the Czech Republic. For most of the protected areas in Ghana, allocation of funds are relatively too low to produce adequate protection for the wildlife populations which have been gradually declining as a result of habitat fragmentation, poaching and the trade in bush-meat (Brashares et al., 2001 and Brashares et al., 2004). In order to reduce the declining rate of wildlife due to poaching and other illegal reasons, there should be an increase in funding for monitoring in these areas. Subsistent hunting in Ghana by surrounding communities around PAs should he discouraged and rather locals introduced to alternative livelihood support programmes such as bee keeping, mushroom farming and animal rearing. The inclusion of conservation principles in the curricula of education in both countries will educate, increase awareness and in effect reduce the dangers confronting PAs.

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Souhrn

Příspěvek je zaměřen na analýzu socioekonomických aspektů ochrany přírody a krajiny v komparaci mezi dvěma odlišnými zeměmi – Ghanou a Českou republikou. V ochraně přírody a krajiny je v obou zemích mnoho odlišností, které je možné hodnotit z různých úhlů pohledu. Jedním z nich jsou kategorie chráněných území, druhým je rozdílná legislative, třetím z nich je snaha harmonizovat zájmy podnikatelů a místních obyvatel s požadavky ochrany přírody ve zvláště chráněných území a vytvořit systém náhrady za újmy plynoucí z omezení hospodaření. Těchto úhlů pohledu však může být i vice. Článek se zabývá tlaky a ohroženími chráněných území a socioekonomickým významem chráněných územích v obou sledovaných

zemích. Celková plocha chráněných území v Ghaně je v procentuálním vyjádření přibližně podobná jako v České republice a tvoří přibližně 16 % území, avšak celková rozloha Ghany činí 238 533 km2 a celková rozloha České republiky je 78 867 km2. Tempo zhoršování a ztráty přirozeného prostředí v Ghaně se v posledních letech nezdá býti klesající, což může být přičítáno zvyšujícím se sociálním a ekonomickým tlakům. Existuje naléhavá potřeba řešit hrozby v těchto oblastech. Za účelem snížení klesajícího počtu volně žijících živočichů v důsledku pytláctví a jiných nezákonných důvodů, by mělo dojít ke zvýšení finančních prostředků pro monitoring těchto aktivit ve zvláště chráněných území v Ghaně. Zahrnutí principů ochrany přírody do vzdělávacích osnov by mohlo v obou zemích zvýšit povědomí o ochraně přírody a snížit nebezpečí pro chráněná území.

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NON-WOOD FOREST PRODUCTS USE IN THE CONTEXT OF FOREST RECREATION AND EDUCATION

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Abstract

This article presents the needs and challenges of education in the field of non-wood forest products utilization. Attention was drawn to the insufficient public knowledge of forest floor resources. The possibility of promotion of valuable but less known species of forest plants and edible mushrooms have been also indicated. Information about the proper harvesting methods of forest goods, the "cultural" return to traditional forms of forest use, the appearance of niche products, but also on the risks associated with toxic properties of some fungi and plants species have been analyzed as well. Moreover, the significance of non-wood forest products availability for the recreational forest value has been pointed out.

Key words: forest utilization, forest undergrowth, forest education

Introduction

The use of forest resources or non-wood products as a natural, spontaneous activity in Poland has great traditions, as well as practical significance, both historical and contemporary: in many cases the value of these assets exceeds the value of wood production. This applies particularly to those goods that are - under certain conditions - widely available, so those which, in fact, are a result of public forest functions (Grzywacz 2001; Nowacka 2012; Staniszewski 2011b, Śliwka 2011; 2012). The use of non-wood forest goods has had a documented importance for rural development. For the inhabitants of villages and small towns forest floor resources are a primarily important source of income, while residents of large cities treat the acquisition of assets of forest primarily as a recreation. Rural development is largely dependent on the use of non-wood forest products (Barszcz 2006; Barszcz, Suder 2009; Nowacka 2012; Nowacka et al. 2014; Staniszewski, Nowacka 2014; Staniszewski 2011b). It is difficult, however, nowadays to look at the use of eg. fruit or fungi as a field of sustainable forest management - in fact, it functions outside the structures and out of the control of the owner of the forest, which in addition gains nothing in sharing their wealth of benefits. Undoubtedly, the widespread availability of these benefits is the phenomenon by all means positive, however, is one of the reasons why the importance of forest management is not appreciated by the administration of the forest, and especially is not seen as a potential source of income. This currently makes the estimation of the real value of forest side-production very difficult.

In Poland and in most European countries we are dealing with one hand with the growing interest of non-wood forest products and, on the other hand - with serious shortcomings relating to regulation of the use of these resources and knowledge of the structure of resources and their use.

It should be noted, however, that in modern, multifunctional forestry, the term "non-wood forest utilization" takes on a much broader meaning and goes beyond the realm of raw material products. It includes a broad reap sometimes difficult to valorize, the benefits of the forest; it has a close relationship with non-productive forest functions: conservation, landscape, and, above all, recreational (Paschalis-Jakubowicz 2007; Staniszewski 2013). However, even if you narrow down the concept to the traditional "material" meaning, we must recognize the important role of these benefits in the context of tourist and recreational values of the forest - a collection of forest fruits and mushrooms (both in Poland and in many other countries of Europe) is a popular way of spending free time in the woods.
Non-wood forest utilization should also be considered in the context of education. Public interest in the area of forest is large, which creates an opportunity to introduce elements of non-wood forest use for educational programs, and this in turn can be a valuable element of the promotion of forestry.

Non-wood forest resources versus education and recreation

Forest education is a part of the broader environmental education. Since the early nineties of the twentieth century forest education of society is the responsibility of the State Forests. It is therefore a question: what aspects of non-wood forest use should be considered as potential elements of forest education?
Analyzing this problem, you need to address the core issue of the perception of non-wood forest resources, specifically the resources of the undergrowth, as goods widely available. Collection of fruits and wild mushrooms is inscribed in our tradition; it is understandable, therefore, that any attempt to restrict access to those goods do not meet with the acceptance of society.
Applicable regulations in Polish forestry in part relate to non-wood forest use. For example, the art. 27 of the Act on Forests states that: a collection of undergrowth crops for industrial purposes requires the agreement (contract) of the forest inspectorate and that: Forest Manager can refuse to conclude an agreement, where a collection of undergrowth threatens the forest environment. These provisions are not respected in practice; whatever we have to deal with the social consent to violations of these provisions. Rare cases of signing agreements relate to "niche" raw materials of particular value and purpose, while the commercial harvesting of mushrooms and fruits completely out of control and does not bring any income to the owner of the forest (Kapuścinski 2007; Staniszewski, Janeczko 2012).
The effectiveness of these regulations is questionable. According to the authors, writing in the Act on Forests of the need to sign agreements with the forest inspectorate in the case of a commercial collection of the mushroom and fruit, is not accurate, and it would be better to regulate the market and processing of these resources rather than their acquisition in the forest (although for a significant proportion of pickers, this practice is an important, sometimes primary source of income).
A major challenge, especially in terms of education is to educate the public that mushrooms, berries and herbs are not "goods unowned", and the owner or landlord of the forest bear certain costs, among others, associated with silviculture and forest protection to those goods may have arisen, and we can use them. Arrangement regarding the commercial collection of the forest goods is necessary, but the process should be evolutionary, not revolutionary. This necessity is connected among other things with the idea of certification in forestry: the acquisition of forest land must be implemented in accordance with the rules of conduct of sustainable forest management, ensuring sustainability of forest resources (Staniszewski,

Janeczko 2012). Records confirming this position can be found, among others, in a document entitled: ”Polish criteria and indicators for sustainable management of forests for forest certification” (within the PEFC system). It states inter alia that "(...) forest management should be supported by other units that use for free, often in an unconscious way, the goods and services provided by forests and forestry" and that "universal access to forests and use goods and use the services of forest institutions and legal persons should respect the contribution of forestry to the protection and development in the use of goods and services by the respective participation in the costs incurred by forestry or tax relief" (Staniszewski 2011a). Therefore, the real challenge in the educational dimension appears to be to reconcile the public functions of forests with the need to make the public aware that these goods have a certain value, and their availability is associated with measurable costs incurred by the administration of the forest.

In regard to the use of forest floor resources, a particularly important issue is education in the field of mycology. There has been a huge public interest in the subject, and many studies indicate limited knowledge of society in terms of knowledge and skills of determining both the edible mushrooms or poisonous ones, the importance of fungi in the forest ecosystems, the need for their protection, etc. (Koperek 2015, Kopeć 2016, Łopatko 2007, Skorupska 2012, Śliwka 2011). There are many examples of blatant ignorance of mushroom pickers, for example claiming that all poisonous mushrooms have a bitter or burning taste; that poisonous mushrooms, after several boiling and changing water is safe to eat; that the fungus, which is "grubby" or bitten by slugs or rodents, is harmless to humans - these false opinions can have very dangerous consequences. It should be noted that the knowledge of the most dangerous mushrooms in our forests - Death Cup Mushroom (*Amanita phalloides*) is not widespread: still a "symbol" of the fungus poison is Fly agaric (*Amanita muscaria*) - mushroom well known and poisonous, but not endangering life.

What is significant is also the promotion of knowledge about the proper ways to harvest of wild mushrooms. A collection of undergrowth should be conducted in a way that is not threatening the supply of resources, while respecting the provisions on the protection of species and area, but above all, to allow safe use of the goods of high quality. Fruit bodies of fungi is recommended to acquired as a whole, twisting them gently from the ground. Cutting by a knife at the base is not the recommended way as it is impossible to overlook certain anatomical details, essential for the proper determination of the species (Staniszewski 2011c).

To sum up this aspect of forest management, education in this field should primarily focus on the following issues:

- learning to recognize the most dangerous species of poisonous mushrooms;
- dissemination of information about the danger of poisoning mushroom sometimes mistakenly considered to be edible (i.e. Brown Roll-rim - *Paxillus involutus*);
- promoting the proper way to harvest wild mushrooms;
- information on the impact of the use of fungi on the environment;
- information about their role in forest ecosystems (saprotrofic fungi, pathogenic, mycorrhiza, etc.).
- promoting proper behavior in the forest (including why you should not destroy inedible fungi);
- promotion of valuable and little-known species of edible mushrooms (only the ones which are easy to recognize clearly!);
- information on species protection.

It should be noted with satisfaction that in many places there are excellent educational programs realized in Poland, often in the form of mushrooms festivals or happenings, targeted for audiences of all ages, from preschoolers to the elderly.
A particular problem for non-wood forest use, is specialist education, associated with the principles of sourcing, marketing and possibilities of use and processing of selected forest resources, for example, secretions of trees, of which in Poland birch sap takes on the meaning. It is not just about technology of acquisition, but also the acting at the policy level, which may significantly affect the development of commercial use (such as supporting the creation of small and medium enterprises, the development of technology and its availability, training programs, fiscal initiatives, promotion of exports etc).
Underestimated in terms of the educational aspect of forestry is "cultural" return to the old, traditional forms of forest use. You can mention the successful attempts to reactivate beekeeping, for example the Spała Forest District. The attractiveness of such activities not only has an educational dimension, but also tourist and recreational (Śliwka 2012).
At this point it is worth noting the strong correlation between forest education with recreation, especially in the context of non-wood forest benefits. The attractiveness of forest areas as a place to rest is largely associated with recreational values, forest landscape, but also with the general availability of undergrowth. Non-wood forest utilization has a strong relationship with recreational functions of the forest. It turns out that the collection of berries and mushrooms - next to walking and cycling - in Poland is a form of recreation most often taken by users of forest areas, regardless of the location conditions (Janeczko, Staniszewski 2013).
The presence and ability to gain mushrooms and forest fruits undoubtedly contribute to the growing importance of non-production, and in particular, recreational functions of forest. However, the collection of undergrowth may significantly affect the environment. The growing importance of the social functions of the forest, forces the need for proper access and adaptation of forests for recreational purposes. Moreover, it requires the introduction of appropriate regulations and specialized forest management.
In the context of the problems of undergrowth crops harvesting noteworthy are the so-called “mushroom car parks”, which are plots created especially for amateur pickers of mushrooms. These places should be equipped with the infrastructure to rest, cleansing collected fruits, but also information boards, approximating basic knowledge of mycology.
A special role in education, but also recreational, is played by trails, of which we have 900 in forests in Poland (Janeczko, Staniszewski 2013). The trail is a marked route in the natural environment, mostly forest, enabling the acquisition of knowledge and skills, either alone or with a guide (Antczak 2007). The first forest trails, as well as other elements of the recreational development in the forests began to appear in the 50s, the first in the United States and later in Europe. In Poland the first trails in the national parks were created in the 70s of the twentieth century.
Because of the fact that the subject track is divided into multithematic and monothematic. Especially the latter provide opportunities acquainted with the public and with the issues concerning the use and protection of non-wood forest benefits. This chance is not yet fully utilized, and should be, because it is these benefits that attract the forest multitudes of tourists.
It seems that the needs and possibilities of transmission of information on the possibilities non-wood forest use on the forest paths of education are associated mainly with the following issues:

• sustainable forest utilization; information on the impact of forest utilization on the environment;
• promotion of undergrowth resource as goods widely available; regulations of use;
• information on the importance and possibilities of use of non-wood forest resources;
• information on appropriate harvest of fruits and wild mushrooms;
• information about the risks associated with the use of the forest;
• highlighting the relationship of forest use with forest resources conservation and environmental protection (Janeczko, Staniszewski 2013).

Conclusions

The desire to spend free time in the forest is largely due to the availability of such benefits as fruits and mushrooms. But knowledge of the importance and proper use of these goods is not satisfactory. Foresters leading the education concerning non-wood forest use meets so much social interest. Paying special attention to the fact that - as if "the way" for developing knowledge concerning this specific field of forestry - education can (and should!) be an effective tool for promoting forest management in general, contributing to the creation of a positive image of foresters in the public eye. Moreover, including educational aspects in this area for recreational forest management appears to be an obvious direction.

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Souhrn
Pod pojmem „využívání lesů“ se neskrývá pouze těžební činnost a nedřevní produkty lesa, ale také je to vliv na lidský život. V současné době je stále více a více věnována pozornost sociálním funkcím lesa. Právě ty úzce souvisí s právě s nedřevními produkty lesa, jako jsou zejména houby, ovoce, a léčivé rostliny. Sběr těchto komodit by měl být taktéž považován za velmi důležitý prvek rekreace. V této souvislosti je třeba věnovat pozornost k politice informací a vzdělávání, pokud jde o využívání výhod lesa.
Tento článek prezentuje potřebu a problémy vzdělávání v oblasti nedřevních produktů lesa. Pozornost byla věnována zejména nedostatečné informovanosti veřejnosti o komoditách získatelných z nejnižších pater lesního ekosystému. Dále je možné informovat veřejnost o cenných, ale méně známých druhů lesních rostlin a jedlých hub. V článku byly uvedeny i informace o vhodných metodách sklizně lesních produktů vycházejících z tradičních forem využívání lesů.

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POTENTIAL BIOMASS PRODUCTION OF URTICA DIOICA L. FOR MEDICINAL USE IN FOREST

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Abstract

Non-wood forests products (NWFPs) are wide group of forest products which are obtained from forest ecosystems. Very important NWFPs are medicinal plants where very important medicinal plant is *Urtica dioica* L. The aim of this article is comparison of biomass production of *Urtica dioica* L. growing on different localities and different crown cover in forest stand. There are differences in production of biomass on plots under forest stand with full canopy, half canopy and without canopy. Differences are in number of potential harvests; where it is possible make one harvest under full canopy, two harvests under half canopy and three harvests on places without canopy.

Key words: nettle, harvest, utilization

Introduction

Stinging nettle has been used in medicine and the cosmetic industry (Szewczuk et al. 2002). Hippocrates (460–377 BC) reported 61 remedies using stinging nettle (Upton 2013). His statement “Let food be your medicine” has been incorporated into the traditional concept of food, and stinging nettle is a representative example. A growing body of evidence documents positive health benefits from food components not considered nutrients in the traditional definition. Medicinal plants are a very rich source of such compounds, as well as the richest bio-resource of drugs of traditional medicine systems, food supplements, pharmaceutical intermediates and chemical entities for synthetic drugs (Ncube et al. 2008), since they contain a broad range of bioactive compounds such as lipids, phytochemicals, pharmaceutics, flavours, fragrances and pigments (Wang and Weller 2006). With an emphasis on quality and standardization, food manufacturers may find medicinal plants to be the new source of functional ingredients.

Materials and methods

Research plots of 1 m^2 were established in 2015 on two localities. First locality was School Training Enterprise Masaryk Forest in Krtiny (49°15‘40.0“N 16°38‘34.6“E, 365 meters above sea level) with three plots and second locality was Rasosky forest (50°19’35.9”N 15°55’16.5”E, 262 meters above sea level) with one plot.

There were three different plots on first locality – first with full canopy, second with half canopy and third without canopy cover. Forth plot was under half canopy on second locality. Mixture of Norway spruce (*Picea abies*) and Scotch pine (*Pinus sylvestris*) was on both localities. All nettle biomass from plots of was collected on both localities in time when nettle was ready for use for medicinal purposes. It was in time when diameter of stalk was 0,005 m in diameter on the ground.

Results and Discussion

Table 1 shows results of pilot measurement of dry nettle biomass weights on research plots.

Tab. 1: Dry weight of nettle biomass

Date	Plot			
	1	2	3	4
	Dry weight (g)			
15.5.2015				1 100
29.5.2015	339	593	405	
12.7.2015		432	673	
10.9.2015			443	
12.9.2015				880
Total (1 m^2)	339	1025	1521	1980

The highest biomass of nettle on research plots was on third plot without canopy cover. Compare forth plot to plot two it seems that higher biomass weight is there due to lower altitude and it is probably caused higher moisture in soil due to nearby pond. The smallest biomass was logically on thirst plot under full canopy. It will be interesting to see if the results from research plots are similar this year.

When we calculate total dry nettle biomass per hectare, it is 0,37 $Mg*ha^{-1}$ on first plot, 1,66 $Mg*ha^{-1}$ on second plot, 2,79 $Mg*ha^{-1}$ on third plot and 2,46 $Mg*ha^{-1}$ on forth plot. Compare to results of cultivated nettle biomass production (Di Virgilio et al. 2015) to nettle biomass in forest site we can claim that production on plot without canopy is very closed to low yield obtained from cultivated nettle.

Conclusion

Results of our pilot research on biomass production of nettle (*Urtica dioica* L.) in forests under different light conditions shows that forest sites without canopy and partially sites with half canopy cover are promising areas for sustainable harvest of nettle with low imputes of energy. Differences are in number of potential harvests; where it is possible make one harvest under full canopy, two harvests under half canopy and three harvests on places without canopy. Nettle is clear and valuable source of biomass for medicinal use. It can be promising source of income for forest owners and countryside people.

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Souhrn
Nedřevní lesní produkty jsou rozsáhlou skupinou lesních produktů, které jsou získávány z lesního ekosystému. Velice významnou skupinou jsou léčivé rostliny, kde mezi důležité druhy patří kopřiva dvoudomá (*Urtica dioica* L.). Cílem příspěvku je porovnat produkci biomasy kopřivy na různých lokalitách a s různou mírou zástinu. Bylo provedeno sledování produkce biomasy na volné ploše bez zástinu, s polovičním zástinem a pod lesním porostem. Výsledky šetření potvrdily, že nejvyšší produkce je na ploše bez zastínění, menší produkce při polovičním zástinu a nejmenší produkce pod porostem. Podobně I počet sklizní byl nejvyšší na volné ploše, kde bylo dosaženo tří sklizní, při polovičním zástinu byly dvě sklizně a pod porostem pouze jedna sklizeň. Kopřiva získaná ze stanovišť neovlivněných znečištěním se jeví jako hodnotná surovina, která může být slibným zdrojem příjmů pro vlastníky lesa a lidi na venkově.

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PRACTICAL USE OF VISITOR MONITORING DATA IN THE MANAGEMENT OF PROTECTED AREAS

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Abstract

This text presents the basic results of continuous visitor monitoring in selected Protected Landscape Areas of the Czech Republic for the period 2010-2014 and based on case studies from Beskydy PLA, Jeseniky PLA and Krivoklatsko PLA it presents the possibilities of practical application of this type of data in visitor management of these areas.

Key words: visitor, monitoring, management, protected area

Introduction

Czech nature conservation is still struggling with certain inconsistencies in the approach to visitor management in protected areas. This can lead to indecisions when we try to make an objective assessment of the positive and negative impacts of specific products and tourism activities (single trail routes, mountain marathons, sky – trails, etc.) or when deciding on the appropriateness of measures to mitigate or prevent these impacts, and as a result even when implementing these steps so that the general public can understand it and accept it.

Especially for these reasons, in the countries of so-called Western Europe, such as Great Britain, Germany, France, Austria (et al.), and also the North American continent (USA, Canada) complex visitor monitoring is an integral part of the protected areas management, solving not only actual but also long-term questions of tourism burden in ecologically sensitive parts of the territory (eg. for No entry), but also questions of the visitor structure in these locations, level of understanding and willingness to accept the area regime from the public and also questions of incoming visitors' preferences. Data from the visitor monitoring in each of these countries serve as one of the primary materials when deciding on area regime adjustments, on the product realisation for specific visitor categories or when deciding on the investment allocations. Added value of the visitor monitoring output to the competent nature conservation authorities can be the possibility of having a relevant argumentation when communicating with partners in the area (tourism industry entrepreneurs, government, etc.). Also it can be used to enumerate (not only) visitors' economic potential in the area and assess the effectiveness of investments made.

In 2009, the visitor monitoring system was applied in the first two protected landscape areas (PLA), Czech Republic. These were Beskydy and Jeseníky PLAs and there were a total of 12 natural sites monitored. After the publication of the first and often surprising results the other PLAs became interested in this monitoring system and in 2014 first complex tender was issued by Agency for Nature Conservation and Landscape regarding visitors monitoring in all of the Czech Republic 's PLAs, where traffic was taken as a factor that needs systematic monitoring and analysis. Currently visitor monitoring takes place in 19 PLAs on more than 100 locations.

Applied methods of visitors' monitoring in the protected areas of the Czech Republic

Visitor monitoring in National Parks and Protected Landscape Areas (that are subjects of this particular text) is understood as a combination of continuous automatic visitor counting and an additional physical field investigation.

Nowadays there are three different technologies used in the Czech Republic PLAs for automatic visitor counting which differ from each other with regards to the site conditions and counting subjects. First and most used technology is the thermal (pyro) sensors that respond to temperature emitted by passing visitor. When the subject comes in its effective range which is about 4-6 meters long beam the sensor records heat impulse on the memory media. When the devices are correctly installed they are very precise and extremely resistant against even the most unfavourable environmental conditions (very reliable during whole year). Thermal sensors are used for counting pedestrian and cyclist visitors. When combined with a long-range this technology is also used for the counting canoeists on rivers (eg. on the Morava River tributaries in Litovelske Pomoravi PLA). Second technology is represented by magnetic counters responsive to the motor vehicles and bicycles metal parts. These devices operate on the magnetic response and are currently used for counting vehicles and cyclists. As a third counting technology pressure sensors (mines) are used. These devices operate on the pressure changes principle. They react to sudden pressure caused by counted objects (tourist or cyclist passing) and the consecutive release of the pressure. This kind of device is suitable in specific conditions (narrow trail, seasonal traffic) mainly for pedestrians and cyclists counting. The basic condition for the automatic visitors counting is the usage of such sensors that are not easily detected by the public so that there is lower risk of operating errors due to vandalism (Fig.1).

Fig. 1: Example of discreet usage of heat (pyro) sensor in Jeseniky PLA.

As mentioned above, the automatic counting is always accompanied by physical field investigation. Range of this investigation varies according to specific requirements for monitoring results in various areas. The main purpose of a physical visitors monitoring survey is the accuracy of automatic counting checking and tracking of unwanted trends in the tourists' movement in the field, which could jeopardize the reliability of the measurement devices (e.g. the so-called " routes shortening", thus evading the devices). Other results of the physical field investigation are tentative information about given routes directional occupancy, utilization of access directions to the site, visitors' structure, etc. This part of the visitor monitoring is in the case of interest extended with questionnaires that allow to find out wide range of other information about the nature of traffic in the area.

Traffic development in Beskydy and Jeseniky PLA during the period 2010-2014

Our longest available series of visitor monitoring data in protected areas comes from Beskydy Mts. and Jeseniky PLAs where monitoring began in the fall of 2009. Jeseniky PLA is being continuously monitored, especially mountain ridges and their accesses (Vysoka Hole, Ovcarna, Bila Opava valley in National Nature Reservaton – NNR Praděd, Vresova studanka, Keprnik in NNR Serak - Keprnik) but also valley location Resov Falls that lies outside of the PLA. The only continuous monitoring in Beskydy PLA takes place on Lysa hora, or on its two main access routes to its top. The traffic progression trend in these areas (see Fig. 2) is very obvious. Summary of the traffic (expressed by „how busy" are the walking trails) in the sites monitored in Jeseniky PLA increased by about 57,000 visitors (23%) in the period from 2010 to 2014 while in Beskydy Mts. on Lysa hora it was actually nearly 130,000 visitors (63%). The increasing traffic trends in both territories were more or less evident during whole monitoring period. We can therefore predict continuation of this trend in future years. The fact that growing visitor numbers will lead to an increase of pressure to maintain the ecological stability of the area is clear and obvious and how to deal with it will depend primarily on the respective administrations of PLAs. Some good practice examples of using data on traffic management in the target areas are below.

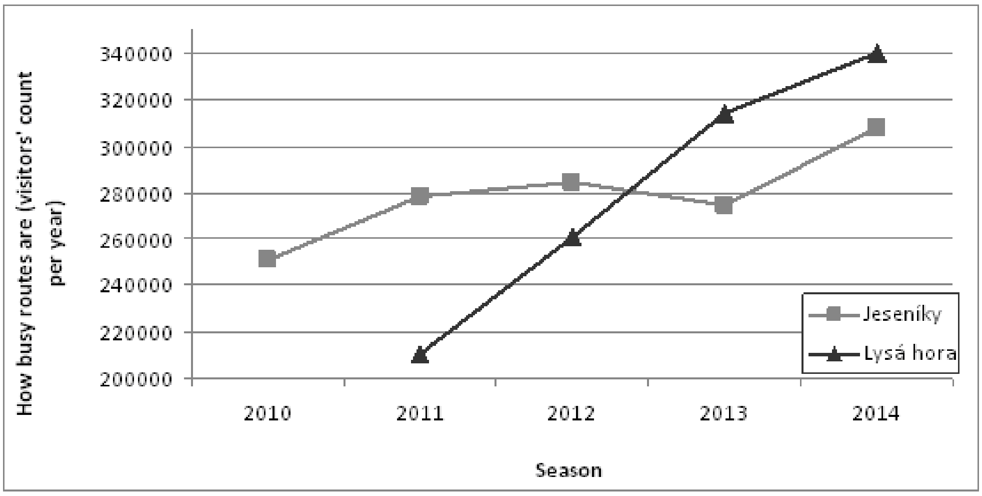

Fig. 2: Traffic development (how busy are the trails) in the ridge positions of Jeseniky PLA and on the access routes to the peak of Lysa hora (Beskydy PLA).

Example no. 1: Directing traffic in environmentally sensitive areas
Visitor counting results in NNR Vuznice – Krivoklatsko PLA show the long-term trend of more frequent violations of entering the no-entry zones into sensitive parts of the area (in the case of NNR Vuznice the reserve interior) near the busy tourist or other infrastructure than in areas where the entry into such areas is located farther away from related hiking trails and paths. The rate of interior reservation penetrations for entrances located near the busy routes is 39 % higher compared to the more secluded entrances for NNR Vuznice. But how to achieve greater public respect for the protective conditions if we exclude the possibility of a complicated (and in practice mostly non-achievable) related infrastructure diversion from the target area? Solution of similar situation in NNR Knehyně – Certuv mlyn in the Beskydy PLA can give us the answer. There the PLA‘s administration tried to restrict the traffic to the peak of Knehyne because of the avifauna sensitive species protection (especially the population of the *Tetrao urogallus*). The first attempts to reduce the tourist burden on the area – withdrawal of the labeled pavement and placing the „no-entry“ signs – were having very small, sometimes even counter-productive effect (after placing of the „no-entry“ sign the pavement attendance paradoxically temporarily increased!). There was an interesting turning point observed by people who were counting tourists in the spring of 2012 when the Beskydy PLA Administration replaced strictly prohibitive signs with modest interpretive text, clarifying and justifying the need for these restrictions with an emphasis on explaining the possible conflict that can happen when the „peace régime“ and the object of conservation are not respected. There was a 40% decrease in traffic after the interpretive sing installation compared to the seasonal average attendance before placing this text (see Fig. 3). This trend was confirmed in the following years and preserved until now.

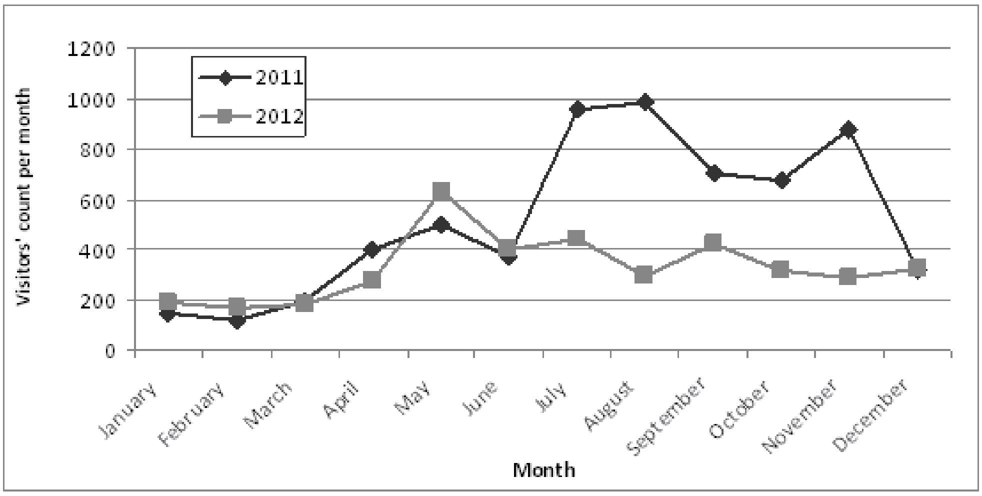

Fig. 3: Traffic development on the route in NPR Knehyne – Certuv mlyn (Beskydy PLA) in season 2011 and 2012 (in May 2012, installation of interpretive panel with justification of the no-entry took place).

The opposite case where the opening up of the site could mean an increase in its stability can be backed up from the Lysa hora - Beskydy PLA highest peak that represents one of the most attended natural attractions in the Czech Republic.

Beskydy PLA Administration monitored the traffic on the former (so-called North) slope, that served the public as a shortcut to the top of the mountain and therefore was taken as welcome unofficial alternative to ordinary tourist path, for several years. It was found out by the monitoring that this shortcut is used by more than 80 thousand visitors per year. These visitors cause fatal slope erosions by spontaneously creating numerous walkways and paths. Based on the monitoring and the resulting recommendations PLA Administration agreed in 2015 to build the official pavement through northern slope and also agreed to some related biological measures (planting indigenous tree species) that prevent visitor movement on the slope outside the marked pavement. Visitor monitoring data served here as one of the key documents for obtaining funds for the construction and monitoring here will continue in the following years.

Jeseniky PLA Administration invested into improving and increasing the tourist infrastructure attractiveness in the Bila Opava valley in a very similar way. When considering an investment here, it was and is very important not to take only the nature conservation point of view but also the basic visitors safety in the area, as the path goes through very steep and rugged terrain and is annually (especially in winter) responsible for numerous cases of serious injuries. Since 2014 the PLA Administration invested 350,000 CZK into the local tourist infrastructure and currently another project is being realized here for approximately 650,000 CZK (infrastructure and interpretation). When we divide the total investment by the average number of visitors identified by monitoring through the year (60,000 unique visitors) and we convert it for a 5 years period (the expected infrastructure lifetime up to the time of another investment need), we will come out with the amount of 3.5 CZK per visitor, invested to ensure their safety and sustainable tourism experience in the area.

Example no. 2: Visitors’ monitoring as a control mechanism of sustainable tourism development projects

Inspiring way to capture and use visitor monitoring data for nature conservation authority was recorded in 2015 in Dolni Morava - a rapidly developing tourist resort west of Kralicky Sneznik NNR. In 2014 Jeseníky PLA Administration monitored the abrupt increase in traffic in the upper parts of Kralicky Sneznik, which could be possibly explained by commissioning Sneznik funicular railway from Dolni Morava to the Slamenka cottage located at an altitude of 1110 m.

The funicular railway traffic potentially significantly facilitates the public penetration into the Kralicky Sneznik highest and most valuable parts. In 2015 Jeseniky PLA Administration (as the competent nature conservation authority) received a request for a positive standpoint on the proposal to extend the limited operation of the funicular railway to year-round operation. PLA Administration has conditioned its standpoint on the matter by necessity of processing visitor traffic impact study of the chairlift to the Kralicky Sneznik NNR and by acquisition of monitoring devices for key tourist corridors that will serve to validate the study's conclusions in the following years. In this case the government conservation has a possibility to accurately and specifically check the influence of the project on the site and supplement its existing monitoring system with more spots at the expense of the investor. This example can serve as an interesting inspiration for government conservation representatives how to proceed with the approval of potentially conflicting tourism development projects and monitor their sustainability.

Example no. 3: Visitors' monitoring as foundation for arguments with partners in the area

Nove Město pod Smrkem, located on Jizerske hory northern edge, is taken as a very popular destination for Czech and foreign bikers (mountain bikers) since 2008. It was the first place in the Czech Republic where so-called singletrack - a system of various difficulty levels trails for mountain biking inspired by similar centers in the UK - was created. Municipal partner of the project is Nove Město pod Smrkem in whose cadastral area the substantial part of singletrack lies.

Nove Město pod Smrkem city management is monitoring the single-track route traffic since 2013. In 2014 Single-track operators faced objections from the professional gamekeeper public that pointed out the fact that the public does not respect the limitations of Single-track traffic and uses this route at night in conflict with the Operating Rules. This leads to an interference and restriction of animals tied to local forests, especially in the time after dusk, when their activity peaks. To verify these facts data from traffic monitoring were used and confronted with sunrise and sunset times for the region taken from the Czech Hydrometeorological Institute, which were subsequently rounded to the nearest whole hour and averaged for the month. The results showed that during a year of operation (from November 2013 to October 2014) nearly 74,500 cyclists passed the Single-track, and from that 273 cyclists (0.37%) attribute for part of the day from dusk to dawn - on the so-called night period (see Table 1). In the annual distribution this total represents less than one night-passing cyclists (0.77) per day. To what extent is this number significant in terms of game disturbance is another question. But the fact is that the local monitoring clearly showed that the declared game mass disturbances during the night have no real basis.

Tab. 1: The overview of Singletrack "pod Smrkem" attendance with regards to the lighting conditions in given month.

Month	Visitors through daylight	Visitors through night	Definitions of parts of day after nightfall *
November 2013	914	29	17.-7. hour
December 2013	528	14	16.-8. hour
January 2014	469	36	16.-8. hour
February 2014	666	17	17.-7. hour
March 2014	2 172	23	18.-6. hour
April 2014	5 483	12	20.-6. hour
May 2014	8 460	4	21.-5. hour
June 2014	9 353	27	21.-5. hour
July 2014	13 822	16	21.-5. hour
August 2014	16 047	26	21.-5. hour
September 2014	8 615	32	20.-6. hour
October 2014	8 248	37	19.-7. hour
Total	74 777	273	

Conclusion

The aforementioned practical examples of the visitors' monitoring data use are only a relatively small sample from a number of other cases and possibilities that were recorded in approximately 5 years of continuous monitoring in the PLAs. These examples can serve as an inspiration not only for nature conservation authorities representatives but also for other subjects in the field of nature conservation and tourism that are trying to maintain sustainable tourism in environmentally sensitive areas.

Acknowledgement

Most of the data presented in the article were obtained from projects funded by Czech Agency for Nature Conservation and Landscape. We thank you for the opportunity to present the observed results.

Souhrn

Článek popisuje vybrané výsledky monitorování počtu návštěvníků v chráněných oblastech, příklady z praxe a databázové aplikace pro vyhodnocování. Monitorování počtu návštěvníků bylo prováděno v Beskydech a CHKO Jeseníky od roku 2009. Z obou měření je patrné, že se trend cestovního ruchu v těchto oblastech za poslední roky zvyšuje. Správa CHKO Beskydy tak pomocí automatizovaných čítačů/senzorů sledovala účinnost opatření zaměřených na minimalizaci rušení populace tetřeva hlušce (*Tetrao urogallus*, L.) v Kněhyni – Čertův mlýn, v sezónách 2009 – 2014. Výzkum se také zaměřil na vliv turismu na podmínky na Lysé hoře. CHKO Jeseníky naopak zaznamenávají rostoucí trend cestovního ruchu, investice do infrastruktury a interpretací přírodního dědictví. Kontinuální počítání návštěvníků CHKO poskytuje účinný nástroj pro rozhodování se kam alokovat finanční zdroje na základě četnosti návštěv turistů v rámci cestovního ruchu. Monitorování návštěvníků v CHKO Křivokládsko přineslo zajímavé výsledky. Na základě tohoto výzkumu mají pracovníci CHKO k dispozici informace, které dokazují, že počet návštěvníků pronikajících do „zakázaných“ částí NPR Benátky poblíž stezek je o 39 % vyšší než v místech, kde není žádná infrastruktura.

Na příkladu rozvoje lyžařského resortu Dolní Morava nacházejícího se v těsné blízkosti NPR Kralický Sněžník můžeme vidět, jak mohou být data z monitorování použita při posuzování záměru přijatelnosti či rozvoje cestovního ruchu v cílovém prostoru a použita pro následný management udržitelnosti. Poslední případová studie monitorování návštěvníků nám naskýtá jiný úhel pohledu, kdy data získaná ze Single-trackové dráhy „Pod Smrkem“ jsou dále využívaná jako materiály pro komunikaci s orgány ochrany přírody, majiteli honiteb, lesníky atd. V tomto případě monitoring pomohl odhalit skutečný rozsah chování návštěvníků single-trackové dráhy ve vztahu k divoké lesní zvěři. Všechny zmíněné monitorovací případové studie jsou přenosné a použitelné i v jiných oblastech.

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PROMOTION OF WATER RESERVOIRS OF BANSKÁ ŠTIAVNICA BY DESIGN OF BIKE TRAILS

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Abstract
Banská Štiavnica as the oldest mining town in Slovakia is characterized by a rich history of mining. With the development and rescue of mining in this area is closely related to the unique water management system. It was also an interdependent system of water reservoirs – dialect called "tajchy" that enabled the capture and multiple use of water for driving of mining machines. At present, these reservoirs play a recreational and landscaping function.
Region of Banská Štiavnica, a territory belonging to the Protected Landscape Area Štiavnické vrchy, is particularly attractive from the view of tourism development. It provides many opportunities for hiking and cycling too. The aim of this paper was to promote water management system to a wider public by design of bike trails that Access these water reservoirs. The tool was the use of transport accessing of a given territory and in particular less significant and frequent roads such as public roads of local importance, forest and agricultural roads or hiking and walking paths. It has been designed system of three bike trails with a total length of 56.9 km, which will display an existing system of bike trails. Technical parameters of individual trails were specified. The proposal includes a design of educational content of information boards and a design for their deployment.

Key words: tourism, bike trails, water management system

Introduction
The region of Banská Štiavnica is highly attractive to tourists who admire and its cultural and technical historical monuments. The system of water reservoirs is also a significant technical monuments - dialect called "tajchy" are part of a unique water management system, which since 1993 has been registered with the city of Banská Štiavnica in the UNESCO World Heritage Site. The water management system presented a unique hydraulic engineering solution which was designed mainly for driving mining equipment. In the past this equipment essentially influenced and saved mining work by mining of gold and silver in this region. The hydrological regime of ground-water was disturbed by underground mining activity causing the flooding of large areas of underground mines and a serious threatening of mine activity in the region. Hydrologically the territory is characterized by the fact that it falls under two major rivers Hron and Ipeľ, while there are no major streams. Shortage of water in the country was solved by interception (trapping) of rainwater by sophisticated system of collecting ditches. The collecting ditches fed the water to the water tanks (hydropower dams) from the area much larger than the actual river basin. Even they allowed the use of water from „foreign river basin" and as well interconnection between tanks system tunnels and shafts (Abaffy, Lukáč, 1991). From these water tanks, the water was distributed by connecting ditches to mining

equipment in the mine. The hydropower dams were placed beneath it in cascade for effective and multiple using of water catchment height. From the early 16th to the late 18th century it was built about 60 water reservoirs – „tajch"(s) (derived from the German Teich - pond) for a total volume of 7 million. m3 of water. The length of their detention ditches was 72 km ditches unit and drive 57 km. For this unique work were mainly responsible mining specialists M. K. Hell, his son J. K. Hell and S. Mikovíny. Presently it is registered on the existencing 28 reservoirs (Lichner, 2005). Currently, these hydropower dams are attractive for tourist and used for recreation, almost half of them are also used for bathing. The region of Banská Štiavnica is very attractive for tourism development, and especially cycling. The free association of amateur mountain bikers is active in this area. It contributed to the realization of the project „Bajkom k tajchom". The aim of this project was to promote the development of tourism by building marked trails for mountain bikers (www.bajkomktajchom.sk).
The aim of this paper was the propagation of these water works to the general public by a suggestion of bike routes making available these reservoirs.

Materials and methods

The area of interest of the region Banská Štiavnica is located in the geomorphological unit of Štiavnické vrchy, which are the largest volcanic mountain range in Slovakia. Its history is linked mainly by mining activity especially precious metal. The area was declared in 1979 as a protected landscape area with 77,629 hectares because of the need to protect the nature and landscape. Significant landscape elements enhancing the attractiveness of the area represent littoral landforms in the form of water reservoirs. Those were related to hydrological conditions of Štiavnické vrchy, which influenced the formation of river network by its high elevation and rugged terrain. The river network is characterized by short streams with low annual flow. Ingeniously built water management system consisted of interconnected reservoirs concentrated into 6 groups:

- Piargské tajchy: the largest „tajch" group creating almost a half of the volume of all reservoirs, located southwest of B. Štiavnica,
- Banskoštiavnické tajchy – belong to the oldest,
- Kolpašské tajchy - near to Banský Studenec,
- Hodrušské tajchy – in the valley of Hodruše,
- Vyhnianske tajchy - in the valley of Vyhne,
- Belianske tajchy – in the valley of Belianska a Kozelnicka.

Within the frame of the project „Bajkom k tajchom"- „To Tajchs by Bikes" there is established and maintained 10 major bike that are thematically named and aimed to tajchy. Other attractions are also possible Veľký hodrušský okruh, Malý hodrušský okruh, Mikovíniho zelená jazda, Hellov okruh, Kopanická osmička, Lillova harmovačka, Beliansky okruh, Vyhniansky okruh, Pivovarský okruh, Bolemanová trasa. These main routes are interconnected by other short connecting paths (*www.bajkomktajchom.sk*).
The methodology of work was based on a survey of water management system, in the mapping of individual reservoirs and their surroundings from the point of view of tourist attractions and finally traffic accessing. The area is attractive for cycling tourists, there are several existing trails. In terms of the design of new bike routes was important mapping these routes.
The Routes were designed according to norm STN 018028 and the methodology by Ľupták (2010). The area falls within protected areas, so design of proposed routes are based on existing roads, without affecting the natural environment. The choice of selection was primarily focused on unfrequented and little used roads, forest and

field paths and hiking trails. From the point of view the surface of bike paths, a choice of natural and pebble surface with minimal asphalt was the priority. Based on the results of terrain research was created the proposal of bike routes using software „Cyklotrasy 2.36“ (www.cyklotrasy.info). Routes were designed as circular (the beginning and end of the route is in the same place) and were intended for road and mountain bikes. In the used software, maps are presented as vector digital maps. On the maps are, according to the legend, showing roads, places and objects. The proposal contained a selection of routes transport communications. On the maps it has also been shown a draft of relaxing seats that were made available by primarily individual tajchy. The outcome of the proposed routes was also the altitude profile, itinerary which specialize to the course of roads and statistics with data about tour (length, alignment design, height).
A part of the proposal is also the draft of information boards with educational content. Introductory information board is designed for a start of each route. Its proposal includes a map view, route elevation profile and photo documentation of the route contained reservoirs. The location of information boards of relaxing seats is designed for individual reservoir and its proposal contains basic technical parameters and attractions about reservoir or partial map projection.

Results

Rough terrain mapping of existing routes, it was found that these routes are concentrated in the area of the village Hodruša-Hamre and village Vyhne, but not available to the area around the town of Banská Štiavnica. We have tried to complement each other and link these routes to form an integrated system of capturing all of the unique water system. We designed three routes, which are located close to existing routes, but also in areas of without cycling, being made available to all groups of 6 water management system.

Route no. 1 Banský Studenec - Banská Štiavnica - Banský Studenec

The proposed bike trail access Banskobelianska group and Kolpašská reservoirs group. The route is of medium difficulty, begins and ends in village Banský Studenec. Its length is 26.3 km, average time of completion for 1 hour. 6 min., the elevation is 224 m. On the route are designed 4 stops - rest areas, which are located near reservoirs Malý a Veľký Kolpašský tajch, Halčiansky tajch and Belianský tajch. Direction of the path (Fig. 1): Banský Studenec - Malý a Veľký Kolpašský tajch (stop 1 and 2) - signpost Caniar - settlement Kysyhýbeľ - Halčiansky tajch (3) - settlement Konôpkovci - Drieňová (city district of Banská Štiavnica) - tunnel Ferdinand - Beliansky tajch (4) - settlement Jergištôlňa - Drieňová - Konôpkovci – Banský Studenec. The route leads road: 05353-24 forest road - forest road 05253-4 - road III. class 05253 – I. class road 50 - forest haul roads - road III. class 05254. Elevation profile and slope conditions of the route are shown in Fig. 2 and Tab. 1. On the route are addition to reservoirs and other tourist attractions, such as Banskoštiavnická Calvary, botanical garden and arboretum Kysihýbeľ.

Route no. 2 Štiavnické Bane - tajch Počúvadlo - Štiavnické Bane

The proposal makes bike trail Piargska reservoirs group. The route is a historically rich rugged terrain but not difficult. Route boarding place and destination are in Štiavnické Bane. Main characteristics of the route: the length of 14.1 km, the average completion time 45 min, altitude 290 m, rest 5 places.

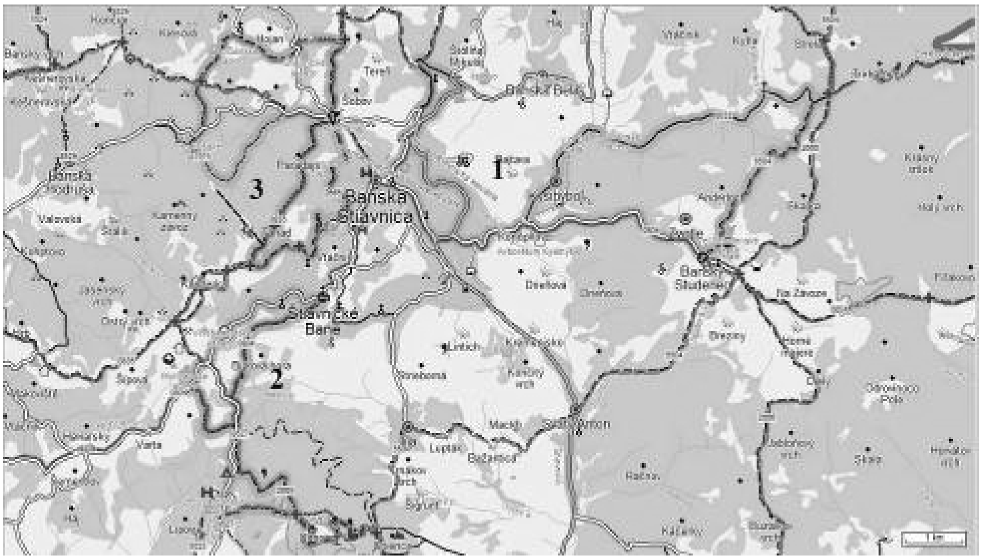

Fig. 1: The proposed cycle trails

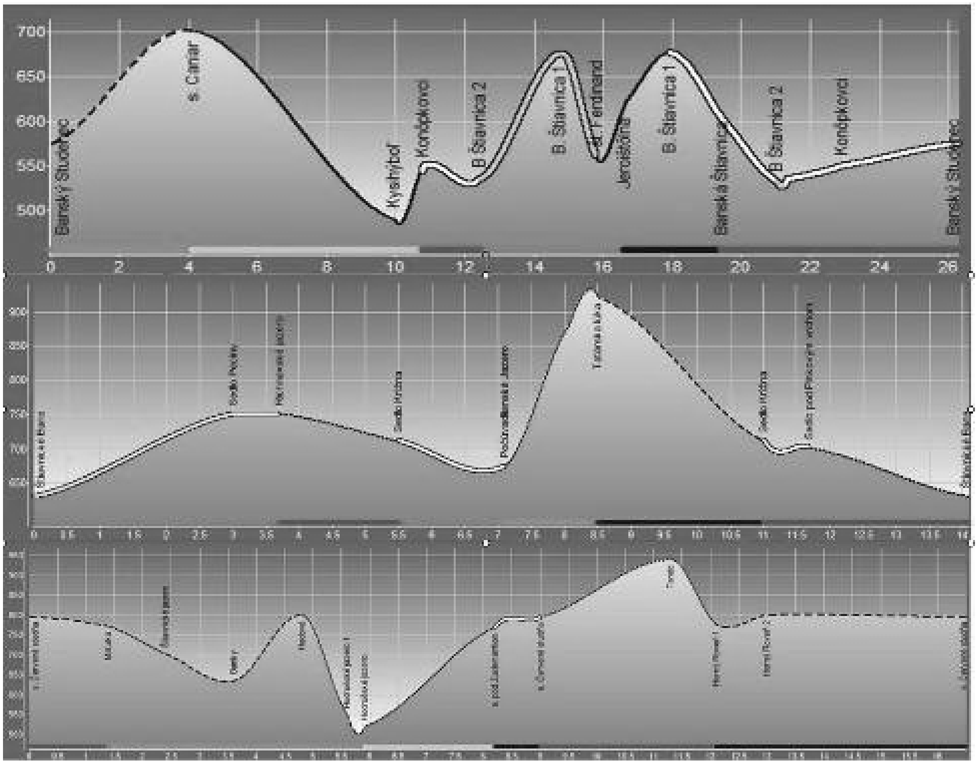

Fig. 2: Altitude profile of the proposed bike trails no. 1-3

Tab. 1: Slope conditions suggested bike trails

	Route no. 1	Route no. 2	Route no.3
climb in sections	12.1 km (46 %), 0:35 h	4.4 km (31 %), 0:20 h	7.5 km (45 %), 0:36 h
falling in sections	14.2 km (54 %), 0:31 h	9 km (64 %), 0:23 h	9 km (55 %), 0:22 h
maximal height	706 AMSL.	920 AMSL	939 AMSL
minimum height	482 AMSL	630 AMSL	520 AMSL
camber	224 m	290 m	419 m
total height up hill	491 m (slope 4 %)	365 m (slope 8.3 %)	607 m (slope 8.3 %)
total height down hill	607 m (slope 3.5 %)	356 m (slope 4.1 %)	607 m (slope 6.7 %)
max. slope up hill	8.1%	21.4%	13.6%
max. down hill slope	10.9%	31.6%	31.6%

Direction of the path (Fig. 1): Štiavnické Bane (municipal office) - tajch Vindšachta (1) - Seat Pecina - tajch Veľká Richňava and tajch Malá Richňava (2, 3) - seat Krížna - tajch Počúvadlo (4) - Tatárska lúka - seat Krížna - tajch Evička (5) - Štiavnické Bane. The route runs along roads: road II. Class 524 - hiking trail - the path III. class 05244 - walking path (green sign) – agricultural road - walking path (red mark). Route elevation profile is characterized by a standoff with a slight slope, with one steep climb to the Tatárska lúka (21.4%) (Fig. 2, Tab. 1). On the route there are also other attractions like the highest peak Štiavnica Hills - Sitno (1009 m n. M.), or Graetzmacher spring.

Route no. 3 Červená studňa – Hodruša – Roveň - Červená studňa

The proposal makes bike trail Hodrušské, Vyhnianske and Banskoštiavnické reservoirs, boarding location and destination of the route crossing Červená studňna. It is a rugged off-road trail, medium difficulty, historical and natural rich too. Main characteristics of the route: length 16.5 km, average completion time 59 min, altitude 290 m, 9 rest places. Direction of the path (Fig. 1) Červená studňa - directory Matulka - tajch Rozgrund (1) – village Banky -387ančiansky tajch (2) - signpost (directory) Hadová - Horný Hodrušský tajch (3) - Dolný Hodrušský tajch (4) - crossroad under Zuckmant – crossroad Červená studňa – tajch Červená studňa (5) – crossroad Under Kaderka - tajch Klinger (6) - tajch Ottergrund (7) - tajch Malá and Veľká Vodárenská (8, 9) - Červená studňa. The route runs along roads: forest road 06517-7 - walking path (green marker) - footpath (06518 - yellow sign) - road III. class (06517) - walking path (06518-19) - forest road (05245-4). Route elevation profile is characterized by significant elevation of one lever climb to the top of the hill Tanád (Fig. 2, Tab. 1). On the route there are also other attractions such as Paradajs hill (939 AMSL), hill Tanád (939 AMSL), or the ski center Salamandra resort.

The proposals routes also contain proposals notice board. It was an elaborated technical design of their construction, educational content of individual sheets, placing them in the terrain discussed with administrators of the reservoirs and material cost calculation. The budget for the establishment of 18 sheets represents the total amount of 3414 EUR.

Conclusion

Banská Štiavnica as the oldest mining town in Slovakia is famous for its mining activity in history and its associated water systems. It was formed by a number of water reservoirs – "tajchy" interconnected into groups, making it possible to reuse the water multiple times or divert away where it was needed. Although their mining significance disappeared and many reservoirs disappeared, still they represent a significant element of the landscape and recreational use too. One of the intensive emerging forms of recreation in the region is also cycling. Evidence of this is the system built bike paths, particularly in the project "Bajkom k tajchom". This allows natural diversity, terrain contour and a rich history. The result of this work is to design three new routes with a total length of 56.9 km and supplementing the existing system of paths that are accessible to the 18 existing reservoirs for promotion purposes. The proposal involves the bike trails and design of information boards with a nature and with educational content.

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Souhrn

Banská Štiavnica jako nejstarší důlní město na Slovensku je proslulé svou hornickou činností a s ní souvisejícím vodohospodářským systémem. Tvořilo ho množství vodních nádrží - tajchů vzájemně propojených do skupin, čímž bylo možné vodu vícenásobně využívat, zda přesměrovat vždy tam, kde to bylo potřeba. I když jejich důlní význam pominul a mnohé zanikly, stále představují významný krajinotvorný prvek, jakož i nástroj rekreačního využití. Jednou z intenzivně rozvíjejících se forem rekreace v tomto regionu je i cykloturistika. Svědčí o tom i systém vybudovaných cyklostezek, zejména v rámci projektu Bajkem k Tajchům. Umožňuje to přírodní rozmanitost, terénní členitost, či bohatá historie. Výsledkem této práce je návrh 3 nových tras o celkové délce 56,9 km doplňujících stávající systém cyklostezek, kterými je zpřístupněno 18 stávajících tajchů za účelem jejich propagace. Součástí návrhu cyklotras je i návrh informačních tabulí s naučně-edukačním obsahem.

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PROPOSAL OF RECREATION FACILITY IN KAVEČANY VILLAGE, SLOVAKIA

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Abstract
The process of environmental impact assessment (EIA) is undoubtedly the important environmental tool to protect the environment and ensure sustainable development. This process identifies, evaluates, assesses and provides information on the impacts of the proposed project/activity on the environment and specifies in detail the measures to mitigate adverse impacts before approval of the project. In the EIA process is always necessary to consider at least two alternatives of the proposed action. The purpose is to choose the optimal alternative. The aim of the paper is to assess the effects of sport and recreation center Kavečany on the environment as required by the European Union, in particular in Slovakia under Act no. 24/2006 Z.z. as amended. The result of the research is a comparison of the proposed activity with the current state of the area.

Key words: Environmental Impact Assessment, sport and relax centre, multicriteria analysis

Introduction

Assessment process of environmental impact of structures, within the content of National Council of the Slovak Republic Act No. 24/2006, is an analytic process systematically examining possible environmental impacts and consequences caused by planned activities. Then in advance, on the basis of the obtained knowledge, necessary provisions are prepared or implemented to eliminate undesirable impacts.

The purpose of National Council of the Slovak Republic Act No. 24/2006 (only Act in the following) is to ensure the procedure for the overall expert and public assessment of construction, and other activities determined under the Act (see Act Annex) before the decisions on the permission thereof under special provisions, and also for the assessment of proposals for certain development policies and generally binding legal directives from the point of view of their presumed effect on the environment.

In the Act the term „activity“ is defined as an operation (structure, facility or others) that by its properties, localization or cooperation with other factors can affect the environment and cultural heritage. To implement such an activity, the permission (approval) or other decision according to specific regulations is necessary.

The Act consists of six parts and sixteen annexes. Annex 8 presents a list of activities subject to environmental impact assessment. It is divided into part A, presenting activities subject to obligatory evaluation, and part B presenting activities subject to screening.

The aim of the assessment is in particular:

- To make an overall investigation, description and evaluation of the direct and indirect environmental impacts of the activity on the environment;
- To determine measures that will prevent or mitigate pollution and damage to the environment;
- To explain and compare the advantages and disadvantages of the proposed activity including its variants, in comparison also with the situation that would exist if the activity were not implemented.

According to Act, the assessment process consists of the following basic steps: preliminary study submission, determination of scooping, elaboration of environmental impact report, public hearing, elaboration of assessment, elaboration of final statement. Particular steps are mutually tied and from the initial stage all participants of assessment process enter them. (Galas et al., 2014)

In the EIA process is always necessary to consider at least two alternatives of the proposed action: I) zero alternative – if there is no activity (current state of the environment) and II) alternatives of the proposed activity – variants of the activity that usually differ in locality (site of construction), used technology, time of implementation, etc.). The purpose should be to find the optimal solution, in practice a choice called "preferred option".

According to the Act, construction of recreational and hotel complexes and related facilities over 500 accommodation places and up 10 000 m^2 inside urban area and 60 accommodation places and up 5 000 m^2 outside urban area are under assessment of environmental impact. (Fialová et al., 2014)

In the paper an environmental impacts of sports and relaxation centre Kavecany, recreational facility with 60 accommodation places, is assessed.

Materials and methods

Prediction of change assumes that there is a relationship between the proposed activity and the environment. (Říha, 2001) Part of the prediction is numerical evaluation of the effect. The way depends on the nature of the effect and the recipient. Objective assessment is based on the use of objective technical and economic units, e.g., SI. Subjective assessment requires special attention and sensitive work with verbal and numerical scales. Subjective assessment generally distinguishes three ways, i.e., assessment of (Říha, 1995):

- indicators (or indicator values);
- indices of value;
- direct application of interval or proportional scale.

The first method consists of only a very approximate method, where an indicator may represent by its value a description of the analyzed problem.

The second method expresses the opportunity to state the magnitude or quality of parameters using the index function of several variables, i.e. $P = f(x, y, z, ...)$. A team of experts can formulate and define an entirely new index function for a particular requirement. The third method uses subjective assessment of the full features of interval and ratio scales.

Characterizing the source of impact is an important indication of quantitative, qualitative, spatial (territorial) and temporal factors (Říha, 1995).

Formalized workflow involves ensuring that detection of an impact is done using a single method, and prognosis of induced changes is carried out on a scientific basis.

The selection of the optimal alternative is enjoyed by various methods, particularly by multicriteria analysis. The general procedure of multicriteria evaluation of alternatives includes six relatively discrete steps (Zvijáková, Zeleňáková, 2015):

- The creation of purpose-oriented set of evaluation criteria,
- Setting the weights of the evaluation criteria,
- Assessment of the results (consequences, benefits, but also potential damages or losses of alternatives), it is a partial assessment of the alternatives,
- Assessment of the risks associated with implementing of the alternatives,
- Determination of the preference order of alternatives and selection of the best option.

Multicriteria analysis is used to determine the value of a comprehensive land use in terms of the quality the environment affected by humans. Multicriteria method utilizes the catalogue of criteria (Zvijáková, Zeleňáková, 2015; Majerník et al, 2008; Galas, Krol, 2008). Its structure is hierarchical, adaptive and basically the whole society allows you to select the preferred option of a conventional set of alternatives or to give a preferential position of alternatives to a given set of criteria.

Results and Discussion

The proposed activity – Sport and relax Centre Kavečany is proposed outside the built-up area of village Kavečany (Fig. 1) with the number of inhabitants 1,235. The cadastral territory of village Kavečany falls under the governing Region surroundings of Kosice district. Kavečany is located northwest of the Kosice City at an altitude of 453 m asl..

Area of the village is 1,049.6 ha (10.5 km^2). From this area the greater part of cadastral area of Kavečany is an agricultural land – it occupies 618.3 hectares, which largely consists of arable land and permanent grassland. Non-agricultural land 431.3 hectares consists largely of built-up area and forest land.

Kavečany village is due to its location and altitude a popular area for relaxation and sports activities in a really clean environment.

Description of the proposal of the recreational facility near Kavečany village is presented below. The Sport and recreational centre is designed as a relaxing resort for summer and winter recreation with complementary restaurant and accommodation services (Šemráková, 2015; Nigut, 2011).

The complex is integrated into the garden area adjacent to nearby deciduous forest. It is located about 5 km from Kosice in the direction of the village of Kavečany. Nearby is a possibility of a rich sporting and cultural activities. There are available ZOO that is opened year round, high tower with a beautiful view, ski resort and hiking or biking trails. The facility is situated near to the road, on a slightly sloping terrain. The layout of individual sections is designed practically and functionally. Restaurant with summer terrace is with a very nice view.

The purpose of Sport and relax centre is to attract potential customers. The accommodation section is two storey building covered with saddle roof with triangular dormers (Fig. 2). The reception is situated in the centre of the complex; it divides the restaurant and the accommodation part of the hotel. The reception area is bordered by constructions in the shape of a truncated cylinder. The cut surface is a glass roof, rotated westward. The health centre is situated at the back of the complex. Back position and a lowered height level compared to other section of the facility provide sufficient privacy for visitors (Šemráková, 2015; Nigut, 2011).

Fig. 1: Study area – Kavečany village, near Košice city

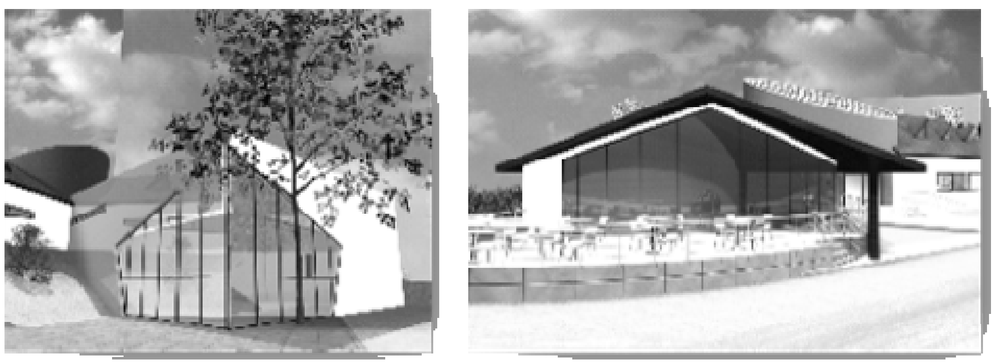

Fig. 2: Sport and relax centre

The environmental impact assessment of Sport and relax centre Kavečany includes the comparison of alternatives of the proposed activity and the proposal of optimal alternative.
The recreation facility is proposed in one variant and is assessed in comparison with zero alternative:

- The zero alternative – Alternative 0 – if no activity is implemented.
- The first variant – Alternative 1– the environmental impact assessment of the proposed Sport and relax centre Kavečany.

Comparison of alternatives of proposed activity and the proposal of optimal alternative is based on multicriteria method. The first step of this evaluation is creating a set of criteria and determining their importance (weight) for the selection of the optimal alternative. We have defined a total of nine criteria (Catalogue of criteria), which we have divided into four groups according to their character – technical, economic, environmental and social (Tab. 1).

Tab. 1: Catalogue of criteria

Criteria		Weight	Alternative 0		Alternative 1	
			Value	Points	Value	Points
C1	Time of construction	0.078	0 years	1	1 year	0.4
C2	Time of operation	0.094	0 years	0.7	30 years	0.5
C3	Using of renewable sources of energy	0.117	no	0	yes	0.8
C4	Investment costs	0.183	0 €	1	2 000 000 €	0
C5	Operation costs	0.156	0 €	1	300 000 €	0.2
C6	Waste production	0.128	minimal	0.8	middle	0.3
C7	Land occupation	0.072	0	1	26 000 m^2	0.7
C8	Job opportunities	0.150	0	0	12	1
C9	Increasing the living standards	0,022	partially	0.3	yes	1

The ranking method was used to state the weights of criteria. The points (0-1) associated with each criterion were stated based on experts' suggestions (Fig. 3). Authors' proposals were discussed with professionally qualified persons working in the field of environmental impact assessment as well as civil engineers.

The optimal Alternative was determined as higher value of: weight x points (from Tab. 1). The result for Alternative 0 is 0.3344. The result for Alternative 1 is 0.5638. The results prove that the highest preferences have the first alternative – proposal and construction of Sport and relax centre – that is the optimal Alternative for the study area from environmental point of view.
The main contribution of the present paper is using of theoretical knowledge of the issue, evaluation on the state of the environment in the area graphical and analytical multicriteria method to select the optimal variant of the action in the decision-making process in order to preserving environmental quality for further sustainable development of society in the study area.

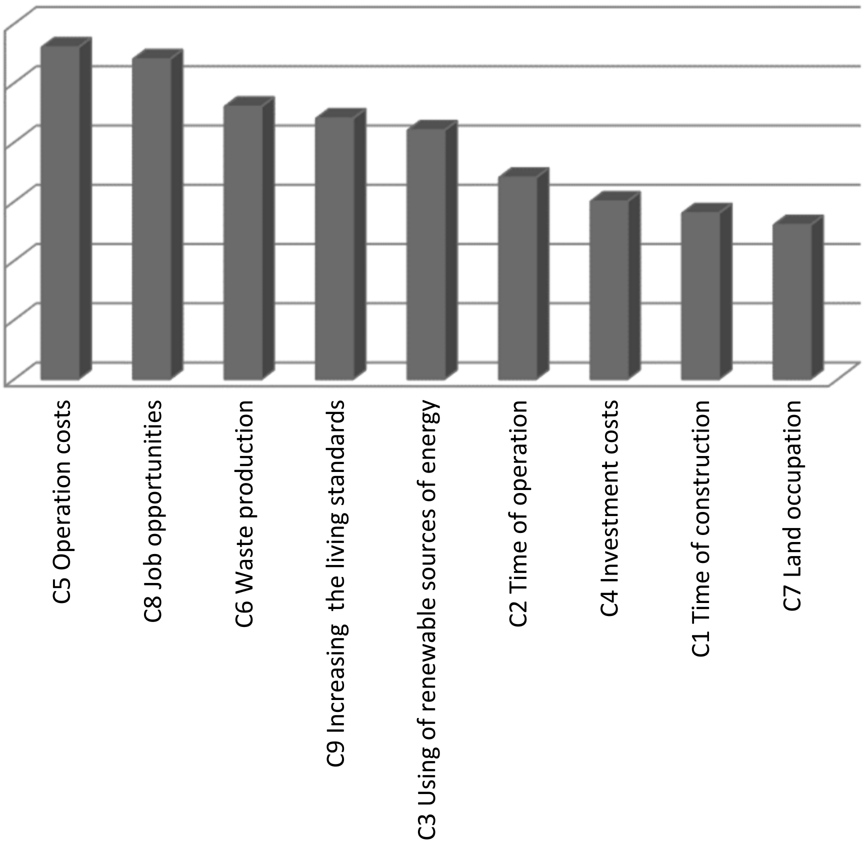

Fig. 3: Hierarchy of criteria according to preferences

Conclusion

Environmental impact assessment process for plans, structures, facilities and other activities is applied in developed countries for several decades and is one of the main tools of preventive environmental protection and sustainable development. Environmental Impact Assessment is a process that identifies, estimates, assesses and provides information on negative and positive effects of the proposed project on the environment and health, and specifies in detail the measures to mitigate the possible negative effects before approving the project and its implementation. The thesis is aimed at assessing the impact of Sport and relaxation centre Kavečany on the environment. Multi-criteria analysis method was used to compare the impacts of the proposed recreational facility in the area of Kavečany with the state if the activity is not carried out. Results showed a higher quality of the environment in the village, in the case of the proposed activity implementation.

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Souhrn

Koordinovaný proces posuzování vlivů záměrů, staveb, zařízení a jiných činností na životní prostředí se uplatňuje ve vyspělých zemích již několik desetiletí a je jedním z hlavních preventivních nástrojů ochrany životního prostředí a udržitelného rozvoje. Posuzování vlivů činností na životní prostředí je proces, který identifikuje, předvídá, hodnotí a podává informace o negativních i pozitivních vlivech navrhovaného projektu na životní prostředí a zdraví a podrobně specifikuje opatření ke zmírnění možných negativních vlivů ještě před schválením projektu a jeho realizací. Příspěvek je zaměřen na posouzení dopadů sportovně relaxačního centra Kavečany na životní prostředí. Metodou multikriteriální analýzy byly porovnány dopady navrhovaného sportovně relaxačního centra v lokalitě Kavečany se stavem území, pokud by se daná činnost nerealizovala. Výsledky prokázaly vyšší kvalitu prostředí v obci v případě realizace navrhované činnosti.

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PUBLIC PERCEPTION OF TRADITIONAL FOREST MANAGEMENT APPROACHES

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Abstract
Our contribution presents results of public opinion survey regarding newly applied traditional forest management approaches (coppice and coppice-with-standards) at the Training Forest Enterprise „Masarykův les" Křtiny (Czech Republic). At the turn of the years 2014/2015, a public opinion survey was performed at Hády district, where a conversion to copice-with-standards is being carried out. During the summer months of the year 2015, public opinion was surveyed at the Lesná locality, where another conversion to coppice is being carried out. Both conversions are located in suburban areas of the Brno city. The aim of the survey was to find out, whether the newly applied management approaches a) evoke an impression of better forest management, b) are considered more esthetical (as compared to standard high forest model), c) could become a demanded management way on bigger forest areas in the future. Respondents also assessed their impressions evoked by either coppice or coppice-with standards by marking (from 1-excellent to 5-unsufficient). Our results revealed that public opinion doesn't differ with age, gender and achieved educational degree (besides rare exceptions). Coppice-with-standards (coppice respectively) evokes an impression of a better forest management way in 47 % (29 %) of respondents. It was assigned with a higher esthetical value by 28 % (15 %) of the respondents. In the future, it would be demanded on greater areas of the forest by 42 % (34 %) of the respondents. Respondents marked their impression evoked by coppice-with-standards (high forest respectively) with an average mark 3.0 (4.0). Respondents marked their impression evoked by coppice (high forest respectively) with an average mark 3.0 (1.0). Based upon all of above mentioned figures, it could be summed up that public perception of coppice is worse than that of coppice-with-standards.

Key words: coppice, coppice-with-standards, public opinion survey

Introduction

In many European countries, coppice and coppice-with standards have been traditional ways of forest management in the past. As a result of historical development, so called high forest with prevailing seed regeneration became dominant management approach in the Czech Republic as well as in most countries of the central Europe.

Except of wood production, forest ecosystems fulfil a series of non-production and socially beneficial functions (Šišák 1999). Especially in the vicinity of big cities, surrounding forests have been always percepted positively (Coles, Bussey 2000). Public opinion on forest and forest management were analysed in many surveys not only in Europe (Rametsteiner, Kraxner 2003, Rametsteiner et al. 2009), but also in the Czech Republic (KOLEKTIV, 2001, Vítková 2006, Drábková 2013, Sadecký et

al. 2014). Very often were these surveys combined with evaluation of hygienical function of forests (Pejcha 2014, Sadecký 2015).
In many regions, foresters tend to adopt alternative, once common and later abandoned management approaches, such as coppice or coppice-with-standards. Our goal was to find out, whether the newly adopted traditional management ways a) evoke an impression of better forest management, b) have a higher esthetic value (as compared to that of a standard high forest management) and c) could be appreciated by the general public more frequently and on bigger areas.
Our aim was also to survey an impression which coppice, coppice-with-standards and high forest evoke in independent respondents.

Materials and methods

Our survey was carried out in Training Forest Enterprise „Masarykův les" Křtiny. At the turn of the years 2014/2015 a public opinion survey was carried out at locality Hády (49.2249483N, 16.6823317E) where a long term conversion experiment from high forest to coppice-with-standards has been running. In the summer months of the year 2015, another survey of public opinion was carried out at locality Lesná (49.2433644N, 16.6243425E) where there has been a conversion to coppice in process. Both localities are situated in the neighbourhood of the city Brno (approximately 0.5 km from the city border) and the distance between both localities is about 4.7 km.
There were 60 respondents at Hády locality and 100 at Lesná. The respondents answered following questions (options: yes/no):

1) Does the old traditional management evoke impression of a better forest management than high forest?
2) Does the traditionally managed forest a higher esthetical value (as compared to high forest)?
3) Would you appreciate encountering the traditionally managed forest stands more often and on bigger areas in the future?

Respondents further assigned following questions with marks (from 1-excellent to 5-bad):

4) How do you perceive coppice-with-standards (Hády locality) or coppice (Lesná locality)?
5) How do you perceive a high forest?

Respondents were explained basic characteristics of management and forest structure linked with coppice or coppice with standards and high forest. Examples of such managements were shown to them. Respondents were asked to state their gender, age category (<40 years and >= 40 years) and degree of education (basic or high school = B+H, extended high school or university = E+U).
Data analyses and statistical testing of dependence of variables (gender, age and education) were carried out using contingence tables and Chi-square test of independence). Comparisons of two independent groups (perception marking) was carried out using two sample Kolmogorov-Smirnov test. All analyses were done in STATISTICA 12 (Statsoft.cz).

Results

Coppice-with-standards (Hády locality)

Coppice-with-standards evokes the impression of a better forest management in 47 % of respondents. It was assigned higher esthetical value by 28 % of respondents and 42 % of them would appreciate more frequent encountering with coppice-with-standards and on bigger areas in the future.

(tab. 1). Responses of different respondent groups (according to gender, age or education) to questions 1 to 3 didn’t differ significantly. Respondents similarly marked their impression of coppice-with-standards by mark 3.0 regardless of gender, age or achieved degree of education (tab. 2). Respondents assessed their impression of high forest uniformly by the mark 4.0 regardless of gender, age or education. Only subgroup of respondents with extended high school or university degree assigned their impression of high forest with an average mark 3.5. (tab. 2).

Coppice – Lesná locality

Coppice evoked an impression of better forest management in 29 % of respondents. It was perceived to have a higher esthetical value by 15 % of respondents and 34 % of them would appreciate encountering with coppice more often and on bigger areas in the future (tab. 3). Respondents‘ answers didn’t differ among particular subgroups (gender, age or education). Respondents also uniformly assessed their impressions of coppice by the mark 3.0 regardless of gender, age or achieved degree (tab. 4). Impression of high forest was uniformly marked 1.0 regardless of gender, age or achieved degree (tab. 4).

Discussion and conclusion

Currently, there is no study analysing the public perception of coppicing (Nielsen, Møller 2008). Therefore, we addressed this issue by performing a public opinion survey near the Brno city (Czech Republic) in localities with examples of coppice, coppice-with-standards and high forest managements. Our analyses showed interesting results. Firstly, respondents‘ answers were uniform and they didn’t differ according to gender, age and achieved degree of education.

First two questions addressing a better impression of and higher esthetical value of coppice and coppice-with-standards (as compared to high forest) were answered „Yes“ almost twice frequently for coppice-with-standards than for coppice. Compared to high forest, coppice-with-standards is perceived a better forest management in 47 % of respondents and 28 % of them assign coppice-with-standards higher esthetical value then high forest.

Coppice, on the contrary, evoked an impression of better management only in 29 % of respondents and only 15 % assigned coppice with higher esthetical value.

This result is interesting in the light of findings of Vítková (2006). She performed a public survey in urban forests in the Czech Republic. According to her research were so called open forests preferred by 60 % of respondents and more than 70 % of the respondents preferred forests with changing sceneries.

Because coppice-with-standards‘ structure is more open then that of high forest, the disproportion in respondents’ answers could have been caused by placement of concrete examples of forest management during filling-in the questionnaires.

The first and second question of our questionnaire were more frequently positively answered for coppice-with-standards than for coppice. This could be caused by the state of the example of coppice that have been shown to respondents during filling – in the questionnaire. The stand was recently partially harvested and looked more like a clear-cut. On the contrary, the neighbouring mature mixed high forest stand with admixed conifers had a close canopy.

Interestingly, significant subgroup of the respondents would appreciate more frequent encounters with coppice and coppice-with-standards in the future (42 % and 34 % respectively). Such results could be expected in countries were coppicing has uninterrupted tradition up to now (Coles, Bussey 2000) rather than in the Czech Republic.

Tab. 1: Frequencies of answers to questions (No. 1 – No. 3) for coppice-with-standards

(% of the total number of respondents, n = 60; degree of education: B – basic, H – high school, E – extended high school and U - university)

Question 1: Does coppice-with-standards evoke the impression of a more appropriate forest management?					
Total		Gender			
yes	no	woman		man	
46,7	53,3	yes	no	yes	no
		16,7	26,7	30,0	26,7
		Age class			
		< 40		≥ 40	
		yes	no	yes	no
		30,0	30,0	16,7	23,3
		Degree of education			
		B + H		E + U	
		yes	no	yes	no
		30,00	30,00	16,7	23,3

Question 2: Does coppice-with-standards have a higher esthetical value?					
Total		Gender			
yes	no	woman		man	
28,3	71,7	yes	no	yes	no
		10,0	33,3	18,3	38,3
		Age class			
		< 40		≥ 40	
		yes	no	yes	no
		13,3	46,7	15,0	25,0
		Degree of education			
		B + H		E + U	
		yes	no	yes	no
		13,3	43,3	15,0	28,3

Question 3: Would you appreciate to encounter coppice-with-standards more frequently and on bigger areas in the furture?					
Total		Gender			
yes	no	woman		man	
41,7	58,3	yes	no	yes	no
		18,3	25,0	23,3	33,3
		Age class			
		< 40		≥ 40	
		yes	no	yes	no
		25,0	35,0	16,7	23,3
		Degree of education			
		B + H		E + U	
		yes	no	yes	no
		23,3	33,3	18,3	25,0

Tab. 2: Marking the impression of coppice-with-standards and high forest

Question 4: What is your impression of a coppice-with-standards?				
Factor	Level	median	25%	75%
Gender	Woman	3,0	3,0	4,0
	Man	3,0	2,0	3,0
Age class	< 40	3,0	2,0	3,5
	≥ 40	3,0	3,0	4,0
Education	B + H	3,0	3,0	4,0
	E + U	3,0	2,0	4,0
Question 5: What is your impression of a high forest?				
Factor	Level	median	25%	75%
Gender	Woman	4,0	3,0	5,0
	Man	4,0	3,0	4,0
Age class	< 40	4,0	3,0	4,0
	≥ 40	4,0	3,0	5,0
Education	B + H	4,0	3,0	5,0
	E + U	3,5	3,0	5,0

The above commented results projected also to marked questions addressing the impression of coppice, coppice-with-standards and high forest. While coppice and coppice-with-standards were assigned an average mark 3.0 on both localities, high forest was marked significantly worse (average mark 4) on Hády locality. This may have been caused by the character of the example high forest stand, which was quite dense due to understory shrub layer occurrence. On the Lesná locality, on the other hand, the example high forest stand was assigned with best average mark 1.
The aim of the forest policy of many countries is, among others, support of public participation on forest management (Van Herzele et al. 2005). Seen from this perspective, our survey and its results could underline activities promoting traditional ways of forest management (Kadavý et al. 2011, Kadavý et al. 2015) in suburban forest areas of the Training Forest Enterprise „Masarykův les“ Křtiny.

Tab. 3: Frequencies of answers to questions (No. 1 – No. 3) for coppice
(% of the total number of respondents, n = 60; degree of education: B – basic, H – high school, E – extended high school and U - university)

Question 1: Does coppice evoke the impression of a more appropriate forest management?					
Total		Gender			
yes	no	woman		man	
29,0	71,0	yes	no	yes	no
		14,0	33,0	15,0	38,0
		Age class			
		< 40		≥ 40	
		yes	no	yes	no
		16,0	30,0	13,0	41,0
		Degree of education			
		B + H		E + U	
		yes	no	yes	no
		19,0	48,0	10,0	23,0

Question 2: Does coppice have a higher esthetical value?					
Total		Gender			
yes	no	woman		man	
15,0	85,0	yes	no	yes	no
		9,0	38,0	6,0	47,0
		Age class			
		< 40		≥ 40	
		yes	no	yes	no
		5,0	41,0	10,0	44,0
		Degree of education			
		B + H		E + U	
		yes	no	yes	no
		9,0	58,0	6,0	27,0

Question 3: Would you appreciate to encounter coppice more frequently and on bigger areas in the furture?					
Total		Gender			
yes	no	woman		man	
34,0	66,0	yes	no	yes	no
		18,0	35,0	16,0	31,0
		Age class			
		< 40		≥ 40	
		yes	no	yes	no
		20,0	26,0	14,0	40,0
		Degree of education			
		B + H		E + U	
		yes	no	yes	no
		19,0	48,0	15,0	18,0

Tab. 4: Marking the impression of coppice and high forest

Question 4: What is your impression of a coppice?				
Factor	Level	median	25%	75%
Gender	Woman	3,0	2,0	4,0
	Man	3,0	3,0	5,0
Age class	< 40	3,0	2,0	4,0
	≥ 40	3,0	3,0	5,0
Education	B + H	3,0	3,0	4,0
	E + U	3,0	2,0	4,0
Question 5: What is your impression of a high forest?				
Factor	Level	median	25%	75%
Gender	Woman	1,0	1,0	2,0
	Man	1,0	1,0	2,0
Age class	< 40	1,0	1,0	2,0
	≥ 40	1,0	1,0	2,0
Education	B + H	1,0	1,0	2,0
	E + U	1,0	1,0	1,0

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Souhrn
Příspěvek prezentuje výsledky výzkumu veřejného mínění na nově zaváděné tradiční způsoby hospodaření (les střední a nízký) na Školním lesním podniku Masarykův les Křtiny (Česká republika). Na přelomu let 2014/2015 se uskutečnil sběr dotazníků na lokalitě Hády, kde probíhá převod na les střední. V letních měsících roku 2015 probíhalo zjišťování názorů veřejnosti na lokalitě Lesná, která je zaměřena na převod na les nízký. Cílem bylo zjistit, zda nově zaváděné typy lesa: a) vzbuzují u veřejnosti dojem lepšího lesnického hospodaření, b) mají vyšší estetickou hodnotu (ve srovnání se standardním vysokým lesem) a c) zda by se s nimi veřejnost chtěla častěji a na větších plochách do budoucna setkávat. Respondenti dále hodnotili svůj dojem z těchto typů lesa známkováním (1-výborný až 5-nedostatečný). Z výsledků vyplynulo, že názory veřejnosti na sledované cíle nesouvisí s pohlavím, věkem a ani s dosaženou úrovní vzdělání. Střední les (resp. nízký les) vzbuzuje dojem lepšího lesnického hospodaření u 47 % (29 %), vyšší estetickou hodnotu mu přiznalo 28 % (15 %) a častěji a na větších plochách by se s ním do budoucna chtělo setkávat 42 % (34 %) respondentů. Dojem ze středního lesa (resp. vysokého lesa) byl na lokalitě Hády hodnocen průměrnou známkou 3.0 (4.0). Dojem z nízkého lesa (resp. vysokého lesa) byl na lokalitě Lesná hodnocen průměrnou známkou 3.0 (1.0). Na základě všech výsledků je možné konstatovat, že nízký les je veřejností vnímám hůře než les střední.

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RECREATION DEMAND FOR LARGE NATURAL AREAS IN THE CZECH REPUBLIC

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Abstract
The article aims at modelling of recreation demand for large natural areas in the Czech Republic using a discrete choice model based on McFadden´s random utility framework. Our application encompasses 27 recreation areas, including national parks and large protected landscape areas. The main interest of the analysis is to determine which environmental attributes of recreation sites drive the demand for outdoor recreation.The analysis is based on a cross-sectional micro data set gathered off-site from Czech population; and supplementary data on travel cost and environmental variables describing each outdoor recreation site that were calculated using GIS analysis.

Key words: recreation demand, random utility model, outdoor recreation, natural area

Introduction

The aim of the contribution is to derive demand for recreation services of natural ecosystems. The main interest of analysis is to determine which environmental attributes of recreation sites (such as land cover, type or structure of vegetation, forest type) drive the demand for outdoor recreation; emloying the recreation demand model, it is further possible to disentangle the implicit recreation value that visitors associate with particular sites and particular environmental characteristics of the area.

Material and methods

The methodology of recreational demand is based on the neo-classical microeconomic theory of demand. Analogically to assumptions implicating conventional demand theory, the visit rate for particular recreational site (i. e. quantity of recreation demanded) decreases with increasing costs of recreation. Total travel costs reflect both real travel expenses (e. g. on fuel when travelling by car) and opportunity costs of time that the visitor need to spend on journey to the recreation site (e. g. wage rate). Travel cost models are based on real behaviour of visitors, where actual choices of visitors over chosen time period are observed.

Random utility models stem from McFadden´s random utility framework (McFadden, 1974). Random utility modelling in travel cost method aims at estimation of probability that the visitor chooses one recreation site among other substitute areas (Freeman, 2003). Every short trip to natural site of interest *i* brings utility V_i. $V_i$is determined by a vector of covariates, which include travel costs to the site of interest tc_i and various forest site characteristics q_i:

$$V_i = \beta_{tc} tc_i + \sum_{k=1}^{m} \beta_{qk} q_{ki} + \varepsilon_i$$

Error term ε_i then captures every (random) effect unmeasured by the explanatory variables included in the equation - unobserved individual and site characteristics.
The visitor has also a „status-quo“ choice, which is not to choose any of the recreation sites offered for recreation. Then the individual utility is set at V_0 and may be expressed as a function of socio-economic characteristics describing dispositions for recreation z of individual j (Parsons et al., 2000):

$$V_0 = \alpha_0 + \sum_{i=1}^{n} \alpha_{zi} z_{ij} + \varepsilon_0$$

The dependent variable in the random utility model is the probability of choosing the area in question (against all other recreation sites and also against the possibility to stay at home and visit neither of the sites); it is regressed on the price of visit, characteristics of the site and characteristics describing the individual visitor.

The source of data is cross-sectional micro data set obtained within the scope of project funded by the Ministry of Agriculture of the Czech Republic „Monetary valuation of recreational and aesthetical function of forest in the Czech Republic“. The project was solved by the Charles University Environment Center during 2005 and 2007. The data set consists of 884 observations gathered off-site from Czech population in 2007.

Within the survey, information on numbers of short visits (i. e. without spending a night at the site) made by respondents to large recreational areas during last year has been inspected. The main set of recreational areas involves 4 national parks, 21 landscape protected areas and 2 large recreational areas without status of special protection (Krušné mountains and Brdy). Respondents stated that they visited also other recreational areas, but these were not common in the dataset (frequented by <2% of respondents). Figure 1 shows the location and type of the final set of recreational areas involved in the analysis.

The data have been supplemented with natural characteristics of the recreation areas, employing geographic data on Corine Land Cover categories for year 2006 by the European Environment Agency (EEA, 2006).
Also, data on the travel cost have been collected using an objective measure of distance and time (see Kaprová, 2015). Distance and time costs were combined into an overall monetary travel cost (two-ways), which was then included as one determinant of site choice in the econometric model. Through observed travel costs, it is possible to derive the willingness to pay for visit and visitor´s utility from recreation in the recreation site. Since trip costs are always included as one of the characteristics of the trip, the model implicitly captures trade-offs between money and levels of natural characteristics (Parsons, 2003).

Results

Table 1 lists the variables used within modelling, including the descriptive statistics. The variables describing the natural state of the recreation area explain the short-trip utility to the respective area (1 out of 27 areas); and the descriptive statistics are calculated over the areas. The variables explaining no-trip utility (status quo, when the respondent stays at home and visits none of the areas) are associated with the socio-economic conditions of the respondent and are calculated accross respondents.

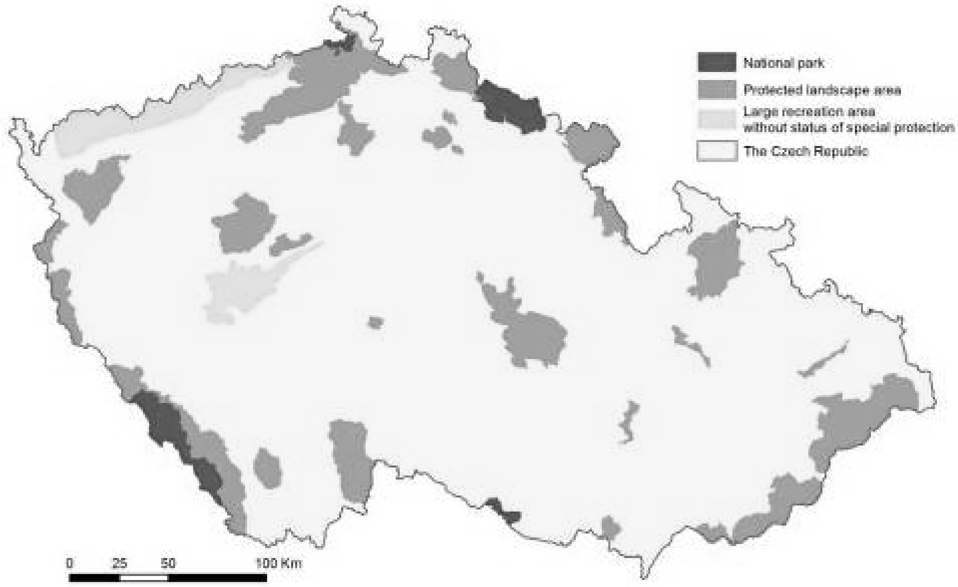

Fig. 1: Recreational areas involved in the analysis
Source: ČÚZK (2014), AOPK (2014)

The respondent makes on average 2.7 short trips to some of the recreational areas in the choice set per year. However, the range of the values is large - from 0 to 100 short trips per year. On average, the respondents incur 790 CZK to get to a recreational area as a travel cost (both ways).

Table 2 shows the results of a multinomial travel cost random utility model, using a set of 884 observations.

Discussion

As expected, the travel cost is negatively related to the probability of visiting the site. The coefficient is significant even at 1% significance level. Most of the variables describing the site that are used to model the short-trip utility are also highly significant determinants of the choice; only the percentage of pastures in the area does not have any effect on the probability of visiting the area. All variables have expected signs - the only variable with a negative coefficient is percentage of artificial areas in the recreational area, which is also intuitive.

The variables explaining the no-trip utility are also almost all significantly related to the probability of choice; only age does not seem to matter. Respondents that workfulltime, live alone or have a university degree or go hiking as the main activity make fewer short trips to large recreational areasper year than the rest of the sample. Also, with increasing number of hours spent at the site during the short trip, the number of trips per year decreases.

Most of the variables in both parts of the random utility model are successful in explaining the choice of the respondent. As the next step, we would like toemploy the results of the recreation demand model to analyze the impacts of marginal changes in the model parameters on the recreation utility of visitors to Czech natural areas. The results of the welfare analysis may be further implemented in the decision-making on the natural areas and for evaluation purposes of changes in the areas.

Tab. 1: Definition of variables and descriptive statistics

Variables	Explanation	Mean	St.dev.	Min	Max
No_trips	No. of one-day trips (i. e. not overnight) per year	2.7	1.0	0	100
Short-trip utility					
TC	Travel cost (in hundreds CZK 2007)	7.9	6.0	0	45.1
Artif_%	% of artificial surfaces	3.1	2.2	0.0	9.4
Pasture_%	% of pastures	11.0	7.2	0.4	25.6
Forest_br	Prevailing forest type is broadleaved (binary)	0.2	0.4	0	1
Forest_con	Prevailing forest type is coniferous (binary)	0.6	0.5	0	1
Forest_snat_%	% of forests and seminatural areas	59.7	17.8	11.9	89.1
Wat_body	Water body present (binary)	0.6	0.5	0	1
Ln_area	Natural logarighm of area (ha)	10.3	1.0	8.3	12.0
No-trip utility					
University	Respondent has an university degree	0.1	0.3	0	1
Fulltime	Respondent works fulltime	0.5	0.5	0	1
Family_no	No. of family members	2.6	1.2	1	6
Family_1	1 family member (binary)	0.2	0.4	0	1
Age	Age (years)	44.0	14.8	18	80
Hours	Hours spent at recreation site on last short trip	5.3	5.1	0	24
Hiking	Main activity on last short trip was hiking (binary)	0.2	0.4	0	1

Conclusion

The articlepresents modelling of recreation demand for large natural areas in the Czech Republic using a discrete choice model based on McFadden´s random utility framework. The application is based oncross-sectional micro data set gathered off-site from Czech population and information on past visits of respondents to 27 large recreation areas. Most of the variables in both parts of the random utility model (participation in a short trip to a recreation area, and participation in the status quo alternative - visiting none of the areas) are successful in explaining the choice of the respondent. As the next step, we would like to employ the results of the recreation demand model to analyze the impacts of marginal changes in the model parameters on the recreation utility of visitors to Czech natural areas.

Tab. 2: Definition of variables and descriptive statistics

Variable	Parameter	Std. err.	Est./s.e.	Prob.
Short-trip utility				
TC	-1.037	0.020	-52.451	0.000
Artif_%	-0.145	0.021	-6.934	0.000
Pasture_%	0.002	0.004	0.534	0.593
Forest_br	0.692	0.151	4.584	0.000
Forest_con	0.517	0.063	8.241	0.000
Forest_snat_%	0.016	0.002	7.553	0.000
Wat_body	0.344	0.057	6.038	0.000
Ln_area	0.177	0.041	4.347	0.000
No-trip utility				
Constant	9.236	0.393	23.489	0.000
University	-0.993	0.052	-18.960	0.000
Fulltime	-0.374	0.043	-8.806	0.000
Family_no	0.131	0.024	5.448	0.000
Family_1	-0.531	0.075	-7.075	0.000
Age	0.002	0.001	1.447	0.148
Hours	-0.127	0.004	-30.607	0.000
Hiking	-0.459	0.043	-10.661	0.000
Mean log-likelihood	-20.09			
No. of cases	884			

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Souhrn
Článek prezentuje modelování poptávky v oblasti rekreace zaměřené na velké přírodní oblasti České republiky za použití rozhodovací analýzy založené na McFaddenových nahodilých rámců. Aplikace modelu je založena na získání průřezových dat z lokalit mimo Českou republiku; zpracování informací od respondentů z 27 velkých rekreačních oblastí; doplňkové údaje o cestovních nákladech a globálních proměnných charakterizující dané místo s rekreačním využitím, které byli vypočteny pomocí GIS analýzy. Většina proměnných v obou částech užitného vzoru (pomocí škálování kdy na jedné straně je výlet do dané oblasti a na straně druhé, bez návštěvy dané oblasti) jsou vhodné při zdůvodnění výběru respondenta.
Jako další krok bychom chtěli aplikovat výsledky modelu a analyzovat dopady marginálních změn rekreační udržitelnost návštěvníků v českých přírodních oblastech.

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RECREATIONAL BACKGROUNDS OF SELECTED SIDEES OF THE BRATISLAVA CITY

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Abstract
Area, where recreation can take place, has a diverse character depending on what ways people spend their spare time. It is, in a broader sense of the word, constituted by places offering an oportunity to recognize arts, historical and cultural monuments, nature as well as places assigned to sport and leisure. In 2015 year within our research we turned the attention on 2 recreational localities of Bratislava city as a prolongation of our previous research made in 2014 year (Pavlickova, Novanska Chrenscova, 2015). As it was done on Zelezna Studnicka and Devin localities, the goal of the study was to recognize visitor´ view on main components of their satisfaction with the quality of provided services which are appropriate for trips, walks and tourings. 200 respondents were addressed, the filled-out questionnaires were received from all of the addressed respondents (100 % return). Even though localities are situated in Landscape Protected Area Small Carpathians, their recreational basis is very different, because the first one – Kamzik – is considered as a „heart“ of daily recreation utilizing focused on natural wealth, so the second one – „Kralova hora“ meadow is considered as an „entry“ of peple living in crowded housing estate into the nature.

Key words: services, facilities, survey, protected areas

Introduction

Cities have varying degrees of the attractiveness for the tourism. Stadtfeld (1995) identifies urban tourism with the term cultural tourism because of the predominance of cultural monuments over the centuries concentrated in cities. Styk and Habodaszova (1997) characterize the urban tourism as any form of stay of visitors in the city, whose main objective is the overall experience of visiting the city, regardless of whether the overnight stay connected with or without him.Urban tourism is a form of visits and visitors staying in the city, whose main objective is the experience. It may be motivated as office (business, congressional) so tourist (cultural,cognitive, shopping) (Foret Foretova, 2001).

The recreation can take place inside the settlement or in the nearby hinterland (Gúčik, 2010), which aims to relax, which allows physical recovery and relaxation in a favorable environment in which it is possible to carry out recreational activities such as hiking, biking, motorcycle tours, swimming and water sports, skiing, hiking, ball games and other (Polacik et al., 2003).Recreational areas of the city means the territory which provides a daily recreation of the population and tourists. Its essential part presentsgreenery, waterways and areas, sports fields, playgrounds and other facilities with a specific function for the rest and leisure.Not necessarily they are the only area outside the city, but also places that have already become part of it. Therefore parks and forest parks, rests of natural localities,riversides, places around lakes and dams, suburban and recreational forests, etc. could be used. Natural

localities and recreational areas in the hinterland cities are becoming an important elements for the quality of life of its inhabitants.
The contribution is dealing with partial results of the survey with the aim of knowing the perception of inhabitants of Bratislava city for the recreational possibilities on locations Kamzik – Koliba and Kralova hora. The research is following the previous one on Zeleznica studnicka and Devin locations (Pavlickova, Novanska Chrenscova, 2015).

Aim and methods of survey

The major aim of exploring the city of Bratislava was, by means of a questionnaire research, to assess the perception of suburban recreation localities of the city of Bratislava by its visitors as well as their views on main constituents of teh satisfaction with the quality of offered services. The explored areas of interest were locations of Koliba – Kamzik and Kralova hora, which are areas suitable for trips, walks and day-long tourism.
200 respondents were addressed. The filled-out questionnaires were received from all of the addressed respondents (100 % return). The questions in the questionnaire were answered by 100 respondents from the localityKamzik - Koliba and 100 respondents from the locality of Kralova hora. The statistical body therefore comprised 200 respondents (n = 200). 47,5 % of males and 52,5 % of females participated in the research, with the population rating from 16 to 45 years of age being the major part. Out of all the participating, represented were respondents with Bc. university education (22,5 %), MSc. university education (26 %), secondary education with school-leaving exam (42 %), secondary education without school-leaving exam (7 %) and elementary education (2,5 %).
For the purposes of the study an interrogative method was chosen – a questionnaire suitable especially in cumulative collecting of information, but also in gaining opinions and attitudes to issues froma higher number of respondents (Halašová, 2001). The questionnaire consisted of open, scaled and semi-closed questions, which offered a possibility of selecting a single or multiple answers. Collecting data took place in 2015 year. Respondents were addressed in person and asked to fill in the questionnaire.

Characterization of affected area

Bratislava is the largest city in Slovakia with its area of 367,58 km² situated on south-west part of Slovakia close to Hungary and Austria. In terms of geomorphological structuring, the area of the city incorporates three gemorphological bodies. All the southern and eastern part of the area is taken by Podunajska flatland, and Podunajska lowland, respectively. In the central part of this area altitude rises due to Small Carpathians mountain range, which splits into Devin Carpathians and Pezinok Carpathians. The area of the city is touched by the southern bulge of Zahorska lowland known as Borska lowland range. Several water courses flow through the area of Bratislava. Out of these, river Danube, together with its tributary river Morava, stands for the most important and commercially used.
The area of the city was in 2011 year inhabited by the population of 415 589, out of which 194 279 were males and 221 310 were females. Population age structure is characterized by high proportion of the working age population (60%) (Statisticky urad, 2012). In terms of ethnic structure is homogenous areas of territory with a population prevalence of Slovak nationality (91%). In the city the majority of the population is Roman Catholics (52%) (Statisticky urad, 2011).More than 75 % of its

inhabitants work in service sector, made up primarily of commerce, banking, informatic technologies, telecommunications, tourism etc.
The city can be considered as one of the most significant Slovak tourism centers. The central part of the Old City is a historical monument zone, while the historical core together with Bratislava castle and Podhradie is a historical reserve. Moreover, Bratislava boatsts lemure zones, parks and facilities with abudance of natural features, which allow for lemure and sport opportunities as a part of suburban recreation. To those localities belong also our reserach areas.
Forest hill top Kamzik is situated in the heart of Bratislava Forest Park, a target of the largest crowds of eager walks of Bratislava for every inhabitant of Bratislava. It is the second highest point in the city (439 m o.s.). Far from being visible by 200 m high TV tower.The whole area is also called Koliba, according to a large residential area on the hillside next to the forest. Kamzik location has gained popularity mainly due to the extensive ski meadow known as Training meadow, where it was once functional short winter ski lift, at present joined by a summer 360-meter long bobsleigh. Next track is Lanoland - cableway on trees at different heights above the ground, where you can test the courage and skill lovers of extreme sports, but also children.In summer the Koliba with surrounding ridge and slopes represents a good place for walking and cycling tours. The recreation could used in addition to the listed facilities and gazebos, benches, tables and rest meadows.It is located in the Protected Landscape Area Small Carpathians (Tab 1).
At the other hand Kralova hora is situated in the immediate vicinity of the settlement Dlhe Diely as a recreational backgorund for inhabitants living in this area of Bratislava city. Kralova hora is also regarded as one of the most visited sites Bratislava with a beautiful view of the Hainburg hills. It is increasingly used as a public natural area for walking and "green". It forms an important element of the landscape. It is part of the Protected Landscape Area Small Carpathians - part Devinske hills with several species of rare and protected plants (Tab 1).

Tab. 1: Protected areas of Kamzik – Koliba and Kralova hora (SOP SR, 2015)

Type	Name	Landscape Protected Area	Expanse (ha)	Year of declaration (revision)	Level of protection
Kralova hora					
NPR	Devinska Kobyla	Small Carpathians	101,1157	1964, 1986	4
PP	Devinska lesostep	-	5,0966	1992	4
Kamzik - Koliba					
PP	Rosslerov lom	-	2,3828	1990	4

Notes: NPP – National Natural Monument, PP – Natural Monument

Analysis and interpretation of results

Obtained data from 200 questionnaires were qualitatively evaluated. Tables 2 and 3 show results in quantity rates (%).
At the beginning were respondents asked for „What was a main reason for visiting the locality?“ The evalutaion is representing by the table 2.

Tab. 2: Main reason for visiting the locality

Type of Reason	Kamzik - Koliba	Kralova hora
	%	%
Relaxant	48	69
Nature beauties	34	51
Culture and history	5	7
Sport	35	36
Other: to take a dog out for a walk	0	6
Other: friends´ meeting	3	0
Other: trips withchildren	3	3

As we can see visitors of Kamzik - Koliba locality came there mainly for a leisure (48 %), nature recognition (34 %) and sport (35 %). Kralova hora area was mainly visited for the purpose of leisure (69 %), nature recognition (51 %) and sport (36 %), too.

To the locality of Kamzik – Koliba came 35 % respondents by city public transport, 31 % respondents by the car, 19 % by the bicycle and 15 % by walking. To the locality Kralova hora came 67 % by walking,17 % by the bicycle, 12 % by city public transport and 4 % respondents by the car.

Respondents were also invited to evaluate their satisfaction with services quality offered at the locality. The results overview is showed in the table 3.

Respondents of Kamzik – Koliba were mainly satisfied with possibilities for sport/leisure enjoyment (96 %), existing information system (65 %), overall satisfaction with services (64 %), cultural activities (56 %) and feeding and refreshment (52 %). Unsatisfied were with the level of services prices (32 %),traffic and parking (17 %), feeding and refreshment(10 %).

Respondents of Kralova hora were satisfied mainly with possibilities for sport/leisure enjoyment (94 %) and cultural/entertainment possibillities   (40 %). On the contrary they were unsatisfied with cultural/entertainment possibillities   (25 %).

At both localities respondents point out missing tourism information centres (36 % Kamzik - Koliba, 87 % Kralova hora). On locality Kralova hora were pointed out also other missing services as feeding and refreshment (85 %), traffic and parking (66 %), existing information system (75 %), tourist services level (78 %) and other services (79 %).

Finally visitors were asked about 2 open questions „What did you not like at the locality (what did you negatively amaze)?“ and on the opposite „What did you like at the locality (what did you positively amaze)?“

Resulting from answers at the locality Kamzik – Koliba respondents consider waste contamination (20 %), parking (10 %), weak maintenance of traffic (9 %) and absence of waste baskets (6 %) as the most negativepoints. They are also unsatisfied with weak quality of feeding facilities (4 %), noise of visitors (8 %), doglikers (5 %), the state of walking pathways (3 %) and the state of bathrooms (3 %).

Resulting from answers at the locality Kralova hora respondents consider waste contamination (28 %), dogs (6 %), weak information system (6 %), absence of waste baskets (3 %) and noise of visitors (1 %) as the most negative points.
Respondents of Kamzik – Koliba indicated the locality as ideal for walking, leisure and relaxation for families with children, young people and doglikers (23 %). They liked mainly nature (44 %), playgrounds and sporting possibilities (14 %), feeding possibilities (10 %). At the locality Kralova hora were visitors fascinated with beauties of surrounding nature (66 %) and peaceful environment (13 %). They were also satisfied with sporting possibilities (10 %).

Tab. 3: Services evaluation

Services	Kamzik - Koliba (%)				Kralova hora (%)			
	1	2	3	4	1	2	3	4
Traffic and parking	32	17	49	2	9	5	20	66
Existing information system – tourism marking, informatio tables	65	4	28	3	14	2	9	75
Tourism information centers	16	1	47	36	4	0	9	87
Feeding and refreshment	52	10	38	0	6	2	7	85
Participation in cultural activities and entertainment	56	2	22	20	40	25	4	31
Enjoyment of sport, relaxation	96	0	3	1	94	1	4	1
Tourism services level	64	8	28	0	16	2	4	78
Level of services prices	40	32	27	1	7	3	6	84
Other services (shops, municipal services, health services, banks, post office)	29	9	59	3	10	2	9	79

Notes: 1-satisfied, 2-unsatisfied 3–unused, 4-missing

Conclusion
Under our research of tourism posssibilities on 2 nature localities in Bratislava city they were positively accepted mainly as places for sport/leisure enjoyment and areas full of nature beauties. It is also obvious, that both localities could be considered as ideal places for leisure and relaxation. Even if they are different from accoording to positive – negative aspects. As Kamzik – Koliba is situated in the Forest park with existing tourist facilities, so Kralova hora presents only the peaceful environment for people living in blocks without tourist facilities. The same

comparison could be also made with our results from previous year from localities Zelezna studnicka nad Devin full of protected areas. But it does not mean that Kralova hora is less important form the point of view of landscape protection. Vice versa itis considered as a gate into the „greenery“ and must be protected, especially as a part of the Protected Landscape Area Small Carpathians.

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Souhrn

Hlavním cílem našeho zkoumání je městský respektive příměstský cestovní ruch v městě Bratislava, a to zejména z pohledu percepce možností turistického využití obyvatel a návštěvníků města Bratislava. Prostřednictvím dotazníkového šetření na 5 lokalitách města jsme se snažili zjistit pohled návštěvníků na hlavní komponenty spokojenosti s kvalitou poskytovaných služeb na lokalitách, které jsou vhodným místem pro výlety, procházky i celodenní turistiku. Dotazníkové šetření byl uskutečněn v přírodním prostředí Železnej studničky a v přírodně kulturním prostředí lokality hradu Devín, tyto výsledky byly prezentované v roce 2015 (Pavličková, Novanská, Chrenščová, 2015). Letos jsme se zaměřili na další dvě lokality – Kamyík – Koliba, který leží uprostřed městských lesů považovaných za srdce zeleně města, a Králova hora, která je bezprostředně vázána na sídliště a představuje vstup do zeleně a oddychu přinejmenším právě obyvatel sídliště.

Z výsledků vyplývá, že návštěvníci obou lokalit Kamzíka – Koliby, stejně tak Královej hory tyto lokality navštěvují zejména za účelem sportovního vyžití, poznávání

přírody, kultury a historie. Spokojení byli především s možnostmi sportovního vyžití právě na obou lokalitách; na Kamzíku – Kolibě i existujícím informačním systémem a poskytováním služeb. Naopak se jedná o turistické vymoženosti, které na Královej hoře jako zázemí obyvatel sídliště úplně chybí. Na obou lokalitách návštěvníci pociťují problémy s řešením odpadů a hlukem. I toto jsou záležitosti týkajícíc se ochrany přírody.

Zaměření výzkumu je v souladu se Strategií Slovenské republiky rozvoje cestovního ruchu do roku 2020, která si jako jeden ze svých tří cílů zvolila lépe využívat přírodní a kulturně-historický potenciál Slovenska podporou cílových míst, kde již existuje stabilizovaný odbyt klíčových trhů, to znamená nepodporovat nová cílová místa s nestabilními segmenty trhu, které nepřináší dostatečný synergický efekt.

V následujícím roce se zaměříme na centrum města spojené s návštěvou bratislavského hradu.

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RECREATIONAL POTENTIAL OF MALÁ FATRA NATIONAL PARK BY VEGETATION ZONES

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Abstract
The paper reports the ecological characteristics of the Malá Fatra National Park forest vegetation zones,which influence the recreational potential of the forest (and to a great extent also non-forest) ecosystems as an important part of the cultural ecosystem services. The area attractiveness to tourists is increased byspecific morphological traits and varying geological formations (canyons, waterfalls, rock cities), forest and non-forest communities, as well as alpine meadows at high altitudes. Altitudinal vegetation zones represent a typical change in the species composition of natural plant communities conditioned by the climate gradient and geomorphology. The current vegetation zones of Malá Fatra reflect the development of nature in the Quaternary but also the human impact in last centuries. There are six forest altitudinal vegetation zones in this territory. From the point of view of biodiversity and attractiveness of the flora the most interesting are natural grassland communities of beech, fir-beech and spruce-beech-fir vegetation zones in the Vrátna valleyand subalpine meadows above the tree line (spruce and mountain pine vegetation zone).
To obtain ecological characteristics of forest ecosystems in these zones the Ellenberg ecological numbers were calculated from phytosociological records in nature reserves Rozsutec, Chleb and Veľká Bránica. There has not been provedany significant negative impact of recreational activities in forest ecosystems of natural reserves in the beech and fir-beech vegetation zone. While human impacts in the vicinity of settlements are large and reflected in the changed structure of the forests (esp. conversion to coppice beech forests), forests in nature reserves are left to spontaneous development without human interventions. To maintain the beauty and attractiveness of Malá Fatra for touristsa sustainable management of subalpine and spruce vegetation zone is needed, as well. The management of tourist trails should be ecologically and landscape friendly. On the other hand, both tourists and species rich meadows in the Vrátna valley may profit from the synergy of the environmentally sensitive (eco)tourism and biodiversity protection. To achieve this, it is necessary to focus also on stopping the succession of woody vegetation below the timberline.

Key words: recreational potential, vegetation zone, Malá Fatra National Park, Ellenberg ecological numbers

Introduction

The Malá Fatra Mts is the westernmost high altitude mountainous area of the Western Carpathians. The river Váh divided this mountain into 2 subunits: Krivánska Fatra and Lúčanská Fatra. The Krivánska Fatra orographical complex in thenorth-western part of the Slovak Republic is the third highest in the Western Carpathians, after the Tatras and the Low Tatras. This orographic complex is in the shape of an asymmetric ellipse with the length ofabout 26km and the width of about 12.5km. The altitude ranges from 358 m (Hradský stream at its mouth to the Váh river) to 1 709m above sea level (the peak Veľký Kriváň). In 1967 the Kriváňska Fatra Mts were declared Protected Landscape Area (PLA) Malá Fatra (Pagáč, Vološčuk et al. 1983), and in 1988 this area was declared the Malá Fatra National Park (NP) (Vološčuk 1999). The area of the NP territory 22 630 ha, whereas area of its surrounding buffer zone is 23 262 ha. Forests cover around 83 % of the NP territory. There are 30 strictly protected areas (nature reserves) in Malá Fatra NP.

The complex geological evolution, a great variety of relief and a wide range of altitudes with distinct micro and mezo climatic conditions, have led to a great species richness of flora (around 900 species of vascular plants). Of these there are22West-Carpathian endemics, 14 Carpathian endemics and 4 endemics of Kriváńska Fatra, as well as a rich fauna of these picturesque mountains (Kliment 1999; Vološčuk 1999).Among the West Carpathian endemites we find for example *Delphinium oxysepalum, Dianthus praecox*subsp. *praecox, D. nitidus* subsp. *nitidus*,*Gentianella* fatrae, *Pulsatilla slavica.Saxifraga wahlenbergii, Soldanella carpatica,* Of the relict species, quitecommon onmountain peaks and crests is*Dryas octopetala.* On limestones and dolomites along the tourist trailscan be seen manyattractive prealpine, dealpine and arctoalpine species, such as are *Aster alpinus, Gentiana clusii,Primula auricula*,*Saxifraga paniculata*,decorative grass *Sesleria albicans*. Noteworthy is also the incidence of *Aconitum firmum, Erysimum wittmannii, Aquilegia vulgaris,* on wetter places *Delphinium elatum, Centaurea montana, Cortusa matthioli,*in the forests*are attractive Gentiana asclepiadea, Saxifraga rotundifolia, orchid Platanthera bifolia.*

Of special attraction for the visitors are species rich mountain and (sub)alpine meadows, glades and pales, e.g. thewhite flowers of *Chrysanthemum leucanthemum, Bellidiastrum michelii,* bright yellow of the *Anthyllis vulneraria,*genera*Ranunculus*, *Hieracium, Helianthemum, Potentilla,Crepis*, on wet grounds *Caltha palustris*, *Crepis paludosa,* the red flowers of *Lychnis flos-cuculi, Cirsium rivulare,* the blue*Gentiana* verna, *Salvia pratensis, Campanula serrata, blue-pink-violetCampanula glomerata, C. patula, Geranium pratense,* or the pink-red blooms of *Lilium martagon, Gladiolus imbricatus and others*(Vološčuk 1983). The attractive wetland orchids include *Dactylorhiza majalis, Epipactis palustris*, in meadows *Gymnadenia conopsea, Traunsteinera globosa*andrather rare*Cypripedium calceolus.*Mountain and submountain pastures are characteristic for their sweet fragrance and colourful carpets of herbs and grasses. The most common grasses here are *Trisetum flavescens, Holcus lanatus, Briza media, Agrostis tenuis, Dactylis glomerata, Festuca rubra, F. pratensis, Poa pratensis, Phleum pratense, P. alpinum,Cynosurus cristatus.*

The fauna of this region is of the typical West-Carpathian species and their orders. Here live about 900 kinds of insects, among them them very rare butterflies *Parnassius apollo, Parnassius mnemosyne, Erebia manto* and others. Among noteworthy birdslives here the wood grouse (*Tetrao urogallus*)*,* black grouse(*Lyrurus tetrix*)*,* golden eagle (*Aquila chrysaetos*)*,* rather common is falcon(*Falco tinunculus*) and common buzzard (*Buteo buteo),* very rarely occurs the wall creeper (*Tichodroma muraria*). Deep woods and glades provide a suitable environment also for a common game, such as *Sus scrofa, Capreolus capreolus, Cervus elaphus.* The large and more rare carnivores include the brown bear (*Ursus arctos*)*,* wolf(*Canis lupus*)and *European* lynx(*Lynx lynx*), a common is the red fox (*Vulpes vulpes*), (Vološčuk 1999).

In terms of natural and traditional cultural values the Kriváňska Fatra Mts together with the surrounding rustic villages (Terchová, Zázrivá, Belá, Varín, Strečno, Sučany, Šútovo, Párnica) have a high recreational potential. In the second half of the 20^{th} century,the Kriváska Fatra has become a popular domestic tourismdestination for residents of near industrial centers, but also from the cities of other countries of Central Europe (Hungary, Poland, Germany). The most attractive summer and winter tourist destination is Vrátna valley with extraordinary geomorphological phenomena on the limestone and dolomite bedrock (especially cliffs, rocky towns and gorges). After the construction of the cable car from the Vrátna Valley to the Snilovské sedlo saddle of the Kriváska Fatra in the second half of the 20th century, mass tourism was extended to the main ridge of this mountain range with species rich alpine and subalpine meadows and with beautiful views of the surrounding mountains and the countryside.

The attractiveness of the recreation area for a long-term recreation is valued according to representation and proportions of the following factors: climate, water (esp. waterfalls and mountain and gorge streams), rugged topography (according to altitude, surface formation and presence of rocks, gorges and caves), richness of organic life (forest cover, vegetation, wildlife), national monuments. The negative factors (lowering quality of the tourist experience) include pollution and other forms of habitat degradation, especially wood cutting, accelerated soil erosion on tourist trails, trampling of vegetation, spreading of invasive and synanthropic species, disturbing animals, etc. (Papánek 1974, 1975; Škodová, Urban 2015). The average number of visitors to the Vrátna valley in 1971 was 3440 and in 2015 was around 500,000 (Pagáč, Vološčuk et al. 1983, Švajda, Vološčuk 2015). Approximately 50% of visitors prefer hiking especially in the alpine environment of the main ridge of the Malá Fatra Mts.

For the visitors of the Kriváska Fatra the ecosystems of different vegetation zones provide special high value cultural ecosystem services. In the Kriváska Fatra Mts occur the ecosystems of six forest vegetation altitudinal zones (according to Zlatník 1956): oak-beech (350-550 m a.s.l.), beech (550-750 m a.s.l.), fir-beech (750-1000 m a.s.l.), spruce-beech-fir (1000-1300 m a.s.l.), spruce (1300-1500 m a.s.l.) and subalpine - mountain pine zone (above 1500 m a.s.l.). The characteristics of the forest vegetation zones of the Kriváska Fatra Mts. were published by Vološčuk (1971) and the latest characteristics of the plant biodiversity of the main ridge by Šibík et al. (2015).Within the years 1972-1975 and 1980-1986a vegetation survey was carried out inthe Kriváska Fatraaccording to vegetation zones.

Materials and methods

Field data collection in vegetation zones of the Kriváska Fatra was carried out on permanent research plots situated in nature reserves Rozsutec, Chleb, Veľká Bránica, Kľačianska Magura, Starý hrad. Phytosociological records on the area of 20x20 m (400 m2) capture the summer aspect of plant communities.The assessment of abundance and dominance of the vascular plant species in phytocenoses was conducted using the Braun- Blanquet scale (Braun-Blanquet 1964, Westhoff, van der Maarel 2007).

The number of phytocenological records in the vegetation zones were as follows: oak-beech zone 7 records, beech zone 3 records, fir - beech zone 26 records, spruce – beech - fir zone 40 records, spruce zone 9 records, mountain pine (subalpine) zone 12 records. Altogether we evaluated 97 phytocenological records.

These records have been savedinthe database program TURBOVEG (Hennekens, Shaminée 2001) and analysed in the programs JUICE (Tichý, Chytrý 2006) and CANOCO (Ter Braak, Šmilauer 2002). To evaluate the fundamental ecological factors and their changes by means of phytoindication we used indirect information provided by the Ellenberg indicator values - ecoindexesindicating key environmental conditions - light, temperature, continentality, moisture, soil reaction and nutrients esp. nitrogen content(Ellenberg et al. 1992). The relevés were evaluated also from the aspect of species composition, esp. diversity.For the evaluation of species diversity, we used the Shannon index H' (Shannon, Weaver 1949). For the lack of space in this article we do not present here the results of the DCA analysis.

Results and Discussion

Recreational activities in Kriváňska Fatra Mts have a summer seasonal cycle (June - September) and winter cycle (December - April). The most visited landscape area is Vrátna valley, which accounts for 70% of total visitors. The summer tourism prevails (50% of all visitors to the Vrátna valley). The distribution of visitors on tourist trails along the main mountain ridge and their frequency significantly increased due to cable car from the end of the Vrátna valley to Snilovské sedlo saddle, especially in the recent years after cable car reconstruction has increased its capacity. Most visitors are concentrated on the trails leading to the main ridge of themountain range. Eastward from Snilovské sedlo saddle a tourist route of main ridge leads to Chleb (1647 m) - Hromové (1636 m) - Poludňový Grúň (1460 m) - Stoh (1608 m) – Veľký Rozsutec (1610 m). South of the Snilovské sedlo a tourist trail leads to the cottage under Chleb (1415 m) and then through Čierťaž (1108 m) to Trusalová, or south-east to the 38 m high Šútovský waterfall. To the west of Snilovské sedlo the hiking trail leads to Veľký Krivaň (1709 m)–Malý Kriváň (1671 m) –Suchý (1468 m) (Pagáč, Vološčuk et al. 1983). On the main ridge of the subalpine vegetation zone is a high concentration of rare and endangered species of flora (Bernátová, Uhlířová, Topercer, 1998; Šibík, Senko, Bernátová, 2015; Dobošová, 2002).

Abig problem is an intolerable burden imposed on theridge trails by high numbers of visitors. In case of the trailfrom Snilovské sedlo to Veľký Kriváňthe load exceeded the limit by more than 100% even in the 1980s and since that time it has grownquite a lot (Pagáč, Vološčuk et al. 1983). This reduces the positive recreational effects, especially mental relaxation, which is the main motivating factor of outdoor recreation.

Recreation in this national park includes spending of the time in forest and its immediate, adjacent,as well as further neighbourhood, both in the forest land and also non-forest land (in grasslands and karst areas). The immediate surroundings of the forest covers 200 meters from the edge of the forest. Neighbourhood forest extends up to 600 m from the forest edge(Papánek 1975).Therefore visitors of Vrátna valley, as well as other smaller recreational centres in the Kriváňska Fatra Mts are always aware of recreation in the forest nature.

Recreation in the mountains is connected with moving through different altitudes, with various temperatures, humidity, views on surrounding landscape and experience. Differentiation of the vegetation zones and their associated flora and fauna is reflected also by their ecological conditions. The ecological characteristics of forest vegetation zones according to Ellenberg ecoindexes are shown in the table 1.

The calculated average ecological indexes include phytocenological records from the years 1974 – 1985, and in the National Nature Reserve Rozsutec repeated reports from the years 2014 and 2015.These results do not imply any significant negative impact of tourism in forest ecosystems of natural reserves in the beech and fir-beech vegetation zone within the years 1975 - 1985. From the geobiocenological point of view (Zlatník 1976) the mountain meadows in the Vrátna Valley belong to the beech, fir-beech and spruce-fir-beech vegetation zone. Secondary alpine and subalpine meadows belong to the spruce and mountain pine vegetation zone.

Recreation in summer on meadows in the mentioned vegetation zones provided in the past and still today agreat possibility of improving relation of man to nature. While hiking on the main mountain ridge or in the gorges,people perceive nature´s beauty and perfection. However,the excessive visitors´ numbers today lead to destruction of the nature trails in the areaand heavily trampled vegetation and erosion decreases also the quality of the tourist experience.

Tab. 1: Average Ellenberg econumber values, average species richness and average Shannon diversity index according to altitudinal forest vegetation zones

Vegetation degree	Light	Temperature	Continentality	Moisture	Soil reaction	Nutrients	Average spec. richness	Average diversity index	Average evenness
3. oak-beech	5.90	5.40	4.10	4.40	4.60	3.30	21.00	1.97	0.63
4. beech	4.60	5.00	3.50	4.90	4.50	4.90	23.53	2.22	0.71
5. fir-beech	4.96	4.62	3.62	5.05	6.22	4.86	40.65	2.64	0.72
6. spruce-beech-fir	4.58	4.40	3.45	5.46	5.99	5.54	37.38	2.58	0.71
7. spruce	5.32	3.64	3.58	5.72	5.27	5.23	36.67	2.52	0.71
8. mountain pine (subalpine)	6.33	3.31	3.73	5.43	5.37	3.85	25.75	2.25	0.71

The recreational potential in the western part of the mountain range dominated by the granodiorite and quartzite bedrock is represented by the nature reserves Starý hrad and Kľačianská Magura. The ecosystems in this area lie ongranodiorite and quarzite substrate and have not only recreational potential, but also exceptional scientific and research values (together forming a broader range of cultural ecosystem services).On thesouthwesternfoot of the Malá Fatra Mts, in National Nature Reserve Starý hrad isthe northernmostlocality of the habitat of European significance– acidic beech-oak forests Fagetum quercinum and Fagetum quercino-abietinum (Šomšák 1963). In the Starý hrad acid oak-beech forests standing dead and broken trunks are typical. These communities belong to the oak-beech and beech vegetation degrees (Vološčuk 1984). Tourist atractions include also the ruins of the Starý hrad (Old Castle) from the 14th century, which stands on a granite cliff above the river Váh.

A high recreational potential of spruce vegetation zone on granite bedrock hasthe best preserved spruce forest in the national nature reserve of Kľačianská Magura with communities Sorbeto-Piceetum (Vološčuk1989). The communities of the spruce vegetation degree below the main ridge of the Veľký Kriváň (which was heavily destructed by shepherds in the 16th-17th century and today is found only in small areas. Limestone, shale and marly sandstones bedrock in the eastern part of the Krivánska Fatra Mts are interesting due to occuring landslides, sometimes leading to natural disasters. The natural disaster in 2014 in Hromové was a result of the synergy of the substrate-geomorphological-climatic impacts and the complex character of the vegetation dynamics here (Vološčuk et al. 2015). To decrease the risk of realising these hazards an effective ecosystem management is needed.

The forest communities of the National Nature Reserve Chleb in Vrátna Valley in spruce- beech -fir and spruce vegetation zones are accessible for tourists only from the tourist trail Vrátna - Snilovské sedlo. To get to the ridge, tourists mostly use the cablecar.High recreational potential of beech and fir-beech vegetation zones in the Vrátna valley have also communities in the national nature reserves Rozsutec and Tiesňavy. Also cold canyons of Dolné, Horné and Nové Diery over which on the dolomite and limestone rocks occur relict communities with pine Pinus sylvestris and larch Larix decidua are very attractive.

The Ellenberg ecological indexes in Table 1 show that in the forest ecosystems from oak - beech to mountain pine vegetation degrees increases the number of species requiring light and decreases the number of species demanding temperature and humidity. In relation to soil reaction indices show the predominance of species of acidic to lightly acidic soils and vegetation in the higher degrees slightly acidic to neutral soil. The average number of taxa of vascular plants decreases from fir-beech to subalpine vegetation degrees. Diversity index decreases only slightly and in the fir-beech, spruce – beech - fir and spruce degrees is relatively balanced. Slightly smaller values of number of taxa are in subalpine vegetation degree.

In the vicinity of the village Štefanová in the potential fir-beech and spruce-beech -fir vegetation zones occur secondary meadows of high biodiversity. However,thecomposition of grassland communities is changing due toabandonment of their agriculture use by local people of Štefanová village. The theory of non-eqilibrium thermodynamicsof living systems (Jörgensen, Svirezhev, 2004) teaches us that abandonment of meadows below the timberline necessarily leads to ecological succcesion, its main driving force is the energy which accumulates in the unharvested biomass (Würtz, Anilla 2010; Sabo et al. 2010). In the current socio-economic situation,this process seemsunstoppable because the local people from Štefanová no longer use their land for agriculture but focus on tourism development.Paradoxically, this lowers the attractiveness of the village immediate surroundings. The situation is quite different on the steep slopes along the main ridge, where the succession often jumps to previous stages due to periodic occurrence of avalanches and landslides. In case they are moderate (not big as were the landslidesbelowRozsutec in 1884 and below Hromové in 2014,Vološčuk et al. 2015) they prepare the conditions leading tohigher biodiversity. Šibík et al. (2015) have found plant biodiversity hotspots in the Kriványska Malá Fatra often at this kind off places. It seems that these hot spots are connected to a moderate intensity of the opposite processes of succession and disturbance, to their dynamics and relative balance, which contributes to greater evenness of communities.

The effect of succession of dendroflora in the abandoned meadow communities sharply changes the diversity of herbaceous communities. But till now this long term process does not havea high negative impacton the capacity ofrecreational potential for mass tourism -theaestheticperception oflandscape, recreation,leisure, exploring enormously interesting karst relief of gorges and rocky towns, etc. However, also the interest in sustainable tourism is growing (and is expected to grow) and especially in its soft form represented just by ecotourism. From this point of view, the loss of species rich seminatural meadows below the timberline would mean a decrease of available options for future ecotourism trails in the area. Therefore we recommend the local inhabitants, the municipality in Terchová and the tourist agencies to join their capacities and to safeguard mowing of meadows at least on a smaller, economically feasible proportion. This would be an investment both to biodiversity protection as well as to the ecotourism development in the area (Sabo et al. 2014).

Conclusion

Vegetation graduality in the Krivánska Fatra Mts. represents altitudinal vegetation zones: oak-beech, beech, fir - beech, spruce - beech - fir, spruce and mountain pine. Their basic ecological characteristics are shown in Table 1. There is a high recreational potential of both forest and non-forest communities on limestone, dolomite, shale and sandstone bedrock, especially in the Vrátna valley, where the summer and winter recreational activities are concentrated. For recreational activities communities of oak - beech up to the spruce vegetation zone in the western part of mountains of the granite bedrock are also attractive.

Among our high mountains the Krivánska Malá Fatra forms a unique sample representation of the ecosystems of six altitudinal vegetation zones typical of the whole Western Carpathians. High recreational potential have especially mountain pine and spruce vegetation zones on calcareous rocks and acidic soil in granodiorite. In flora of the Krivánska Fatra they represented typical Carpathian elements, endemic, relict and critically endangered taxa. Ecosystems of all vegetation zones of the Krivánska Fatra Mts significantly contribute to essentialcultural ecosystem services, in which a unique position has recreation and especially tourism in mountains, including forests and their surroundings (mountain, subalpine and alpine meadows).

The total value of recreational ecosystem services for the National Park Malá Fatra is 38 million euros per year. For comparison the recreational value of the National Park Veľká Fatra is 53 million euros, of the Slovak Paradise National Park 152 million per year, and of the Poland Tatrzański Park Narodowy it is 519 million euros per year (Švajda, Vološčuk 2015).

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Souhrn
Předkládaný článek nastiňuje ekologickou charakteristiku lesních vegetačních stupňů Národního parku Malá Fatra, které ovlivňují rekreační potenciál lesních (a do jisté míry i nelesních) ekosystémů jako významnou součást kulturních ekosystémových služeb tohoto území. Navíc, turisti zde mohou obdivovat i zajímavé geomorfologické jevy na vápencovém a dolomitovém geologickém podloží (soutěsky, vodopády, skalní města).
Rozptýlené osady v okolí obcí Terchová a Zázrivá dále nabízí tradiční dřevěnou architekturu s tradičním polnohospodářským využíváním krajiny. Ve Vrátnej doline je možné takové ukázky najít zejména v bývalé pastýřské osadě Štefanová. Vliv člověka v okolí hřebenové části pohoří naopak v průběhu osidlování této části přispělo k významnému snížení horní hranice lesa.
Vegetační stupně představují typickou změnu druhového složení přírodních společenstev, podmíněných výškovým klimatickým gradientem a geomorfologií. Současné vegetační stupně Malé Fatry odrážejí vývoj přírody ve čtvrtohorách a lidský vliv v ostatních staletích. V Krivánskej Fatře se vyskytují společenstva šesti lesních vegetačních stupňů (dle členění podle Zlatníka, 1959, 1976): dubovo-bukový, bukový, jedlovo-bukový, smrkovo-bukovo-jedlový, smrkový a kosodřevinný (subalpínský) vegetační stupeň. Výškovou zonaci vegetace významně ovlivňuje i klimatická inverze v hlubokých údolích a soutěskách. Pro ekologickou charakteristiku ekosystémů těchto šesti lesních vegetačních stupňů byli použity Ellenbegova ekologická čísla vypočítaná z fytocenologických snímků v přírodních rezervacích Rozsutec, Chleb, Veľká Bránica, Starý hrad a Kľačianská Magura. Celkově bylo vyhodnoceno 97 fytocenologických snímků.
Z hlediska biodiverzity a atraktivnosti flóry jsou ve Vrátnej doline zajímavé spíše přirozené (sub)alpínská luční společenstva na strmých svazích a skalnatých substrátech, horské kosené louky a pastviny v bukovém, jedlovo-bukovém a smrko-bukovo-jedlovém vegetačním stupni a vysokohorské louky nad horní hranicí lesa (potenciálně smrkový a kosodřevinný vegetační stupeň). Návštěvník vnímá lesní i nelesní společenstva přírodních rezervací převážně z turistických chodníků, které jsou na mnohých místech v důsledku vysoké zátěže (i málo odolného podloží) silně erodované. Udržení atraktivnosti území Malé Fatry pro turisty si proto vyžaduje ekologicky a krajinářsky citlivý management chodníků.
Současné široké využívání zářivých hliníkových žebříků, laviček a stupňů při rekonstrukcích chodníků narušují přirozený vzhled území. Na druhé straně, synergií přírodě šetrného (eko)turismu a ochrany přírody je možné současně udržet vysokou biodiverzitu lučních společenstev i zvýšit kvalitu zážitku turismu. Management stále méně využívá sekundárních horských luk a pastvin ve Vrátnej doline – proto je

nutné zaměřit se na zastavení sukcese dřevinné vegetace. V důsledku klimatické změny sukcese může v budoucnosti ohrožovat i přirozené louky nad horní hranicí lesa.

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REQUIREMENTS FOR THE STARTING POINTS OF HIKING TRAILS EQUIPMENT

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Abstract
On the starting points and other selected locations of trails should be established car parks with enough capacity, resting places as well as sanitary facilities. For sanitary facilities is necessary to design such constructions that will suitably fit into the natural environment. It is appropriate to build minor wooden buildings or just structures based on wood. The construction of the object can be designed as a module, mobile or build by mounting method directly on the required area by different systems. Thereafter buildings of the same type we can place into needed locations. The article shows demands for designing separate objects with sanitary rooms, which may provide even wheelchair access usage. Resting places and sanitary facilities outdoors are especially important for wheelchair users. It is necessary to design areas which will respect minimum dimensions and other requirements which are given by new Decree no. 398/2009 Sb., about general technical requirements ensuring the use buildings by persons with limited mobility. It is appropriate to devise such objects which will not be distracting in the natural environment and which architecturally fit into the location.

Key words: car park, resting places, sanitary facilities, wheelchair users, wheelchair access

Introduction

Still relatively large number of people visit the countryside for rest and relaxation and interesting and valuable natural locations. It is necessary to regulate by suitable way the movement of visitors because of protection the nature. It is suitable to preserve valuable natural sites, to define the locations without visitors, to avoid disturbing wildlife, avoid trampling vegetation or other negative effects. We use the hiking trails and educational trails with elements of visitor infrastructure to guide visitors. Thanks to them, stay in the nature will be more attractive. They are represented mainly by information boards and structures and small buildings such as timber deck walkway, walkways, benches and shelters. However, it is necessary to solve the bases of trails and roads. As reported Jakubisová (2013), except the realization of parking it is necessary to solve sanitary facilities or resting places with trash on these places. Toilets will particularly appreciate disabled persons and persons on the orthopaedic wheelchair. It is suitable to design such objects to the natural environment that will not be disruptive and that will architecturally fit to the landscape. These facilities must be located not to interfere to the free width of the road and also to allow access for the persons on the wheelchair. It is possible to dispense from the separate sanitary facilities in places that are nearby restaurants etc. The ideas we have to have on nind during the design are described by Ondrejka Harbuľáková et al (2012, 2014, 2015)

Materials and methods

Sanitary facilities

Requirements to be respected in designing barrier free buildings are taken from Decree no. 398/2009 Coll., on General Technical Requirements for Barrier Free Use of Buildings. The designer should be aware that he or she is responsible for how the disabled will be able to use such facility.

There must be an area of at least 1,500 mm x 1,500 mm in front of the entrance to the building. The slope of this area may be in only one direction and not steeper than 1:50 (2%). The entrance to the building must have a minimum width of 1,250 mm, a clear opening width of door is at least 900 mm. The door, which is not entrance door, must have a minimum clear width of 800 mm. The door shall have no sills. It has to be borne in mind that the door needs to be fully opened to provide a clear passage width of 800 mm. Openable door wings should be equipped with horizontal handrails over their entire width in a height of 800 to 900 mm, positioned on the side opposite to the hinges, with the exception of automatically operated door (Šestáková, Lupač, 2010).

Door to disabled toilets should open outwards for safety reasons in case of medical or other complications.

As defined in Decree no. 398/2009, the toilet cubicle must have a minimum width of 1,800 mm and length of at least 2,150 mm (see Fig. 1). The toilet bowl must be mounted at an axial distance of 450 mm from the side wall. There must be an area of at least 700 mm between the front side of the bowl and rear wall of the cubicle. We must not forget to leave an area for a wheelchair next to the toilet bowl, which will be minimally 1,200 mm. The space around the toilet bowl should allow frontal, diagonal or side approach. The upper edge of the toilet bowl seat must be at a height of 460 mm above the floor. It is possible to use special high toilet bowls or wall-hung bowls. The toilet bowl should be provided with a foldable handrail on the side of approach at a height of 780 mm extending beyond the bowl by 100 mm. The handrail on the opposite side of the bowl must be fixed and must go beyond the bowl by 200 mm. Handrails are mutually spaced by 600 mm (Decree no. 398/2009 Coll.).

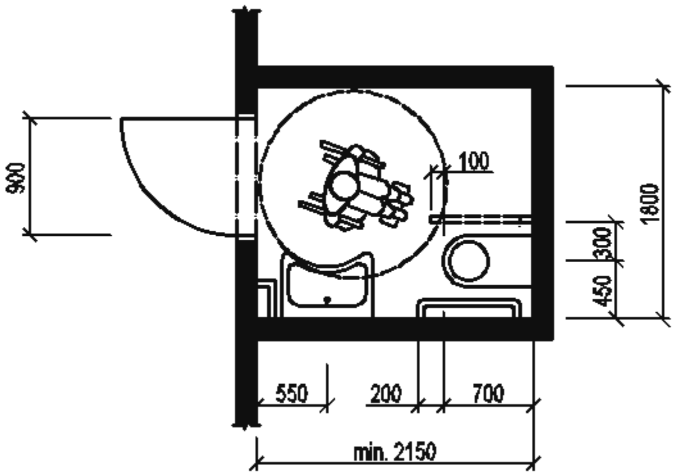

Fig. 1: Minimum dimensions of toilet cab

Washbasin must be provided with a lever-operated faucet with a spout. The washbasin should be affixed so that its upper edge is at a height of 800 mm enabling the wheelchair to manoeuvre below the fixture to allow close approach for washing convenience. Other equipment must be within a reachable distance of the disabled (Decree no. 398/2009 Coll.).

Parking

Parking are designed according to ČSN 73 6056. Basic requirements for the protection of the environment, especially the protection of surface and underground water must be reflected when designing parking areas. Parking places are designed as perpendicular, longitudinal or oblique, but always with the necessary handling area for getting on / off the vehicle. Dimensions of parking spaces presents standard ČSN 73 6056. Examples of proposals of parking spaces for perpendicular or oblique sorting of vehicles is shown in Fig. 2 and 3.

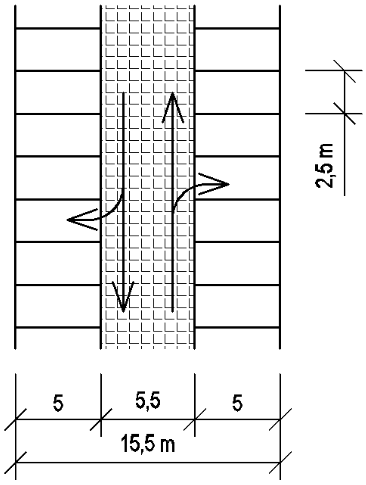

Fig. 2: Perpendicular parking allows approach and retraction from both directions.

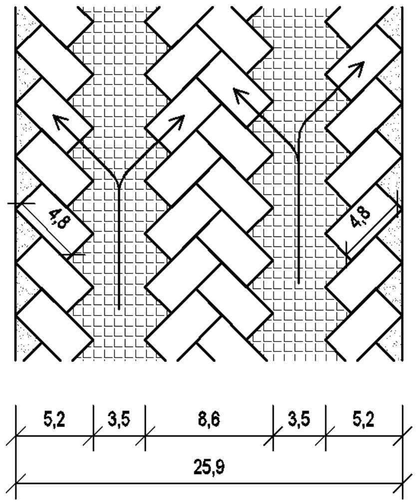

Fig. 3: Oblique parking (45°) only for one-way traffic.
The width of a parking space is 2.5 m.

Reserved parking spaces for vehicles carrying severely disabled and those reserved for persons accompanying a child in a stroller must have a minimum width of 3,500 mm, which includes a manoeuvring area at least 1,200 mm wide. Two neighbouring spaces may use one single manoeuvring area. The width of the double space is designed 5.80 m. (see Figure 4)
In the case of longitudinal standing by the road for vehicles transporting persons seriously physically handicapped, the length of parking space must be at least 7,000 mm (see Fig. 5). A direct, unobstructed access to a pedestrian path must be provided from the reserved parking spaces and these parking spaces must be situated as close as possible to the entrance to the tourist attractions. (Decree No. 398/2009 Coll.)

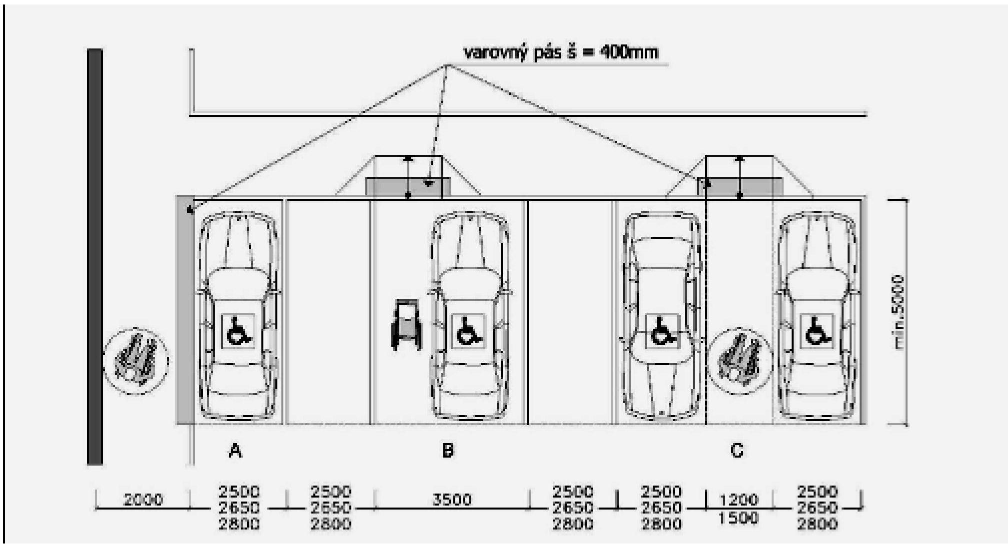

Fig. 4: Reserved perpendicular parking space: A - at the pavement, B - parking with its own handling area, C - two spaces with a shared handling area
(Zdařilová, 2011)
(Explanatory notes to Figure 4: Varovný pás - Warning strip)

Reserved parking space may have a longitudinal slope of no more than 1:50 (2.0%) and a maximum cross slope 1:40 (2.5%).
In all designated outdoor and indoor parking lots and yards and in garages for personal motor vehicles, places for vehicles carrying persons with severe disabilities must be reserved in following numbers based on the total number of spaces available in each parking lot:

2 to 20 spaces	1 reserved space
21 to 40 spaces	2 reserved spaces
41 to 60 spaces	3 reserved spaces
61 to 80 spaces	4 reserved spaces
81 to 100 spaces	5 reserved spaces

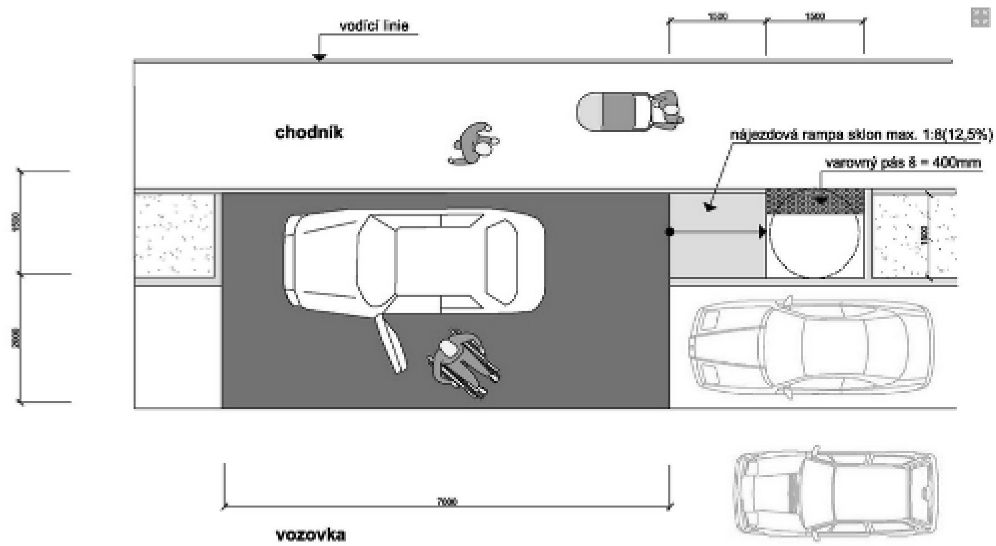

Fig. 5: Reserved longitudinal parking space (Athena, 2009)
(Explanatory notes to Figure 5: Chodník – Sidewalk; Vozovka – Roadway; Vodící linie – Guiding line; Nájezdová rampa – Ramp; Varovný pás - Warning strip)

Results

For the construction of toilets, it is possible to recommend using of mobile portable chemical toilets made of polymers from the already well-known manufacturers. Setting these units into the natural environment is often inconvenient.

It is possible to use compact toilet facilities, which consists of reinforced concrete or steel frame elements. They are manufactured and assembled in the factory, fitted with roof and facade, which can be adjusted such lining materials according to the investor. In that area should not cause too distracting.

In the natural environment will be appropriate to design wooden constructions for the sanitary facilities. Construction of objects can be designed as modular, mobile (see Figure 6) or built by mounting method directly on the required area by different systems.

The main advantage of these structures is easy prefabrication, which means rapid and economical construction The production can take place in a factory. Individual parts or whole units are then transported directly to the construction site and mounted there. This method does not affect the environment by heavy construction equipment, dust, noise and other similar factors that ordinarily arise in construction. The choice of construction method and object system will depend on requirements of the investor but also on the environment where the building is being planted. It is necessary to solve the transport and use of heavy machinery on site. In some locations can be difficult to get with heavy machinery, it is preferable to use construction site mounting from timber. For wooden structures can be used frameworks, but also the construction of the massive panels.

Fig. 6: Sanitary facilities – prefabricated wooden building
(source: https://www.behance.net/gallery/2089708/Modulov-verejn-WC)

Discussion

An important area of the solution of the designed toilets in the natural environment is water supply and wastewater disposal. Usually it's not possible to connect sanitary facilities to utilities. One of the possible solutions is the design of chemical toilet, which is completely independent from the water connection and drain of waste into drains or sump. Mobile toilets are not dependent on electricity, so they can be used really everywhere. Another option is to transfer water from the tank, to which was pumped or imported from the local spring. The next problem is waste water. Objects with occasional operation can use technology based on mechanical pre-treatment on extensive types or accumulation of waste water into the pit. After filling, the content should be exported to the nearest wastewatter treatment plant. Economical option, as stated Plotěný (Plotěný, Uher, 2010) is a septic tank supplemented by tertiary treatment as a natural filter or vegetative WWTP.

Conclusion

The aim of the article was to highlight the necessity of solving the starting point of hiking trails and educational trails in the countryside, especially in places where we would like to attract more visitors and direct traffic to certain sites. It is necessary to design sufficient parking space, as well as sanitary facilities which can also use people on an orthopaedic wheelchair. We must respect requirements of the Decree no. 398/2009 Coll., on General Technical Requirements for Barrier Free Use of Buildings. The designer should be aware that he or she is responsible for how the disabled will be able to use such facility. For sanitation facilities in a natural environment, it is necessary to design buildings that will not be disruptive and that will architecturally fit into landscape. Suitable solutions are modular wooden constructions.

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Souhrn

Na východiskách turistických tras i dalších vytipovaných místech stezek by měla být zřizována parkoviště s dostatečnou kapacitou, odpočinková místa, ale i hygienická zařízení. Pro hygienická zařízení je třeba navrhovat takové stavby, které budou do přírodního prostředí vhodně zapadat. Je vhodné stavět drobné stavby ze dřeva nebo na bázi dřeva. Stavba objektu může být řešena jako modulová, mobilní nebo stavěna montážním způsobem přímo na požadovaném prostoru různými systémy. Stavby stejného typu pak můžeme umístit do potřebných lokalit. V článku jsou uvedeny požadavky pro navrhování samostatných objektů s hygienickými místnostmi, které mají zajistit i bezbariérové užívání. Pro vozíčkáře jsou

odpočinková místa a hygienická zařízení v přírodě obzvláště důležitá. Je třeba navrhovat prostory respektující alespoň minimální rozměry a další požadavky, které jsou dány vyhláškou č. 398/2009 Sb., o obecných technických požadavcích zabezpečujících užívání staveb osobami s omezenou schopností pohybu a orientace. Je vhodné navrhnout do přírodního prostředí takové objekty, které nebudou působit rušivě a do lokality i architektonicky zapadnou.

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RESTING IN FORESTS OF MAZOWIECKI LANDSCAPE PARK IN THE LIGHT OF THE SURVEY RESEARCH

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Abstract

The article presents the results of the survey on the preferences of people vacationing in the forests of Mazowiecki Landscape Park (MPK). The study was in 2000 and conducted on a sample of 700 people, and then repeated in 2012 surveying 350 adults, age 18 and over. The questions in the survey concerned; time and frequency of rest, leisure activities in forests and choice of holiday destinations. The results show That there are differences between the preferences of the respondents recreational needs, established in 2000 and thereafter. In the years we can see noticeable changes primarily declared frequency and duration of rest in the forest. The percentage of people, who prefer daily relaxation in forests and vacationing in the woods at least once a week, Increased significantly. The park has become more recognizable. Respondents pointed to a higher number of places frequently visited in the Park than in previous studies. Besides noticeable aspects there are the changes with respect to the preferred forms of recreation. There is a bigger share of respondents taking part in different ORMs of recreation dry as biking, horseback riding, jogging, walking or for education purposes.

Key words: tourism and recreation management, social preferences, leisure in forest

Introduction

Forests in Poland, because of the space they occupy, as well as the spatial distribution, are seen as one of the basic values of recreational space. They provide a destination for tourist trips and they add extra attractiveness of other areas (eg. mountain areas, water bodies, etc.). One of the most important issues related to the development of recreational forest is currently considering the needs and preferences of the public holiday. Research is needed to identify the size and nature tourism in the woods, to create the definition of attractive vacation destinations for tourists, to diagnose their preferable way of development of recreational forest etc.At the same time it is also necessary to monitor the dynamics of changes in these preferences. The aim of this article is to compare the results of the survey on the preferences of people vacationing in the forests of Mazowiecki Landscape Park (MLP), conducted in 2012 and ten years earlier.

Material and methods

Mazowiecki Landscape Park is located in the closest vicinity of Warsaw. Forests constitute 77% of the total area of the park. Through forest areas run a network of trails, mostly walking, cycling and horse with a total length of over 380 km. In the years 2007- 2013 they established the area of 77 km horse riding trails, along with spots for rest. In addition, nine nature trails (including seven after 2002), and two bicycle paths, one path to health (2010), a vantage point, four car parks (one after 2002) and nineteen staging points were provided in this park. Since 1995, there has been an Education Center and Museum "Baza Torfy", and since 2009 the Forest Education Centre in Celestynów.

Preferences of people vacationing were described by the method of survey questionnaire. Essential surveys were preceded by preliminary observations on the ground and execution of pilot studies aimed at, among others, determining the organizational and technical aspects of the planned research. The relevant survey was conducted during the months of May - October 2000, and then repeated it in the same period in 2012, expanding the number of measurement points (forests near the river Świder, "Baza Torfy", as well as urban forest "Las Sobieski") of Forest Education Center in Celestynów. We surveyed people over 18, resting in the woods. The study, conducted in 2000, included a group of 755 people, while research in 2012 - a group of 390 people. The resulting research material were successively verified, coded and statistically analyzed. Finally the results were based, after rejecting questionnaires incompletely filled, on the analysis of 700 surveys collected in 2000 and 350 in 2012. The answers to specific questions were coded in a "zero-one" (no response - zero, the answer - one). The collected material was stored in the form of a computerized database, created in Excel. On the basis of the so prepared material it was possible to build result tables.

Results

The study comparing the preferences of respondents over the decades show that the forest area of the Park is visited for recreational purposes most often "at the weekends." As declared by 82% of respondents in 2000 and 79% of respondents in 2012. As a result of the study in 2000 it was found that only 3% of respondents combined their stay in the woods of Mazowiecki Landscape Park with sleeping overnight, while in 2012 the percentage of respondents claiming the same decreased by 2%. Among these respondents were mostly owners of cottages or people visiting relatives or friends living in the vicinity of the Park. Other respondents rested in the woods generally for "three hours" (52% of respondents in 2000 and 57% of those surveyed in 2012). Among the respondents were quite a large group of people resting in the woods "from three to six hours" (34% of respondents both in 2000 and in 2012). Resting longer - "more than six hours," (but less than a dobe) was preferred by the 11% of respondents in 2002 and 8% of respondents in 2012.

The most preferred holiday destinations in the woods of the park, as shown by studies conducted in 2000, included Baza Torfy (32% of respondents), forests in the vicinity of the village, ie. Otwock, Celestynów etc. (33% of respondents) and the forests along the river Świder (15% respondents). Other forest spots had less than 4% of the responses. For comparison, the study conducted in 2012 shows that the most visited sites within the park include Center for Forest Education in Celestynów (34%), Baza Torfy (26% of respondents), forests in the vicinity of Otwock, Celestynów, etc. (13% of respondents), area around the bunkers (12% of respondents) and the forests along the river Świder (9% of respondents). Other places (eg. "Bocianowski Swamp" reserve) obtain less than 3% of the responses. In 2000, 42% of respondents chose the site developed, adapted to the function of recreation, while in 2012, 56% of respondents preferred this type of spaces.

Research dealing with the selection of recreational activities in forests, conducted in 2000 showed that respondents preferred above all walks (22%), a picking mushrooms and forest fruits (17%), cycling (16%), observing of nature (11%) and picnics (7%). Other forms of recreation, such as educational and cognitive walks, jogging, hunting, sleigh rides, horseback riding preference is given to each by less than 4% of respondents. Based on the research carried out in 2012 it can be said that only in relation to such forms of recreation as picking mushrooms and forest fruits and picnics the interest of the respondents clearly decreased (by 6% and 3%). The interest in walking increased, bike tours and observation of nature, as well as horse riding (by respectively 1%, 6%, 8% and 6%).

Discussion

The fact that the vast majority of respondents prefer to stay in the forest usually at the weekends is closely linked with the location of Mazowiecki Landscape Park. Suburban areas of agglomeration are the main place for holiday, the characteristic feature is a short, usually one-day duration of the trip (Lijewski and others, 1998). As a result of the conducted research in 2012, we can see a 3% decline in the interest of weekend leisure, which is correlated with the growing importance of one-day rest. In ten years there has been a very intensive development of housing around the area adjacent to the park. Due to its convenient location, improved transport connections with Warsaw (eg. The modernization of the railway line), large natural and recreational values, as well as a general increase in society's affluence, Park and its buffer zone have become an area of vivid urbanization and the spread of settlements, and so it became an area not only for weekend recreation but mainly for one day.

As it is clear from the research in the last few years people have shortened the time of recreation stay in the forest area of MLP. These observations are consistent with the observations of many researchers who deal with recreational users of forests. Research Vander Stoep, Duniavy (1992) and Sisak (1996) confirm that the one-day recreation in the forests usually takes a few hours. On the other hand Roggenbuck and Lucas (1987) and Hammitt, Patterson (1993) as a result of his research found that the average period of stay for both leisure short- and long-term is gradually shortening. Preferring mainly short-term rest appears to be associated with the lack of free time. The lifestyle of most residents of large cities precludes the possibility of frequent or lengthy contact with nature.

The research shows that increasingly preferred places by respondents are the ones designed to serve as recreation. Research from 2000 showed that people resting in the woods sought rather remote places, undeveloped recreationally. The observed changes are probably the result of an intensive process of development of recreational forest MLP. It is difficult to determine whether a preference for sites developed for recreation is a phenomenon occurring only in the forests located in the vicinity of urban areas or has a wider, national dimension. Research conducted outside Poland also ambiguously settle this problem. For example, Jensen (1993) believes that much more preferred is the image of the forest without any recreational facilities. In contrast, the study Vander Stoep, Duniavy (1992) show that tourists are generally accommodating recreational forest use.

Among the most popular places for recreational purposes mentioned were those which are generally known, promoted by the mass media, present on social networks - this concerns eg. a relatively newly formed object which is the Forest Education Centre in Celestynów. Respondents indicated the place has a good location and easy accessibility. As studies have shown, forests help the implementation of various forms of recreation. Walks are the most common form of relaxation because it can take place regardless of the season, their implementation does not require large expenditures of time, special training of fitness or having expensive equipment. Generally, hiking and walking in the woods, as proved by numerous studies in this area, occupy a high part among the preferred forms of recreation (Krauz 1990, Gołos 1998, Luloff et al. 1990, Vander Stoep, Duniavy 1992 Theodori et all. 1999). In ten years in the forests of Mazowiecki Landscape Park public interest has increased in such forms of recreation as wildlife observation, horseback riding, which undoubtedly should be associated with the development of recreational infrastructure in the area. In turn, the collection of forest fruits and mushrooms, but still belongs to the popular recreational activities in our country is feasible generally only in summer or autumn. Besides forests of MLP are not particularly rich in fruits undergrowth.

Conclusion

Tourism and recreation in forest areas in Poland are a permanent phenomenon and still escalating. Creating a tourist and recreational forests requires, on the one hand, to take action to protect the natural environment and landscape, on the other hand, recognition of social needs, expectations and preferences for leisure in the woods. At the same time, as demonstrated in the study, views and preferences are not permanent. They change under the influence of many factors, generally social ones (fashion in physical activity and healthy lifestyles, increasing wealth, education, natural forest-like) and location (development of tourism infrastructure, improving transport accessibility etc.). Monitoring the dynamics of these changes allows to organize recreational space better, so that the rest was more rewarding and at the same time less disruptive to the environment.

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Souhrn
Předkládaný článek prezentuje výsledky získané z průzkumů prováděných v letech 2000 (700 měření) a 2012 (350 měření) v lesích MLP. Z těchto měření vyplývá, že preference návštěvníků lesů nejsou trvalé. Za dobu deseti let (2000 – 2012), došlo k viditelným změnám deklarovaným na četnosti a doby trvání odpočinku v lese, výběr míst a formy rekreace. Vždy se vyskytuje určité procento lidí, kteří dávají přednost odpočinku v lese a jinému rekreačnímu pobytu alespoň jedenkrát za týden. Což je možné více pozorovat v parcích. Počet respondentů tento fakt vykazuje více než v předchozích studií. Výsledky výzkumů zvyšující se podíl respondentů – rekreantů v oblasti jako je jízda na kole, jízda na koni, běhání či chůze, vzdělávání a kognice, které mohou být do značné míry spojeny s rozvojem rekreačního růstu lesů v rámci parků.

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RIVERS AND WATER RESERVOIRS IN THE ASSESSMENT OF THE RECREATIONAL POTENTIAL OF THE FOREST

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Abstract
In recent years there has been a rapid development of tourism and recreation in the Polish forests. This process is directly related to the growing importance of the social functions of forests, including recreational functions. The concept of the recreational potential is understood as the ability of the natural environment to meet human needs in terms of relaxation. Numerous studies on the assessment of the recreational potential of the forest show that the attractiveness of forest areas is closely linked with the presence of watercourses and artificial water reservoirs. The article presents the importance of surface waters in the evaluation of the recreational suitability of the forest and performs a critical analysis of methodological assumptions taken into account in the assessment of the recreational potential of the area.

Key words: water in the forest, recreational forest management, valorization of the forest, recreational suitability

Introduction
Forests have always played an important role in human lives. However, along with the development of the society the expectations of people with regard to forests have changed. The importance of non-economic functions of forests increased after the Second World War. In recent years the public interest in tourism and recreation in forest areas has been increasing as a result of growing environmental and health awareness of the population. Forests create conditions that favour the satisfaction of the needs of relaxation and restoration of biological, physical and mental strength of humans. In our climate forests – along with diversified land relief and the presence of surface water reservoirs and watercourses – constitute a key factor determining the attractiveness of any area for tourism and recreation. The importance of water reservoirs in the development of tourism is addressed among others by Wagner [2002] and Bielak [2007]. Water reservoirs, both natural and artificial, as well as watercourses, allow not only active recreation (swimming, water sports, fishing), but also a possibility to explore natural values of the environment. The purpose of this article is to present the role and importance of surface waters in the evaluation of recreational potential of forests.

Methods of the evaluation of the recreational potential of the forest
The rational use of forests for recreational purposes involves the need to assess their recreation suitability (Stanowski, Stanowska 1984, Korzeniak 1990). According to Richling and Solon (1996), no universal, comprehensive method of evaluating the suitability of land for recreational purposes has been developed yet. In numerous cases (Łonkiewicz 1986, Kostrowicki 1981, Zimny 1992) the evaluation of recreational suitability of land comes down exclusively to the calculation of its carrying capacity. A wide overview of methods for defining recreational resilience of

forest sites to the pressure of tourist traffic is included in the studies of Ważyński (1997), as well as Wysocki and Sikorski (2000). In general, methods for the evaluation of recreational suitability conditioned by the carrying capacity have been divided into two groups. The first group consists of works in which carrying capacity indexes have been developed on the basis of the detailed studies of vegetation, mainly forest floor vegetation, which is the most vulnerable to mechanical destruction. Examples of this type of works include methods of Kostrowicki (1981) and Zimny (1992). The second group comprises works of Łonkiewicz (1986), Gierliński (1990), which are based on estimated indicators. However, the evaluation of the carrying capacity of the forest does not cover all aspects of the issue of evaluation of forest recreational suitability. The potential for forest recreation largely depends also on the availability of the site. Bartman (1974), Korzeniak (1990) believe that the location of forest complexes in relation to settlements and communication system should be one of the factors to be taken into account in the assessment of the recreational suitability of the forest, especially at the level of local planning. Stępień and others (2000) claim that the degree to which particular forest areas are made available is conditioned by the distance to hard surfaced roads, tourist trails, walking paths, camping sites, or parking lots. Similarly, Zajączkowski (2000) believes that the availability of the forest for recreational purposes is connected with the presence of roads, trails and paths, the tourist infrastructure, and the slope of the land.

The evaluation of the carrying capacity and communication accessibility largely determine the recreational usefulness of the area. However, the recreational potential of the forest is also influenced by the attractiveness of the landscape. Sites with a high degree of the carrying capacity which are available for tourism may not be useful for recreation due to the lack of landscape values or their poor quality (Janeczko 2002). Generally, methods of the evaluation of landscape attractiveness are divided into two groups: classical methods and specialist methods (Śleszyński 1997).

Classical methods comprise *qualitative methods* based on nominal scales, and *quantitative methods* based on ordinal scales (Warszyńska 1974, Warszyńska, Jackowski 1979). Qualitative methods enable the classification of the area by means of such expressions as favourable/unfavourable conditons etc. This type of method was applied in the works of Bartman (1974), Korzeniak (1990), as well as Stepień and others (2000). Quantitative methods allow to determine the relative value of individual elements and their properties, expressed as a numerical value. According to Warszyńska and Jackowski (1979), a quantitative method which is commonly used is the score-based classification method which consists in assigning a certain score to selected properties of the land within the limits of the reference fields. The score-based classification method was used in the evaluation of the attractiveness of the forest by among others Rožkow (1978), Stanowska and Stanowski (1984), as well as Markiewicz and Szużmow (1992). Specialist methods consist in the evaluation of the landscape attractiveness *with the use of photos, slides* of different types of landscapes presented to respondents or *by means of surveys*. Evaluation of the visual attractiveness of the forest based on photographs or slides was presented among others in the works of Brunson, Shelby (1992), Jensen (1993), Kellomäki, Savolainen (1984). According to Janeczko (2002), the landscape attractiveness of the forest is most frequently determined on the basis of such characteristics as: the type of forest habitat, stand type, diversity of tree species and the presence of non-timber products, age of stand, its density, the character of undergrowth and shrub layer, ground cover, etc. Values associated with vegetation are most frequently subject to evaluation, however numerous authors (Mileska 1963, Warszyńska 1974, Rutkowski 1979, Dubel and Szczygielski 1982) commonly believe that the attractiveness of the landscape of the forest is also associated with the presence of surface waters.

Watercourses and water reservoirs as the element of the recreational potential of the forest

Studies show that water reservoirs play a more important role in the shaping of landscape values of the forest than watercourses, and a forest border, in particular the forest-water borderline is perceived as the most attractive visually (Janeczko 2002). Examples of the application of a score-based classification method to evaluate the recreational potential of the forest can be found in the works of Janeczko (2002), as well as Markiewicz and Szużmow (1992). In both of these methods due to the adopted scale the presence of surface water reservoirs is the factor significantly improving the attractiveness of the landscape. In the method developed by Janeczko (2002) the assumption was adopted that the point values concerning the attractiveness of individual forest areas reflect views of the public (tourists visiting the forest) on the importance of the individual elements of the environment for an overall perception of the landscape. Point values for the assessment of particular bodies of water (being in this case peat bogs, rivers, waterholes and bogs with year-round water table) were established on the basis of the structure of recreational preferences. Also Rutkowski (1978) in his method of evaluation of sites for recreational purposes considered the presence of surface waters. The basic parameters of the evaluation included the percentage of water surfaces and the length of water reservoirs' shorelines and forest borderlines per unit area (a square of a fixed size of 1 km). Similarly, Bajkiewicz-Grabowska and Mikulski (2006) also acknowledged that the attractiveness of the landscape increases together with the length of the water body shoreline. A method developed by W. Deja (2001) constitutes one more example of score-based classification methods. The author took into consideration such morphometric parameters of water reservoirs as their overall size, depth, the degree of shore development, lake extension, scrub encroachment of the shoreline, overgrowth of the surface of a lake with water plants and forestation of shorelines, which enable to designate the most visually attractive object. The above mentioned methods belong to the group of classical methods.

On the other hand, the works of Rylke and Gąsowska (2009) and Masłowski (2016) are examples of specialised studies carried out in order to evaluate the forest landscape with surface waters as its integral part. In both of these works the basis for the evaluation of the landscape were colored photographs showing a forest together with its watercourses. Rylke and Gąsowska (2009) used the photographs to evaluate the landscape of the Elbląg Canal, while Masłowski (2016) used them to assess the landscape values of the Łyna river.

Discussion

As demonstrated by the numerous studies, surface waters – both reservoirs and watercourses – are the elements which increase the attractiveness of the landscape. Therefore, they are taken into account in the evaluation of the recreational potential of the forest. The basic characteristics of watercourses and water bodies taken into consideration in the evaluation of their impact on the landscape include: their total area, the length and nature of the shoreline, overgrowth with water plants and forestation of shorelines. In the evaluation of the landscape comprising surface waters practically no elements of hydrotechnical and recreational infrastructure connected with watercourses and water reservoirs were taken into consideration. It seems that this direction of the research will be more important in the future because it contributes significantly to the development of engineering principles of forest landscaping. Setting the rank and importance of individual characteristics of water reservoirs and watercourses in the evaluation of forest landscape attractiveness will contribute to better planning of locations of artificial water reservoirs.

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Souhrn

V současné době došlo k významnému rozvoji turistiky a rekreace v rámci lesních porostů v Polsku. Tento proces je v přímém vztahu k rostoucímu významu sociálních funkcí lesa, včetně rekreačních funkcí. Koncept rekreačního potenciálu je chápán jako schopnost přírodního prostředí poskytnout člověku uspokojení vlastních potřeb z hlediska relaxace. Četné studie o posouzení rekreačního potenciálu lesních oblastí vykazují, že přitažlivost těchto prostředí úzce souvisí s přítomností vodních toků a malých vodních nádrží. Předkládaný článek tedy prezentuje význam povrchových vod při vyhodnocování rekreačního potenciálu lesa a provádí kritické analýzy metodických předpokladů, které byly vzaty v úvahu při posuzování rekreačního potenciálu území.

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SECONDARY GEODIVERSITY AND ITS POTENTIAL FOR GEOEDUCATION AND GEOTOURISM: A CASE STUDY FROM BRNO CITY

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Abstract

Geodiversity is considered to be the most important resource for geoeducational and geotourist activities. Usually the geoeducation and geotourism are developed within natural areas and they are based on the primary geodiversity (natural landforms). Nevertheless, so called secondary geodiversity or man-made/anthropogenic geodiversity (represented by the anthropogenic geosites as old quarries, pits or underground landforms) can be also viewed as a remarkable resource for these activities. Brno city is rich in these landforms; some of them already serve as excursion localities for the university students or they are used for recreation and leisure, some of them are unique (from the geoscience point of view) within the South Moravia (and even all the Europe) and they have also certain added values (historical, archaeological or ecological), however, their potential is not fully developed. The article presents examples of these geosites and outlines possibilities of the rational use for the geoeducation and geotourism purposes.

Key words: anthropogenic landforms, geosites, geoeducational and geotourist activities, quarry

Introduction

The varied lithology and morphology (the high geodiversity) of the Czech Republic are the most important resources for geotourism and geoeducation. Thanks to the long and complicated geological evolution on the contact of Bohemian Massive and Outer Carpathians, nearly every geological period can be found in the relatively small area of this country; from the Pre-Cambrium metamorphic rocks up to Quaternary sediments (Cháb et al. 2007). The landforms also present a high variety - genetically, nearly all the types of relief of the mild humid climate zone are represented here (of course, there are no coastal landforms, but in small scale, the typical litoral landforms are present at some man-made dams) (Pánek, Hradecký eds. 2016).

It is hard to say which type of relief is the “best” resource for the geotourist and geoeducational activities - some issues are very attractive (e.g. glacial landforms in Krkonoše Mountains, limestone caves and cliffs in Moravian Karst, sandstone rock cities in Bohemian Cretaceous), but there is also a big amount of features which are not so attractive for the first sight, e.g. cryogenic landforms, slope deformations or important stratigraphic sites. These hidden resources also form a basis for geotourist and geoeducational activities.

Also, the secondary geodiversity (Cílek 2002) or man-made geodiversity is a very important resource and it has great potential for geotourism and geoeducation. A lot of geosites which are used for geoeducational and geotourist purposes, are former quarries or pits (e.g. limestone quarries in Bohemian Karst are the typical feature of this area; they were also used as film exteriors, one of the oldest declared protected monument Panská skála near Kamenický Šenov is also a former basalt quarry). So, the primary ("natural") geodiversity do not have to be the only resource for the geotourist and geoeducational activities.

A brief overview of basic terminology: geodiversity, geoconservation, geotourism, geoeducation

Geodiversity is defined as "the natural range (diversity) of geological (rocks, minerals, fossils), geomorphological (landforms, topography, physical processes), soil and hydrological features, including their assemblages, structures, systems and contribution to landscapes" (Gray 2013).

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 (or geodiversity) 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 (Australian Heritage Commission 2002). Practically, the geoconservation means the protection of the most valuable part of geodiversity - geoheritage, which is represented by the particular geosites and geomorphosites.

First definitions of geotourism was focused mainly on the abiotic component (geology/geoscience oriented) and its promotion to the tourist:

- 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 1995)

Later, more holistic (complex) approach was accepted:

- Tourism that sustains or enhances the geographical character of a place – its environment, culture, aesthetics, heritage, and the well-being of its residents (National Geographic 2005)
- 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 (Dowling and Newsome eds. 2010)

As can be seen, the geotourism definitions always include the geoeducation aspect. 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 (Bajer, Kirchner, Kubalíková 2015).

Secondary geodiversity represented by anthropogenic landforms

This part brings a short overview of the types of anthropogenic or man-made landforms which represent the secondary geodiversity. The classification is based on Kirchner, Smolová (2010) and Szabó, Dávid, Loczy eds. (2010). The genetic classification of the landforms is probably the most useful for the purposes of this paper:

- mining landforms (quarry, pit, collapse sink, subsident depressions, dump, heap, shaft, adit, deep well etc.)
- industrial landforms (industrial field, heaps, industrial underground, underground factories, underground gas reservoir etc.)
- agricultural landforms (agricultural terrace, pile, ramparts etc.)
- urban landforms (terraces, ramparts, plain, cave, waste dump, urban underground, emergency shelters etc.)
- communication landforms (road or railway cutting, transport platforms, communication embankment etc.)
- water system landforms with a subset of litoral landforms (water reservoirs, dams, polders, water canals, mill race, weir, wells etc.)
- military landforms (craters, ramparts, fortification systems etc.)
- funeral landforms (funeral hill, burial mound, crypt, tomb, ossuary etc.)
- celebration landforms (menhir, dolmen, cromlech etc.)
- recreational and sport landforms (playgrounds, tourist trails etc.)
- others (archaeological excavations, grotto, research landforms etc.)

Probably the most attractive landforms from the geotourist and geoeducational point of view are the mining landforms (quarries, pits), urban landforms (underground, artificial caves) or communication landforms (road or railway cuttings).

Study area

Basement formed by the Brno Massif (part of Brunovistulicum) and its Paleozoic cover (Moravian–Silesian area) is covered by the Neogene sediments of the Carpathian Foredeep. Brno Massif is the Cadomian magmatic body (570–600 Ma old) composed of the Eastern Granodiorite Area of primitive geochemical signature and the Western Granodiorite Area which evolved within an ancient continental crust. Relics of metamorphic rocks in roof pendants of granodiorites bear traces of at least two metamorphic events. The granodiorite areas are separated by the Metabazite Zone composed of slightly metamorphosed basalts with geochemistry similar to basalts of mid-ocean ridges. This belt is the oldest proved part of the Brno Massif (~725 Ma old). The Diorite Zone is often associated with the Metabazite Zone and they are considered to be a parts of one ophiolite complex. Nevertheless, the diorite belt is assigned to the Western Granodiorite Area.

The Devonian basal clastic sediments crop out in a tectonic slice of the Babí lom zone, which separates the Metabazite zone from eastern granodiorites. This boundary is one of the most pronounced geophysical boundaries in the Bohemian Massif according to maps of regional gravity and magnetic anomalies.

The Neogene sediments of the Carpathian Foredeep cover the Brno Massif preferentially along the tectonically predisposed valleys. The Ottnangian gravels prevail in the Jinačovice trough, the Řečkovice–Kuřim trough is filled by the thick Badenian calcareous clays with sands and gravels at the base.

There is no active mine or quarry. The ores were found only as indices; on the other hand the exploitation of construction material (building stone, loess) can be traced back to the 14th century and it has markedly influenced the landscape. The most important limestone quarries are situated on the north-east of the city (Hády, Lesní lom), diorite was extracted e.g. in the north-west part, the loess and sands were exploited in the southern part of the city (Novák 1991).

Selected sites

This part briefly describes selected sites within Brno city which have a potential for geotourist and geoeducational activities. The information is based on the terrain research, Database of the geological localities of the Czech Geological Survey (CGS) and other resources (cited below).

Hády

Hády quarry includes three different sites: Hády plain, the upper bench of the limestone quarry and the lower part of the quarry (Růženin lom). Hády plain has monotone substrate (Vilémovice limestone) rugged by small stone quarries which can be confused with natural landforms. These pits have been there already since the Middle Ages. They have an important role for the local ecosystems (especially thermophilic vegetation) and they increase the overall biodiversity of the area. The upper bench of the Hády quarry is important especially from the stratigraphic and palaeontological point of view. The transgression of the Jura limestone (palaeontologically rich - the amonites, belemnites, crinoids, pelecypods, brachipods, sporadically the teeth of sharks) on the folded Devonian limestone is well visible here. In the lower part of the Hády quarry (Růženin lom), the tectonic thrust of the older rocks of Brno massif on the younger Upper-Devonian and Lower-Carbon limestone of the Líšeň formation can be observed. Also the alternation of the limestone, clay limestone and calcic claystone can be visible together with other facies which reflect the turbulent sedimentation. The bottom is flooded with the lake (Fig. 1) which is important from the ecological point of view - the halophytes and steppe species can be found here (CGS). The Hády quarry is well accessible, there are several marked path in the area and educational trail about the natural attractions of the area. The site is also widely used as an excursion locality for the university students. This complex of anthropogenic landforms is a good example how the overall geodiversity and biodiversity can be increased by the human action and how the anthropogenic landforms can serve the educational and recreational purposes.

Fig. 1: The bottom of the Hády quarry (Růženin lom) flooded with the lake
(Photo L. Kubalíková, 2015)

Červený kopec

There are two geologically and geomorphologically different localities within Červený kopec: The first one is the system of old small quarries where the Lower-Devonian conglomerate was extracted. The conglomerate has a typical red-violet colour which gave the name to the site (Červený kopec - Red hill) and it presents an illustrative and typical example of the basal clastic sediments and also show the evidence about the sedimentation environment, so it has a high educational value from the lithological and palaeogeographical point of view. The stone was extracted since the Middle Ages and it was widely used as the dimension stone; it can be found in the various walls and ramparts within Brno. The second site is the former loess pit (former Kohn's brick-kiln) where the loess profile with fossil soils is preserved. The site is stratigraphically important because it shows whole quaternary evolution (approximately 2 Ma) - this is unique within all the Europe. Thanks to the presence of this complex profile, the site has an immense educational and scientific value (a considerable number of the scientific papers were written about it). Both sites are well accessible and visible, although the second one partly suffers from vegetation growth (CGS).

Pískovna Černovice

The active sand pit of Černovice is important especially from the stratigraphical point of view. During the extraction of the material, the sediments of Tuřany terrace were displayed. They lies 40 m above the present-day level of the Svitava River and they are formed by the sands and gravels with pebbles of various provenance. Bellow this terrace, there are the Brno sands embedded. These sands were formed during the Lower-Badenian marine transgression and they include the concretions of calcareous sandstones or sandy limestone that form the benches, probably the residues of the beach sediments. They are also palaeontologically rich (CGS). The sediments of the Černovice sand pit represents the sediments of the Outer Carpathian Foredeep. The site is accessible with permission after the previous consultation with the owner. Usually, the access for the organised groups is possible.

Abrasion cliffs on Brno dam

Brno dam was constructed in the 30's of the 20th century and it considerably changed the relief of the area. The most remarkable form is the body of the dam itself (23,5 m high, 120 m long, 7 m wide), but there are other anthropogenic features that are important from the geoscience point of view. Probably the most interesting and attractive issues are the abrasion cliffs that were formed thanks to the activity of the water on the shores (e.g. thanks to the oscillation of the water level and the waves caused by shipping). They are developed on the locality of Osada in the quaternary loess sediments (Fig. 2) and they reach the height of 4 m (CGS). These landforms are a good example of dynamic geomorphological process on the litoral environment. The cliffs have also the ecological value as they serve as a place where nest various bird species (sand martin, king fisher).


Fig. 2: Abrasion cliff developed in the quaternary loess on the Osada, Brno dam (Photo K. Kirchner, 2015)

Jedovnická Street cutting (Líšeň)
On Jedovnická Street as a result of road cutting we can find a several rock profiles of Brno massif´s granodiorites (type Královo Pole). The rock profiles are mostly heavily weathered, pinkish to redish, with brown discolouring due to weathering, medium to coarse-grained biotitic granodiorites. Spectacular ones are up to 2cm long, bronz-brown, columnar (pseudohexagonal) biotites. Occurrence of these unusual shaped biotite is totally unique and cannot be found elsewhere in the world, except of localities of Brno massif. Within slope debris of this road cutting, as one of the few localities, this biotite can be very easily found and collected which has a significant educational potential.

Vejrostova Street (Bystrc)
On the right side of the Bystrc housing estate, on Vejrostova Street, there are visible road cutting in rocks of Brno massif´s mantle. Differently tectonically affected gneiss, accompanied by younger granodiorites of Brno massif (type Tetčice) and even younger veins of aplite can be observed here. The profile very well shows a position of Brno massif´s rocks in the regional context and can serve as field geology textbook.

Labyrinth underneath Zelný trh (complex of the cellars)
The underground spaces have been created since the Middle Ages. They served for aliment storing, maturing of the wine and beer, as war shelters and mainly as a background for the marketeers (the markets on the Zelný trh are held already 700 years). In 2009, the cellars and other underground caverns were reconstructed and nowadays they are one of the tourist attraction of the Brno city. From the geoeducational point of view, the Zelný trh underground is a good example of the urban underground with high historical, cultural and archaeological value. The accessibility is good and the site itself is safe (Svoboda 2008).

Ossuary under the St. James' Church
The number of the buried in the St. James' Ossuary is estimated at 50 thousands people, which makes this ossuary the second largest in the Europe. The anthropological analyse shows that there are buried the victims of the medieval plague and cholera epidemics, the victims from the Thirty-year war and the Swedish siege of Brno. The underground was opened for public in 2012 and together with Zelný trh underground it is an important tourist site in Brno. From the educational point of view, it represents the significant funeral underground landform with a high anthropological, cultural, historical, archaeological and religious value (Svoboda 2008).

Conclusion
Although some anthropogenic landforms represent big intervention to the natural ambient, some of them can increase the diversity of natural environment and they can create good basis for diversification of the ecosystems. Also, some of anthorpogenic landforms are very important from the historical and arhcaeological point of view, so the overall value of these geosites is composed of the scientific and cultural value. Moreover, some landforms uncover the features which would normally remain hidden, so they increase the geodiversity of the area. As they show the various geological issues or geomorphological processes, they can serve as a terrain handbook for Earth sciences and they can be used for the geoeducational purposes. Anthropogenic landforms are often visually attractive, so they have also the big potential for the recreational and tourist activities. Above mentioned facts should be respected and even included into the landscape management, regional planning and development strategies. The cooperation of the specialists of the different branches is also desirable (scientists, teachers in the primary, secondary and high schools, local authorities, owners of the landforms), otherwise the geoeducational and geotourist potential of these significant sites will not be fully and rationally exploited.

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Souhrn
Geodiverzita je považována za nejvýznamnější zdroj pro aktivity v oblasti geoturismu a geovzdělávání. Geoturismus a geovzdělávání jsou často realizovány v přírodních oblastech nebo v oblastech bez výrazných antropogenních vlivů, kde je využívána zejména tzv. primární (přirozená) geodiverzita. Sekundární geodiverzita (člověkem vytvořená, antropogenní) však může stejnému účelu rovněž posloužit. Tento typ geodiverzity je reprezentován zejména antropogenními formami reliéfu (lomy, hliniště, pískovny, zářezy komunikací...); při vzniku těchto tvarů jsou často odkrývány složky, které by za jiných okolností zůstaly skryty, čímž je zvyšována celková geodiverzita určité oblasti. Antropogenní formy navíc mohou ovlivňovat biodiverzitu nebo jsou významné i z hlediska historického a archeologického.
Území Brna je na tyto tvary bohaté, najdeme zde jak tvary těžební, tak tvary komunikační, sídlení, průmyslové nebo vodohospodářské. Vybrané lokality jsou používány pro vzdělávání zejména univerzitních studentů jako exkurzní lokality, mají však velký potenciál i pro vzdělávání na základních a středních školách a potenciál pro rekreaci a rozvoj lokálního geoturismu. Text přibližuje některé z nich - je zde uveden stručný popis a návrhy na konkrétní aktivity v rámci vzdělávání, rekreace a turismu. Bylo by vhodné, kdyby se tyto skutečnosti zarhnuly do strategickcýh dokumentů, případně do územního plánování. Je také žádoucí zajistit efektivní komunikaci mezi vědci, školami, úřady a vlastníky půdy, kde se tyto tvary nachází, aby bylo možné potenciál sekundární geodiverzity efektivně a racionálně využít.

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SELECTED ISSUES OF DEVELOPMENT OF ENVIRONMENTAL THINKING OF ELEMENTARY SCHOOL PUPILS

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Abstract
This paper is focused on environmental education and shows at the example of pupils of one elementary school their level of development of their environmental thinking and behaviour. The study is based on the analysis of pupils' environmental drawings and personal stories with the aim to identify significant resources or obstacles of their pro-environmental thinking that can be inspirational material for further education of elementary school pupils in this area as well as for a further research.

Keywords: environmental education, analysis of drawings, pupils

Introduction

This paper focuses on environmental education, and especially on encouragement of pupils to positive attitudes towards nature, which is nowadays a very important topic, that is also emphasized on the web pages of the Ministry of the Environment of the Czech Republic[7].

Environmental education at elementary school education is in recent years in compliance with the new principles of curriculum policy integrated as a crosscutting theme in various subjects, especially in biology, chemistry, civics, geography, but also in literature, art etc. However, pupils come to school with some potential that is the result of their inborn personality dispositions and the educational influence of their parents, surroundings, peers, but also of the overall cultural climate of society. On this basis are developed their values, which will be one of the main sources of motivation of their behaviour in adulthood.

This paper deals with one part of the issue of environmental education at elementary schools, in particular it is the identification of topics that through education and experiences internalized more deeply into the value system of pupils and have become important motivational components of their behaviour. This paper is aimed at elementary school education, because during this period is significantly developed the personality of children, their values and motivational system.

This study was conducted at the Elementary School Třebíč, Horka-Domky, thereby I would like to thank for cooperation the headmaster PaedDr. Paul Kessner, teachers as well as the pupils who participated in this research.

The aims of this study

The **primary objective** of this study is to find out with which environmental ideas and activities are pupils identified, that is which of them pupils consider their own and which of them have become a part of their lives; based on this analysis to

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[7] See "Environmentální vzdělávání, výchova a osvěta" http://www.mzp.cz/cz/evvo.

provide recommendations for improving environmental education in a particular elementary school and propose options for a further research in this area.

Secondary objectives are to find out:

- which activities pupils consider to be environmentally harmful.
- which environmental activities (issues) students do not consider to be important or they totally ignore them.
- what is the self-evaluation of students in relation to nature conservation.

The theoretical background

Environmental education has had over forty years of development and therefore there is a range of views on how to implement it effectively. In the first period it was assumed that the key to responsible behaviour is especially knowledge about ecology. In many countries including the Czech Republic is this concept still strongly anchored. But research has shown that a simple connection "knowledge – attitude – behaviour" in environmental education does not work and that the behaviour is the result of the interplay of many interrelated factors (Gošová, 2011). Broukalová (2011) distinguishes in environmental education competencies these areas: relationship to nature, relationship to a place, ecological processes and regularities, environmental problems and conflicts, readiness to act in favour of the environment.

The influence of education on future environmental behaviour studied Chawla (1999) in her work "Life Paths Into Effective Environmental Action" in which the author conducted structured interviews with open questions with several dozen environmentalists in the US and Norway. Respondents mentioned on the first and second places factors such as their experience of contact with nature, models of ecological behaviour copied from family members. On the third place were environmental and leisure time organizations whose program was situated in the nature. On fourth place – according to the importance of the motives for provoking respondents' interest in the environment – were their negative experiences with human activity in relation to nature. In this context respondents described two groups of their experiences: experiences related to the destruction of a personally important place and their fear of harmful substances (such as pollution, radiation). On the fifth place were factors associated with formal education (e.g. an inspirational teacher or lessons, field trips, internships), and other (less important) influences were also mentioned.

The development of environmental thinking is close to moral development, in which Piaget (1932) specified two main stages – egocentric and allocentric (i.e. prosocial). According to Piaget the transition from egocentric to allocentric stage is in the age about 11 years. (Unfortunately, many individuals never reach the level of the second stage). Kohlberg (1983) developed the stages of moral development in detail and identified three levels and at each level two stages. Needless to say that the highest level of moral judgment according to Kohlberg's theory should be also the goal of environmental education.

A common method of verifying the results of environmental education is a knowledge test, which unfortunately does not always positively correlated with real pro-environmental activities of students (the mere knowledge do not have to be enough strong source of motivation for the action[8]). In this survey is used analysis of drawings as the research method, because as states Davido (2008): children on the

[8] Of course I do not want to belittle the importance of knowledge. /author's note/

paper describe their conscious and unconscious wishes and drawing itself is motivated by their vested interests and by anything that what is bothering them.
Drawing is undoubtedly one of the oldest and most original expressive manifestations of human mental states. It shows a part of the conscious and unconscious personality traits; its relation to actions is closer than the spoken word. Projective value of drawing is considerable. Psychological diagnostics uses so-called thematic drawing techniques. (Svoboda, 1999).
Many author's pay attention to the specifics of children's drawings and the possibilities of their use for the diagnosis and development of children, e.g. David (2008), Cognet (2013), Thomas, Silk (1990). Vágnerová (2005) states that children manifest in their pictures their understanding of reality. Children draw only the things that are important to them or that are interesting for them. Children do not draw lifelike pictures, but their drawing is based on their knowledge of the subject and on their feelings that the subject evokes in them.

Research methods

This study has a form of pre-research and its basic method is the analysis of pupil's drawings[9] (enriched with written and oral specifying descriptions of these works provided by pupils). The task for pupils was to draw two pictures, expressing the answers to the following questions:

- "How do I to behave to nature?", "What is my relationship to nature?"
- "How do other people (or society) behave to nature?"

After drawing pictures, pupils were asked for their description and detailed explanation of the events and activities depicted in their works. (Verbal clarification was important for a full understanding of their graphic representation).
The interpretation is based on the principle of qualitative research, content analysis and is based on the so-called grounded theory…" which does not begin with the theory, but with the observation of the phenomenon and we monitor everything important that emerges." (Strauss, Corbin, 1999, p. 14). In the case of this research it was the determination of the "emerging" categories which appeared in pictures of pupils when they drew above mentioned topics.
Research questions

1. Which motives expressing a positive or negative personal relationship of pupils to nature and to nature conservation will appear in their drawings and in their additional descriptions?
2. Which motives expressing a positive or negative relationship of other people (or society) to nature and to nature conservation will appear in the pupil's drawings and in their additional descriptions?
3. Which common topics expressing a positive or negative relationship to nature and to nature conservation will occur in the drawings sporadically or not at all?

Participants
The research involved a total of 121 elementary school pupils (78 boys and 43 girls); of which 62 pupils were of the first stage (that is equal to a primary or elementary school), i.e. from 3rd to 5th grade (39 boys and 23 girls)[10], 59 pupils were of the

[9] Some these drawings were presented at the Conference "Public recreation and landscape protection 2016".
[10] 1st and 2nd grade did not take part in this research.

second stage (that is equal to a middle school, intermediate school or junior high school), i.e. from 7th to 9th grade (39 boys and 20 girls)[11].

Results and their interpretation

The analysis of pupil's drawings and their complementary explanations revealed the following categories, which are organized into two tables: the Table 1 shows the personal relationship of pupils to nature (i.e. topics expressing this relationship and their frequency in the artistic reactions of pupils), which was expressed in their drawn answers to the questions: "How do I to behave to nature?", "What is my relationship to nature?". The Table 2 provides the frequency of topics that visually reflected the question: "How do other people (or society) behave to nature?" Below each table is given a legend to the table and the detailed analysis.

After the analysis of pupil's drawings elaborating the topic "How do I to behave to nature?" and/or "What is my relationship to nature?" emerged six categories mentioned in the Table 1.

Tab. 2: Pupil's personal relationship to nature and nature conservation.

Activity / Grade	a) Forest, trees + activities	b) Outdoor + activities	c) Garbage + activities	d) Garbage - activities	e) Other + activities	f) Other - activities
3 – 5 n = 62	10	14	40	0	9	0
7 – 9 n = 59	8	12	40	4	5	3
3 – 9 N = 121	18	26	80	4	14	3

a) **The forest or individual trees associated with positive activity of pupils in the context of nature conservation.** This topic was relatively frequent in pupil's drawings and considerably more frequently appeared in the works of pupils of the first stage. Pupils mainly drew a person/s collecting garbage in the woods. For example in the explanation of his picture a pupil of the third grade states: "I helped a nearly uprooted tree, I supported it with a wood, and so I saved it." Similarly, an eighth grade pupil described his picture: "Whenever I see a small tree pulled out from the earth, I try to fix it." Another fifth grade pupil explains her picture: "I am collecting with my mum the garbage in the woods to protect the animals from eating it." A fourth grade pupil drew himself with his uncle planting trees.

b) **Positive outdoor activities and experiences in nature expressing a positive relationship of pupils to nature, or to nature conservation.** This category contains: outdoors activities with a scout, a school, with parents or friends, positive experiences from the trip in nature, the joy of the outdoor stay, gathering mushrooms; but also anger over the destruction of nature or even over a kicked mushrooms in the forest. A third grade pupil says about his drawn experience: "When I was on the trip, I liked one place and when I returned there later, it was full of garbage... it also bothers me when someone cut down trees."

[11] 6th grade did not take part in this research.

c) **Garbage and adequate manipulation with it (i.e. throwing garbage into bins and waste separation)** was the most frequent topic in the artistic responses of pupils on the theme nature conservation. Pupils drew themselves throwing rubbish in the garbage can, tidying away the scattered garbage and waste sorting. In their description they expressed that this activity is motivated by parents, school or their personal experiences (new waste dump on their favourite place). This topic pupils often associated with the forest, in which they were trying to tidy up garbage or take away a dump site. Pupils usually added statements like: "I sort garbage because it helps nature." A fifth grade pupil says: "When I see rubbish, I pick it up and throw into the bin. And the others laugh at me and say that I am a pig." Pupils very often were not able to distinguish waste sorting and recycling.

d) **Garbage and inadequate manipulation with it (i.e. throwing garbage into nature, ignoring waste separation).** This topic was represented exceptionally as self-evaluation of pupils. One student from eight grade states in the context with waste sorting that "it is not his business". Several other pupils said that their "bad behaviour" (i.e. throwing garbage everywhere) was inspired by television and other media.[12]

e) **Other activities expressing the positive attitude of pupils to nature and/or to nature conservation.** Pupils depicted various topics, e.g. their inspiration from movies and books, planting flowers, care of the fish, feeding swans, feeding birds in winter, feeding the forest animals in winter. Surprisingly, animals appeared in the drawings of pupils very rarely – but if pupils drew them their relationship to them was positive, e.g.: "We have a dog and fish. I feed the dog and play with him and pet him and he is nice to me; I also feed fish and then watch them." (Only one pupil stated that she was afraid of insects.) Third grader then says: "Who does not love nature, let do not enter it otherwise he could cause a tragedy. These people are bad and villains and they do not respect anything..." Another pupil explains: "I went into the woods with my friends and we played that one is a protector of nature and the other destroys it. And I was supposed to destroy it... and then I realized that destroying nature is bad, because it gives us oxygen and food, so I helped nearly uprooted tree, I arranged a support for it, and so I saved it."

f) **Other activities expressing the negative attitude of pupils to nature and/or to nature conservation.** One eighth grader drew himself burning plastics. Another ninth grader says that he is not interested in nature. An eighth-grade student "portrayed" himself throwing rubbish into the nature and a sad tree. He said that he did not behave nicely to nature, and therefore he is a bad person. The cause of this and similar responses can be both self-criticism and sincerity, as well as adolescent provocation but also an attempt to express a personal problem. Drawings and essays of pupils that express a deeper personal problem or deviate from the "norm" or evoke emotions in the teachers should not be let without notice but they should be the impulse to provide to these pupils a psychological support.

After the analysis of pupil's drawings solving the topic "How do other people (or society) behave to nature?" also emerged six categories (but slightly different from the Table 1).

[12] The negative influence of media on children emphasized e.g. West (2002).

Tab. 3: Relationship of other people, respectively society, to nature and nature conservation according to pupils.

Activity / Grade	a) Garbage + activities	b) Garbage - activities	c) Nature pollution	d) Forest - activities	e) Other + activities	f) Other - activities
3 – 5 n = 62	12	38	6	17	1	7
7 – 9 n = 59	10	29	13	24	5	10
3 – 9 N = 121	22	67	19	41	6	17

g) **Garbage and adequate manipulation with it (i.e. throwing garbage into bins and waste separation).** Pupils drew people throwing garbage in the rubbish bin, picking up the scattered garbage and waste sorting; or they drew only containers for recycling.

h) **Garbage and inadequate manipulation with it (i.e. throwing garbage into nature, ignoring waste separation).** This topic was the most frequent response of pupils expressing their imaginations representing the relationship of society to nature. They drew the garbage scattered around in the woods, or around containers and garbage bins.

i) **Environmental pollution (polluted rivers, air, smog from factories, cars etc.).** Surprisingly, these topics have been in drawings of pupils represented significantly less than the topic of garbage. Drawing the smoke from factories pupils repeatedly associated the Nuclear power plant Dukovany, which is obviously influenced by experiences from its closeness and also by their experiences from the school excursion.

j) **The forest or individual trees associated with negative activities of people in the context of nature conservation.** The forest or individual trees appear in the drawings of pupils to be the fundamental symbol representing nature. Negative effects of society pupils associated especially with the garbage scattered in the woods, with illegal dump sites, and less often with cutting down trees.

k) **Other activities expressing the positive attitude of society to nature and/or to nature conservation**. This topic was the least frequent in the drawings of pupils. But some pupils sketched pictures where was feeding of wildlife, agricultural activities (e.g. ploughing) or closing a factory which polluted nature.

l) **Other activities expressing the negative attitude of society to nature and/or to nature conservation**. In this category are included diverse topics emerging from the drawings of pupils, e.g. burning forests, deforestation, weeping trees, mining, polluted rivers, crying clouds, fires in the woods, kicking in mushrooms in the forest, building motorways in the woods. One eight grade pupil says: "I do not know if we can still speak about nature – it is so devastated that we can talk more about the playground, on which had a good romp 7 billons kids." Some pupils of the second stage turned away from the assigned topic and commented negatively drinking alcohol and smoking.

Environmental education at the Elementary School Třebíč, Horka-Domky
The Elementary School Třebíč, Horka-Domky is involved in the project UNESCO Associated Schools Project Network within which are also elaborated environmental topics that are part of the school curriculum. These topics include all basic environmental issues; the education is completed by numerous excursions and activities, for example[13]:

- Educational walks in the countryside in the surrounding of the school (forest, Libuše valley, Terůvky etc.).
- Competitions "Mladý Zahrádkář" (the Young Gardener), "Den země" (the Earth Day), the literary competition "The Man – a Friend (Enemy) of Environment".
- The project day "Eco Baba Yaga" – the project day for pupils of first school stage related to nature preservation, waste sorting, learning about herbs and animals.
- Teaching and activities in the school garden, (5th or 6th graders).
- Creation of a calendar of important dates (the Earth Day, the Car Free Day,the World Environment Day).
- Educational events organized by others subjects like e.g. Seiferos, Canistherapy etc.
- School excursions to: "Lesní stezka Bažantnice" (Forest Trail to Bažantnice) for 4th graders; "Waste Dump in Petrůvky","Dukovany Power Plant and Dalešice Hydroelectric Dam", for 9th graders; "TTS energo, s.r.o., Třebíč"; "Wastewater Treatment Plant" for 5th a 8th graders; the serpentine steppe in village Mohelno for 3rd graders; "Pasque flowers in villages Ptáčov and Kobylinec u Trnavy" for 2nd graders.
- Cooperation with ZOO Jihlava.
- Regular educational programmes in "School Facility for Leisure and Further Education SEV Chaloupky".

A part of environmental education is the collection of secondary raw materials and relevant competitions as well as cooperation with local and regional partners, e.g. with the Czech Gardening Union, Forests of the Czech Republic, TEREZA – association for ecological education, a shelter for dogs.

Discussion and recommendations for environmental education
The research was based on the analysis of pupils' drawings and their additional, specifying comments. In this research took part a total of 121 primary school pupils. The results were processed in two key areas: namely "Pupil's personal relationship to nature and nature conservation" and "Relationship of other people, respectively of society, to nature and nature conservation according to pupils". After analysis emerged in each area six categories (see Results and their interpretation). The research method is analysis of drawings, because the aim was to find out topics with which are the pupils identified or which they consider essential. The aim was also to avoid answering based on mere knowledge that may not be reflected in the value system and in the activities of the pupils. Of course, even using this method, we must expect a certain distortion of the results. For example, pupils can be influenced by other pupils or they will try to respond in their drawings in socially desirable

[13] According to internal documents of the Elementary School Třebíč, Horka-Domky and oral information from teachers of this school

manner, i.e. we can expect that for the questions "How do I to behave to nature?", "What is my relationship to nature?" the pupils could draw a situation that express their ideal vision but not their real activity. However, in their additional comments the pupils spoke about their real experiences and opinions. Students tended to comment the first area much more than other area in which they drew the answer to the question "How do other people (or society) behave to nature?"; here also appeared their personal experiences, but prevailed general topics related to environmental issues; when the pupils were speaking about other people we have to take into account a projection of pupils (mainly attributing their own negative tendencies to other people).

In the both analysed areas there was no significant difference between pupils of first and second stage. But in "Relationship of other people, respectively society, to nature and nature conservation according to pupils" is evident more variety and frequency of the phenomena expressing this relationship, which seems logically related to their broader overview of this issue and their experience.

In drawings of pupils as a symbol of nature prevailed definitely forest, eventually individual trees; as a basic ecological problem they depicted scattered (or unsorted) garbage or dump sites (very often in the connection with the forest); this topic was also connected with their imagination of the most frequent environmental activities – i.e. cleaning up the garbage and waste sorting. Perhaps surprising is the finding that the other pupils' activities in their works appeared less frequently (but still more often a care of the flowers and trees than the animal care and positive contact with animals or saving an animal; animal topics in the works of students appeared very sporadically).

Based on this survey, I would recommend to the Elementary School Třebíč, Horka-Domky to considered for implementation to – evidently already quite good – environmental education following:

a) More activities including the "care for nature" (e.g. students of the first stage can within a relevant subject begin to plant their "own plant" in the pot; preferably an undemanding plant, for example the money plant (Scindapsus aureus), which can be easily propagated in school and distributed to children for their further care and which can be arranged in many creative ways (e.g. it can grow up). Regularly with children to check the state of their flowers without negative evaluations (but some kind of competition is possible). After "the plant growing failure" the child should be given another chance. Try to motivate parents to let children to grow the plant themselves (but they can remind them necessity of regular care from time to time). After some period, for example at the end of the school year, children can bring their plants to school for mutual comparison. In the case that a pupil is really not interested in planting activities, do not force him/her to do it but try to find together with him/her the reasons for his/her lack of interest or try to find for him/her another "environmental" activity.

b) If it is possible to buy a school animal (e.g. fish, or animals that can be kept in a terrarium) on which the pupils – volunteers can care for, respectively to assist with the care and all pupils can regularly watch the animal/animals. (However it has to be taken into account that some students can suffer from any form of zoophobia; in this case it should be offered to parents to solve this problem with the help of a psychologist.)

c) More speak with pupils about environmental issues, to assign them "the work of arts" or essays with this topic and project them environmental films.

d) To sponsor an animal in the ZOO that pupils will regularly monitor in long-term.

e) If it is possible to cooperate more closely with the dog (cat) shelter, e.g. to participate in the promotion through drawings, photographs or essays of pupils, of which can be arranged a school exhibition for parents and for the public as well.

f) Drawings and essays of pupils that express a deeper personal problem or deviate from the "norm" or evoke emotions in the teachers should not be let without notice but they should be the impulse to provide to these pupils a psychological support.

The aim of these proposed recommendations is to try to engage students more in the contact with nature through their activities and experiences. I believe that at least some of these proposals will be successfully implemented.

Conclusion

This paper is a form of a qualitative study which is showing on the example of analysis of drawings (with comments) of pupils from the Elementary School Třebíč, Horka-Domky the level of pupils' pro-environmental development – their environmental thinking and behaviour. The aim was to identify significant resources, eventually obstacles of their pro-environmental motivation. In this study participated a total of 121 elementary school pupils. The results were processed in two key areas, namely "Pupil's personal relationship to nature and nature conservation" and "Relationship of other people, respectively society, to nature and nature conservation according to pupils". Based on the results were determined specific recommendations for the improvement of environmental education at the elementary school. The methodology used in this study can also serve as an inspirational material for the further research in this area (e.g. interesting should be a study comparing the environmental thinking and imagines of pupils after some time after implementation of some above mentioned recommendations at this school, or a comparative study including more elementary schools).

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Souhrn
Tento příspěvek řešil formou kvalitativní studie na příkladu žáků Základní školy Třebíč, Horka-Domky vývoj a úroveň jejich pro-environmentálního myšlení a chování na základě analýzy jejich kreseb s jejich upřesňujícími komentáři. Cílem této studie bylo identifikovat podstatné zdroje, příp. překážky pro-environmentálního myšlení a chování žáků. Výzkumu se účastnilo celkem 121 žáků základní školy. Výsledky byly zpracovány ve dvou základních oblastech, a to „Osobní vztah žáků k přírodě a k ochraně přírody“ a „Vztah ostatních lidí, resp. společnosti k přírodě a k ochraně přírody dle žáků“. Základní téma, které se objevovalo ve výkresech žáků, bylo téma odpadků (často ve spojení se znečistěným lesem); toto téma bylo vnímáno jak negativní ekologický jev, který způsobují ostatní, tak také jako podnět k ekologickým aktivitám žáků (často kreslili sami sebe, jak třídí odpad a/nebo sbírají odpadky v přírodě). Možná překvapivě ostatní aktivity (např. péče o rostliny či zvířata) byly v pracích žáků (jak v kresbách, tak v jejich doplňujících popisech, příp. vyprávěních) zastoupeny minimálně. Na základě těchto výsledků byla stanovena konkrétní doporučení pro zlepšení environmentálního vzdělávání na této základní škole, ve kterých jsou navrženy aktivity obsahující více aktivních činností spojených s přímým kontaktem s přírodou (např. individuální pěstování rostlin, pravidelné pozorování školního, příp. sponzorovaného zvířete, propagace útulku pro psy, příp. pro kočky založená na výstavce „uměleckých“ prací žáků inspirovaných exkurzí v tomto zařízení). Použitá metodika může také sloužit jako inspirativní materiál pro další výzkum tohoto charakteru (např. zajímavá by byla studie porovnávající environmentální myšlení a představy žáků po nějaké době od zavedení některých doporučení uvedených v této studii v této škole nebo realizace srovnávací studie zahrnující více základních škol).

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SPRINGS OF WATER IN LANDSCAPE AS A TRIP DESTINATION

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Abstract
The article deals with the rises of springs – wells in the northern part of Brno-venkov district. Observed wells are managed by Lesy města Brna, a.s. (company managing the forest estate of Brno city). The research involved 10 springs, however the presented results apply to the for of them. The aim of research was the water quality assessment, especially specification of the parameters carried out monthly in situ: water temperature, pH, content of oxygen. Further the water yield was monitored and following parameters were evaluated in laboratory twice during the assessed period: pH, conductivity, alkalinity, chloride, ammonium, nitrate, nitrite, chemical oxygen demand by permanganate, turbidity, color, calcium, magnesium, ferrum, coliform bacteria, colonies of 36° and 22° C. Sources had been monitored from May 2014 to March 2015. The overall situation of wells and the surrounding area was also evaluated, eventually proposed measures to improve their condition and function. The accessibility and connections to the tourist trails were also assessed.

Key words: spring yield, water quality, water temperature, well

Introduction
Springs and wells have been from of old a grateful source of water both for drinking and refreshment. In the past, sources of drinking water had great importance, especially when working in a forest or in fields, where they often represented the only source of water for refreshment for working people. The wells were often associated with supernatural beings and phenomena, and thus became a place of worship and therefore represented also the destination for many pilgrims. Later, during many years, wells have been neglected, became part of the amelioration of the landscape and often damaged and abolished. Today wells and springs in the landscape again become renewed and the attention is paid to them. Although their function as a source of drinking water is often secondary, they are primarily perceived as an important element in the landscape, a place of tourist significance also as an aesthetical and functional element.

Materials and methods
The study was prepared on the initiative and in cooperation with Lesy města Brna, a.s. From the wells, located on the territory of forest owned by the city of Brno, ten of them were selected for regular monthly measurements. The measurements, field survey and observation of the sources of springs formed the basis for this work. The paper is focused on wells in the cadaster of Lelekovice. The area is very frequently visited by tourists mainly from Brno and there is kept mainly short-term suburban recreation.
In April 2014, the current state of selected locations and the natural conditions of the area were explored at first. The exact position of each spring was located with the aid of GPS device Trimble Juno ST program TerraSync.
The particular measurements were carried out monthly from May 2014 to March 2015. The values of pH, water temperature and oxygen saturation were measured

by means of the Multi 340i device. Measurements of water yield were accomplished by direct measurement. In October 2014 and February 2015, the water samples were taken for laboratory testing of water quality. Samples were processed by Brněnské vodárny a kanalizace, a.s. Water quality was assessed according to the Ministry of Health Decree no. 252/2004 Coll., Laying down hygienic requirements for drinking water, hot water and the frequency and scope of drinking water control.

In the laboratory conditions, it was assessed the pH, conductivity, alkalinity, chloride, ammonium, nitrate, nitrite, chemical oxygen demand by permanganate, turbidity, color, calcium, magnesium, ferrum, coliform bacteria, colonies of 36° and 22° C.
For selected wells the proposals to improve both its neighborhood and eventually the technical design of the structure of wells were made.

Results

Pod Obrázkem spring

Localization
Altitude: 408 m.a.s.l.
GPS: 49°17'50.572"N, 16°35'21.105"E
The well is located by the forest pathway connecting Lelekovice with the green tourist trail. The well is named after the icon of the Virgin Mary, which can be found on a tree on the green trail leading over the spring. This route was formerly pilgrimage route to Vranov.
The spring is formed by a concrete stave, from which water flows out of the pipe into the wooden channel (Fig. 1). The water flows through the narrow pipe on a forest path from there.
The water in the well is undrinkable – not suitable pH and there is an increased incidence of coliform bacteria (analyses of water from the spring: October 2014 and February 2015). Even so we find mugs next to the well. (Borunská, 2015)
In the dry season, water does not flow during the year and is mostly microbiologically contaminated. Conductivity reaches the value of 40 to 52 $mS \cdot cm^{-2}$, the water hardness is lowest during snow melting 1.7 $mmol \cdot l^{-1}$ and the highest at the end of November up to 2.4 $mmol \cdot l^{-1}$. The chloride content varies from 3 to 14 $mg \cdot l^{-1}$. (Drápalová, 2002)

Fig. 1: Pod Obrázkem Spring

U Lavek spring

Localization

Altitude: 450 m.a.s.l.

GPS: 49°18'36.362"N, 16°35'0.599"E

The well can be found beside the forest road connecting Lelekovice with the crossroad U Jelínka, near the nature reserve Babí lom.

The spring is protected by stone brickwork and covered by wooden roof. The well is formed by a concrete sump, into which the water flows from feed pipe. The water accumulates in the sump (Fig. 2).

The water is soft with 2 $mmol \cdot l^{-1}$ of hardness with high sulphate content of over 200 $mg \cdot l^{-1}$. Water is therefore not of the best quality, however the indicated limit for sulphate 250 $mg \cdot l^{-1}$ is not exceeded and the nitrite content is below 15 $mg \cdot l^{-1}$. The spring also contains 0.04 $mg \cdot l^{-1}$ of nitrite (limit of 0.1/0.5). On the surface, we can see the blue clumps formed by the primitive wingless insects – water springtails: *Collembola*, *Podura aquatica*. (Drápalová, 2002)

The water quality in the well is unsatisfactory due to low pH and increased incidence of coliform bacteria (analyses of water from the spring: October 2014 and February 2015). (Borunská, 2015)

Fig. 2: U Lavek Spring

Brčálka spring

Localization

GPS: N 49°17´51.00´´, E 16°34´59.88´´

Altitude a: 368 m.a.s.l.

Brčálka fountain is located behind the Lelekovice municipality towards Babí lom watchtower near the retention reservoir. It is a shallow flow underpinning spring, often visited by people from the neighborhood. The well is of natural character. The entire structure is built of natural quarry stone, from which the spout sticks out (Fig. 3). The spring is detained by the stone wall on cement mortar. Water flows through the steel effluent conduit into the stilling basin reinforced by stone. The results of observation show the well is much-frequented by locals. Laboratory analyses of water samples meet Decree no. 252/2004 Coll. for drinking water. In November, there was discovered a spring of fresh water, which is located approximately two meters from the well to the left. Beside the well, there is a small wooden bench that was probably built by local residents. Surroundings of well is maintained and clean. The disadvantage of well is almost constantly waterlogged footpath leading to the spring. (Stehnová, 2015)

Fig. 3: Brčálka Spring

Olšová spring

Localization

GPS: N 49°18´16.92´´, E 16°34´55.86´´

Altitude: 430 m.a.s.l.

Spring Olšová is located north of the Lelekovice municipality approximately 800 meters along the paved forest road leading from Lelekovice around the well Brčálka. The well is located at the eastern bottom of Babí lom. The spring is also known as "U silničky".

The well was built at the end of 80s of the 20th century by members of the Czech Union for Nature Conservation from Lelekovice. The spring can be characterized by very volatile flows throughout the year. The water yield ranges from 0.8 to 60 $l \cdot min^{-1}$. The discharge can be manifold increased after greater rain event. That is a shallow groundwater flowing downslope away from the watchtower at Babí lom at a depth of several meters. Spring Olšová is of natural appearance and is built of quarried stone on cement mortar. The well is diverted into the headwater reservoir into which visitors can look through a steel door on the side of the stone structure of well (Fig. 4).

The environment of the well is clean and tidy. There are not significant waterlogging sites of concentrated runoff. The well is provided with information boards which notify visitors of history and natural surroundings. The board says the water is "perhaps still drinkable." Laboratory analysis showed that water does not comply Decree no. 252/2004 Coll., On requirements for drinking water – unsuitable pH, COD and coliforms. (Stehnová, 2015)

Fig. 4: Olšová Spring

In order to keep the extent of the article, the graph of measured water yields of springs was selected as the one from all investigated parameters, see Fig. 5. All the values of the measured data and the results of the analyses are available at the authors of the paper.

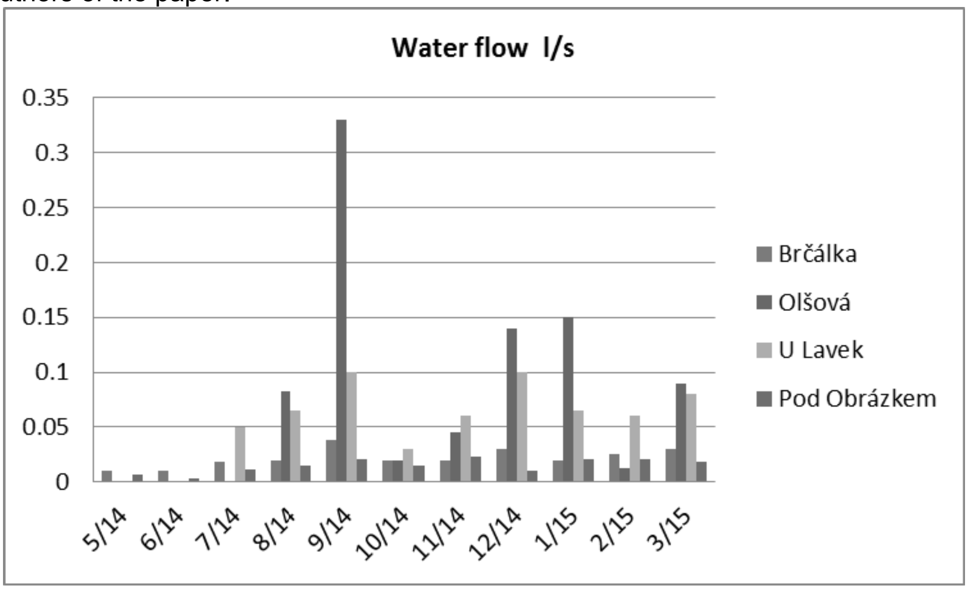

Fig. 5: Water yield of monitored springs

Featured wells are located northeast of the Lelekovice municipality near the roads, either directly tourist trails or the forest road (Fig. 6). All the wells are easily accessible and could be linked by educational trail devoted to the springs and wells. The proposed route is long about 4.5 km, the altitude ranges from 321 m.a.s.l. to 472 m.a.s.l. Information boards would notify of the water quality in the well, flora and fauna in the area, furthermore would contain a detailed description of the construction of wells. Small structures made of wood are addressed in article (Kotásková, 2011).

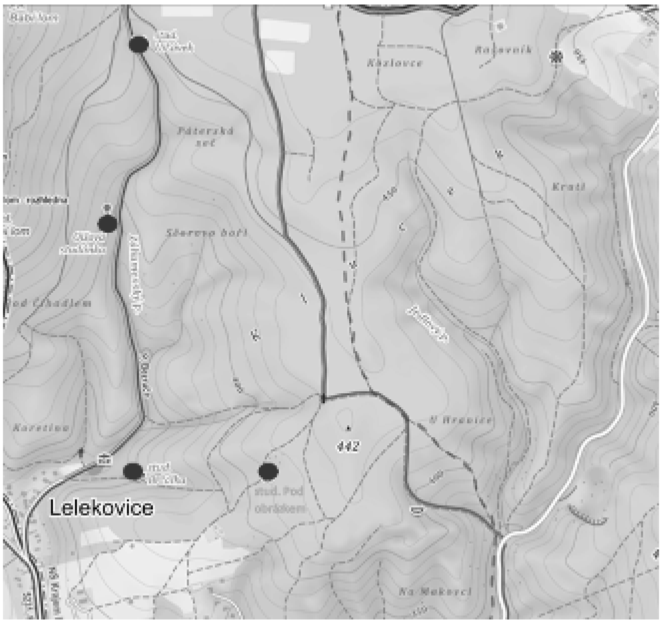

Fig. 6: The location of wells

Discussion

Most of the wells historically served as a source of drinking water for the pilgrims, wayfarers and forest and field worker. Unfortunately, the water quality in wells is mostly poor due to human activities in the watershed. The investigated wells in the Lelekovice cadaster are in the area, which is widely used for short-term suburban recreation. The wells often attract a refreshing, especially if the spring and its surroundings are properly maintained. These places can represent a source of inspiration for us, lessons and relaxation. If the selected wells represent the stopping point of educational trail, it is advisable to provide information about the quality of the effluent. However the maintenance and exaggerated effort to beautify the place can be counterproductive, partly increased movement of people can damage the headwater area, and also modified spring, but with polluted water would be a source of problems.

Conclusion

Selected monitored wells managed by Lesy města Brna, a.s. are located in the northeastern part of the Lelekovice municipality. There are four wells: Brčálka, Olšová, Pod Obrázkem a U Lavek. Water from the wells was subject of analyses accomplished in the period from May 2014 to March 2015, when the pH, conductivity, oxygen content, temperature and water yield had been monthly monitored. Moreover, during the period the following parameters were assessed: pH, conductivity, alkalinity, chloride, ammonium, nitrate, nitrite, chemical oxygen demand by permanganate, turbidity, color, calcium, magnesium, ferrum, coliform bacteria, colonies of 36° and 22° C. The wells were chosen as suitable for the design of a educational trail "O Pramenech" as these are easily accessible from tourist trails or forest roads. The trail circuit would be about 4.5 km, with a difference in altitude of about 150 m. However, water quality analysis showed that water in most of the wells does not meet the requirements of the Decree no. 252/2004 Coll., Establishing requirements for drinking water. The biggest problem in evaluating the quality of water sources are coliforms. The only spring Brčálka met requirements for drinking water during the reporting period.

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Souhrn

Předkládaný článek se zabývá vyvěrajícími prameny – studánkami v k. ú. Lelekovice. Sledované studánky jsou ve správě Lesů města Brna, a.s., sledováno byla celkem 10 pramenů, zde jsou publikovány výsledky čtyř vybraných studánek. Hodnocena byla kvalita vody, a to parametry stanovené měsíčně v terénu: teplota vody, pH, obsah kyslíku. Dále byla sledována vydatnost a dvakrát během sledovaného období byly laboratorně hodnoceny: pH, konduktivita, alkalita, chloridy, amonné ionty, dusičnany, dusitany, chemická spotřeba kyslíku manganistanem, zákal, barva, vápník a hořčík, železo, koliformní bakterie, kolonie 36° a 22 °C. Prameny byly sledovány od května 2014 do března 2015. Byl také hodnocen celkový stav studánek a jejich okolí, případně navržena opatření pro zlepšení jejich stavu a funkce. Také byla hodnocena dostupnost a napojení na turistické stezky.

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SUPPORT OF DEVELOPMENT OF LANDSCAPE NOT-PRODUCTION FUNCTIONS IN SPATIAL PLANNING AND LAND CONSOLIDATION

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Abstract
In the Czech Republic, two basic processes exist forsupporting protection and creation of agricultural landscape as a whole and in its particular components: spatial land planning and land consolidations. Both of them are sophisticated processes with a long tradition and evolution that hold a fixed and irreplaceable position in planning and reorganization predominantly of rural space. Their goal (besides creating conditions for rational management, increasing ecological stability, and others) is to improve the landscape aesthetic value and recreation potential, and to preserve the landscape character.
Based on the needs of professional practice,an update of the methodology entitled "Coordination of Spatial Plans and Land Consolidations" was published in 2015. This important text provides detailed instructions for designers of spatial plans and land consolidations in order to coordinate their work and optimize their mutual cooperation and utilization of groundwork documents. It is also intended for municipalities, land offices and professional public.
Our contribution presents the general structure of this methodological material and focuses on the potential of its implementation for development of recreation and related landscape functions.

Key words: coordination of spatial planning and land consolidations, landscape aesthetic value, recreation potential, landscape character

Introduction
The main goal of the updated methodology "Coordination of Spatial Plans and Land Consolidations" is to introduce, both to professional and lay public, the need of close coordination and mutual relationship of two essential planning documentations dealing with the rural space (landscape), i.e. spatial planning and land consolidations. The current practice shows frequent misunderstandings leading not only to time delays in implementation of projects related to both processes, but also to reduction of effectiveness of the invested finances.Based on several years of experience, the methodology shows, in a short and simple way, the points where those two planning documentations meet, where their common interests lie, and where they can complement each other.The methodology should thus define the contact points for possible cooperation of both documentations and declare the need to manage the rural space jointly and comprehensively.
The long-lasting search for effective means of preservation and formation of a poly-functional harmonic and sustainable cultural landscape in our country has resulted in two main instruments playing an essential role in its appearance. These instruments of public administration are spatial plans (SP) and land consolidations (LC). Both are sophisticated processes with rather a long tradition and evolution, holding a firm and irreplaceable position in planning and reorganization of undeveloped, especially

agricultural, land.The common aim of these instruments is to reflect and specify the public interests in the agricultural landscape.Among them are for example:

- effective and sustainable management in the landscape,
- increase of ecological stability of the landscape,
- provision of the landscape patency,
- protection of land against floods, and water and wind erosion,
- protection and increase of the aesthetic and recreation value of land and its landscape character.

Taking in consideration the topic of the conference, we must emphasize this particular function, which is ensured by proposals of the measures supporting recreation and tourism on the territory of the given community.Among them are,for example, design of new or adaptationof existingwater reservoirs for recreation, creation of scenic overlooks including clearing of vistas, especially in the case of a historic composed landscape. The main goal, however, is to make the landscape permeable for both pedestrians and cyclists and to ensure accessibility of all the above-mentioned recreation targets.Indeed, numerous examples of implemented elements ofthe Spatial System of Ecological Stability (SSES)show that their function can be joined with the recreation needs (a pond for swimming with a shelter for sitting combined with a bio-centre, wood species with a function of bio-centreaccompanying a touristic trail or cycling path, etc.)

Spatial planning establishes the basic concept of development of the particular area, preservation of its values, surface and spatial organization, concept of the landscape organization and public infrastructure, andensures protection of the required land for these functions.The level of details in the concept and discussions of the spatial plan are not intended for immediate implementation of the included objectives – spatial planning is therefore a conceptual, not an implementation document.

Land consolidations deal with undeveloped land at the level of proprietary land parcels. They divide or integrate the land parcelsspatially and functionally, provide access to the land parcels and solve the ownership relationships.At the same time, these consolidations are aimed to propose and implement measures for improving the environment, preservation and enrichment of the land fund, water-management measures and measures increasing the ecological stability of the landscape. The land consolidations include both design and implementation of the proposed measures and facilities.As concerns recreation, the common land consolidation facilities offer the unique possibility to bring the above-mentioned proposed measures for recreation into the form of documentation for zoning proceedings.

The current practice of acquisition of spatial plans and processing land consolidations shows frequent misunderstandings about the contact points in which both these instruments have to be mutually coordinated. Also, there is no comprehensive guide as to when and what objective should be taken over by the other party and at what level of detail. The methodology should therefore not only introduce the interested professionals in both these areas to the processes and methods ofpreparing these important documents related to undeveloped land (free landscape), but namely define the possibilities of mutual cooperation.

Both these processes intersect in the design of common facilities of land consolidations and definition of public utility constructions, and in public utility measures in the spatial planning designs.These points reflect the public interests for further development of the area.

Material and Methods

The main problems of coordination between spatial planning and land consolidations can be encountered in the following points:

Time horizon

- The spatial plan is evaluated at regular intervals at least once in four years, and changes in the spatial plan and possible and acceptable.
- The expected validity of land consolidations is long-standing, changes in borders of the land property are very difficult and costly, land parcels and basic landscape structures are reorganized.

Processed content

- The spatial plan is a conceptual document for land development and use.
- The plan of common facilities, which is an integral part of the land consolidations, is processed at the level of building documentation for zoning proceedings.

Processed details

- The spatial plan works with surfaces and corridors.
- Land consolidations deal with details of proprietary land parcels.

Form of discussion – approval

- Both documents are discussed with the relevant organs, municipal authorities and the public (land owners), but there are differences in possible settlement of objections and comments from the side of land owners.
- During land consolidations, the position of the land owner is crucial, and the consolidation cannot be successfully completed without approval of the owners of a minimum land surface given by the law. The spatial plan can be issued even without approval of the land owners touched by the spatial planning.

Both spatial planning and land consolidations are influenced by a number of professional documents playing a role in the process of elaboration, discussion and approval of the facility. These documents mainly represent general plans (for traffic, flood protection, spatial system of ecological stability – SSES, etc.), which aremore easily reflected in the spatial planning than in land consolidations.Among other problems, adequate cooperation between spatial planning and land consolidations is hampered by the fact that there is no “official” way to provide all data from territorial analytical documentationsneeded to prepare the land consolidation.

Coordination of spatial planning with land consolidations is based on valid laws of the Czech Republic, in particular on the building act (Act No. 183/2006 Sb., as subsequently amended) and land consolidation act(Act No. 139/2002 Sb., as subsequently amended). The presented methodology provides a summary of relevant regulations with a brief process of acquisition of a spatial plan and the process ofdesigning a land consolidation. It also offers more detailed description of the recommended procedures for elaboratingthe spatial plan and a design of a land consolidationfor subsequent variant situations that may occur in the area of interest.

1. The municipality possesses a valid spatial plan and the land consolidation is started.
2. The area of interest includes an existing land consolidation recorded in the real estate register, and there is a subsequent change in the valid spatial plan, or a new spatial plan is designed.
3. The spatial plan or its change is acquired and processed in parallel with the land consolidation.

4. The spatial plan is acquired with regard to the possible future design of a land consolidation.

The relationship between spatial planning and land consolidations

By defining the built-in area and the area for development, the spatial plan establishes the inner border of the area for land consolidations relative to the settlement area.This may also lead to the situation where the land consolidation applies to built-in surfaces as well, if it is approved by the owners of these land parcels and if this area needs to be solved in more detail (i.e., at the level of ownership rights). For example, due to the harmless water drainage into a recipient, the land consolidation may also include the built-in area or area for development.If the land consolidations have beencompleted and recorded in the real estate register before the spatial plan is acquired and issued, they may also include areas defined later by the spatial plan as areas for development.

The spatial plan expresses its resolution by structuring the administrative territory of the particular municipality into areas of different use, by establishing conditions for their use, by delimiting corridorsfor the traffic infrastructure (including specificcommunications) and for public utility facilities of non-building nature (including e.g. bio-corridors).

In this way, the spatial plan reflects the proposed concepts in the territory (urban concepts, landscape structure concept, public infrastructure concept), which are then elaborated in more detailed documentations (regulation plans, documentations for zoning proceedings). The landscape structure concept is more precisely processed in land consolidations, which by the degree of detail are at the level of aregulation plan. The land consolidation can be established as a regulation plan for an undeveloped area, and the designof a common facility (as part of an LC)serves at the level of the overall documentation for zoning proceedings.

Excessively accurate or too detailed spatial plansrepresent one of the basic reasons for conflicts between spatial planning and land consolidations.The spatial plan must provide adequate space for designing land consolidations.Only at the level of LC, the proprietary rights are resolvedfor land parcels where the measures for ensuring landscape permeability and land parcel accessibility, land conservation, and flood protection should be implemented, thus ensuring the above-mentioned proposals supporting the recreation landscape attractiveness.

The spatial plan, similarly as it cannot place individual buildings in the areas of housing, public infrastructure and other, cannot place the landscape measures in the undeveloped areas.Based on the data relevant for the design of concepts, it must define and justify location of the areas and corridorswhere the landscape measures should be adopted. This distribution of areas and corridors is therefore onlyindicative and must also allow adequate tolerance for the design of a particular technical measure in land consolidations.Moreover, it also includes designs of water-management and anti-flood measures based on precise hydro-technical calculations and consideration of ownership rights, orientation of the proposed land parcels, and possible supportive organizational measures. The same holds for the design of the traffic network and SSES elements. These are proposed according to the positioning of the actual state, need for accessibility of proprietary land parcels, suitable configuration in the terrain, and technical requirements of the individual proposed structures.The designer of a land consolidation may face the problem of a required change in the spatial plan that was submitted only afterapproval of the common LC facilities.In these cases, it is important to establish the degree of tolerance for more accurate location of the common facilities with regard to the required change, taking

into account the accuracy of the background documentation as well. Land consolidations utilize accurate and updated positioning of the actual state as the main background.
Parties acquiring the spatial plansshould claim a reasonable degree of precision from the designer, but also from therelevant organs (for example, organs of wildlife protection sometimes require inadequately detailed definition of SSES elements). During the discussions over the design of spatial plans, the relevant organ administering the land consolidation should check whether the concept for landscape organization has not been determined with excessive precision.

Resultsand discussion –support of non-production landscape functions in spatial planning and land consolidation
It is logical that the overlap in managing spatial plans and land consolidations mostly relates to the landscape measures.
Concerning the SSES design, there are two basic phases. The first phase includes definition of the SSES and the second creation of the SSES. The SSES system is mostly designed during the process of spatial planning.Depending on the scale of the spatial planning documentation, theSSES is gradually defined in more detail in accord with the relevant data that are available at the particular spatial planning documentation level (Principles of Spatial Development, SD). The spatial plans define the areas and corridors for SSES elements fulfilling quantitative and spatial parameters for their creation in a more detailed design.
Land consolidations only deal with local SSES. In practice, regional and supra-regional SSES are usually not adequately treated due to their high spatial requirements. The plan for common facilities must lead to a proposal of a feasible SSES design(a set of life science, technical, economic, organizational, and property-right issues). Designs of SSES serve as an indispensable background for implementation of the land consolidations.
The spatial plan cannot locate the SSES elements to particular land parcels until their localization has been decided in an administrative procedure (e.g. by declaration of a particularly protected area). The spatial plan can therefore allocate SSES to only those areas and corridors that fulfil the criteria for SSES creation in the particular administrative procedure. On the other hand, they must not be excessively over-dimensioned, becauseunfounded blocking of land that could be used for other purposes is not in the public interest. The person processing the spatial plan is dealing with a difficult task to balance these SSES elements with the needs of the particular territory and the public interest, because the land consolidation must be subsequently approved by the relevant owners.
The landscape patency can be roughly reduced to tracing specific communications, the cause of most common conflicts. The concept of landscape organization expressed in the spatial plan can present the landscape permeability in three ways:

- by stabilizing the existing specific communications,
- by proposing renewal of functionless communications,
- by delineating corridors for new access communications.

Delineation of specific communications in the concept of landscape organization is aimed particularly at:

- joining settlements and their partsfor pedestrian and non-motor transport,
- providing accessibility to recreation localities in the landscape both for local inhabitants and for visitors – tourists and recreating people,
- joining agricultural and forest specific communications,

- connecting buildings and facilities located in undeveloped areas to the public road network.

The extent of design of corridors for new specific communications and possible renovation of the non-functional field paths must be proposed in the spatial plans in consideration of their investment requirements and the necessity of subsequent management of the specific communications.
Again, the spatial plan proposesa corridor for the building structure, not the structure itself. Only the land consolidations locate the building of specific communications with their precise position in particular proprietary land parcels.While planning the common facilities, specific communications are designed in orderto provide access to the proposed proprietary land parcels.
The concept of landscape organization must take into account the erosion risk of the particular territory.Based on available professional documentation, it defines the areas threatened by erosion in the landscape and establishes conditions for their use in dependence of the need to solve the increased erosion risk.
The design of a particular erosion control measure and its location is resolved by land consolidations, by proposal of common facilities. Only in the framework of a land consolidation,anerosion controlmeasure may be proposed, e.g. by suitable division of a long slope with a field path, changing the land parcel orientation for adequate management along the contour, changing factor C (effect of vegetation cover) in the calculations of erosive wash,or by a proposal for grassing or foresting.
The concept of landscape organization must also take into consideration the need for protecting selected parts of the region against floods. Its design is mainly based on professional documentation and outputs from water management planning,in particular the “Plans for Management of Flood Risks”issued by the Ministry of Environment as a set of measures of general nature. These plans specify the “Programmes of Measures”, which represent the principal tool for achieving the objectives specified in the plans.Other important materials are maps of flood risks and maps of flood threats.
Spatial planning cannot substitute for the planning of water management by proposing particular flood control measures in the particular region. The spatial plan must ensure that the area is ready for implementation of the “Programmes of Measures”. For the issued measures of general nature, the spatial plan will define the areas or corridors for public utility measures. Their localization in particular land parcels shall be designed by land consolidations.Protection against floods requires double efforts invested into detailed calculations andnecessary documentations for a particular adequate measure in theLC. Protection of human lives and property is at stake, and this requires detailed documentation treated with responsibility.
Both erosion and flood control measures often display a poly-functional character.Beside slowing down water runoff and increasing water retention in the landscape, preserving soil and water, they can contribute to better landscape patency (e.g. by means of a path witha collecting ditch), to increased ecological stability (if they are part of a bio-corridor or bio-centre) and to increased landscape aesthetic features (water surfaces, planting ofareal, linear or solitary woody species).
The concept of landscape organization can define areas for non-sojourn recreation and relaxation, offering the local inhabitants a suitable environment for short-term recreation and relaxation.A similar function can be fulfilled by areas of mixed undeveloped areas.The spatial plan can enhance the existing recreation potential by

designing areas for recreation(water surfaces, points of vistas) and also by development of a network of specific paths, cycling paths,etc. In this regard, the land consolidation can only explain these proposals of the spatial plan to particular owners, because its main taskis to get approval with the proposed land consolidationfrom the owners, or optionally from the tenants and users.

Conclusion

Spatial planning and land consolidations represent sophisticated, original documents with essential influence on the character of the territory in our country.Each of them is irreplaceable in its action, but there is still sufficient space where both these documents blend, and their specific roles and scope must be delineated. We may expect that particularly the role of the recreational function of the landscapewill be increasing.This methodology attempts to bring about the necessary mutual coordination of the processes used by both these instruments and to define their rules based on the experience from acquisition and implementation practice.

The methodology was created and disputed by professionals – experts in acquisition and designing of both instruments, and should therefore serve as a guideline. However, it is obvious that specific cases not resolvable by the guideline will be encountered in the practice, and in that case one will have to think and proceed individually.

Its next fate depends on dear readers, to whom it is addressed – how they will accept it, what they will find in it, and what they will miss. The team of authors of the methodology will be grateful for any constructive comments leading to its desired improvement, and thus to its more versatile use.

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Decree No. 500/2006 Sb., onspatial analytical documentation, spatial planning documentation and themanner of recording spatial planning activities, as amended by Decree No. 458/2012 Sb.

Act No. 139/2002 Sb., onland consolidations and land offices,as subsequently amended.

Act No. 503/2012 Sb., on the State Land Office and changes of some related regulations, as subsequently amended.

Decree No. 13/2014 Sb., onthe proceeding of implementing land consolidations and requirements for the design of land consolidations.

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Souhrn
V České republice existují dva základní procesy podporující ochranu a tvorbu zemědělské krajiny jako celku a v jejích jednotlivých složkách: územní plánování a pozemkové úpravy. V obou případech se jedná o propracované procesy s dlouhou tradicí a vývojem, které zaujímají pevnou a nezastupitelnou pozici v plánování a přetváření především venkovského prostoru. Jejich cílem (vedle vytváření podmínek pro racionální hospodaření, zvyšování ekologické stability aj.) je zlepšení estetické hodnoty krajiny, rekreačního potenciálu a ochrana jejího rázu.
Na základě potřeb odborné praxe byla v roce 2015 publikovaná aktualizace metodiky Koordinace územních plánů a pozemkových úprav. Tento významný dokument poskytuje projektantům územních plánů i pozemkových úprav podrobný návod jak koordinovat jejich práci a vytěžit maximum ze vzájemné spolupráce a využití podkladových materiálů. Je také určen obcím, pozemkovým úřadům a odborné veřejnosti.Příspěvek prezentuje obecně strukturu zmíněné metodiky a zaměřuje se na možnosti jeho využití pro rozvoj rekreační funkce krajiny a souvisejících funkcí.

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SUPPORTING OF SUSTAINABLE TOURISM DEVELOPMENT IN LLAQUEPATA COMMUNITY, CUSCO, PERU

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Abstract
The article presents model project focused on the development of Community Based Tourism in Llaquepata , which is a mountain area located in the Sacred Valley at a distance of about 22 km from Cuzco. The local population has very few economic alternatives. Main activities are agriculture, focused mainly on cultivation of corn and potatoes and livestock in very small quantities. The main objective of the project aims to facilitate the economic and social development of this community through the development of sustainable tourism, which would also sought to maintain current environmental and cultural values that the community has. An internal potential of the community, making it possible to develop a sustainable tourism is based mainly on key elements such as: tourist attractive natural environment, strong cultural base, cultural heritage and traditions that have been preserved from the pre-Hispanic period, but also initiative of the members of the community in this field. The solution of community standards of living increasing is proposed on the development and support of community-based tourism through arranging a tourism programme and preparing the community members to arrivals of external visitors.

Key words: sustainable tourism, community-based tourism, regional development, rural development, poverty reduction

Introduction

The tourism and socioeconomic development of regions

To provide the tourist activity in the region as a development tool in the area is feasible given that tourism has been recognized for more than half of the world's poorest countries as an effective tool to participate in the global economy and to combat against poverty. Additionally, tourism was already in 2002, according to the WTO , the main source of foreign income in 46 of the 49 Least Developed Countries (Kadubcová, 2014). Due to the importance of this activity, in the 2011, this organization has joined seven organizations and programs of the United Nations in order to create a Steering Committee of the United Nations Development Tourism. Second, tourism is a key tool to promote and enhance the cultural heritage, natural and technological reaffirming cultural identity. To do this, it is necessary to: a) Deepen the recovery of ancestral traditions and techniques from all areas, b) and it is essential to systematize them to contribute to the development of current technologies (Navarrete, Coll, 2012)

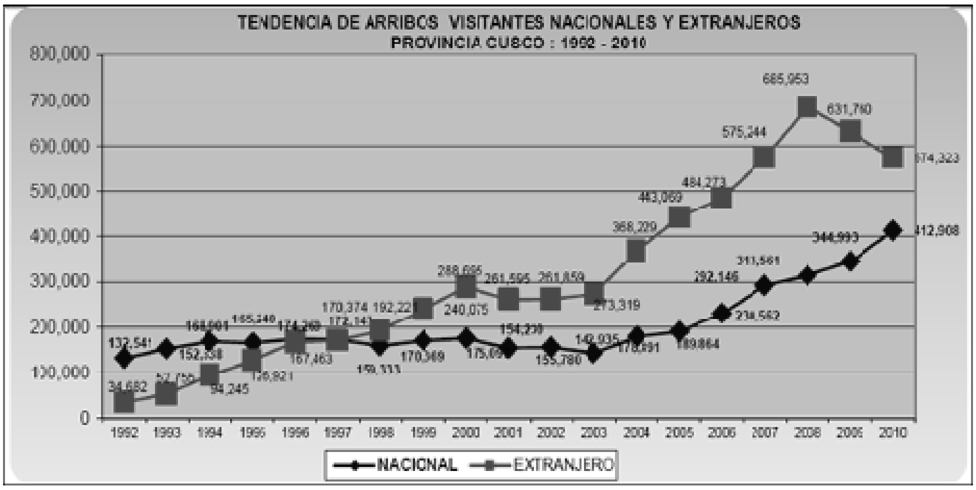
Commnunity-based tourism

The term Community Based Tourism (CBT) emerged in the mid-1990s. CBT is generally Small scale and involves interactions between visitor and host community, particularly suited to rural and regional areas. CBT is commonly understood to be managed and owned by the Community, for the community. It is a form of 'local' tourism, favoring local service providers and suppliers and focused on interpreting and communicating the local culture and environment. It has been pursued and supported by communities, local government agencies and non-government organizations (NGOs). Effective Community Based Tourism can address social needs, contribute to building a more sustainable environment, and be commercially viable. (Asker et al., 2010).

Tourism in Peru and Cusco region

Number of tourists is still increasing and in 2011 Peru received 2 597 800 international visitors what receipts 2 359 700 US dollars (The Peru Travel & Tourism Competitiveness Report 2013).

The figure no 1 shows comparison between arrivals of national and international visitors in region Cusco in time development 1992 – 2010. Significant increase of international tourists is seen. In 2008 it was even two times more than national Peruvians. In 2010 number of international visitors decreased to 574 323. From 2010 and to the future number of Cusco´s visitors is still increasing.



Fi. 1: Tendency of arrivals national and international visitors in region Cusco from 1992 to 2010. Source: Dirrección Regional De Comercio exterior y turismo, 2012

Material and methods

Community Llaquepata

The community of Llaquepata is situated in the mountainous area in the south part of Andes in the Cusco region in altitude approximately around 3400 above the sea level.

The total population of the community is composed of a total of 50 families, roughly 200 people. The community is located in the Sacred Valley, in a distance of about 8 km from Pisac and 22 km from Cusco. The settlement of the community begins in the immediate vicinity of the road (the former Inca trail), which is about 8 houses (local part Pinchec). The main part of the settlement, however, is located in the hills above the road, a distance of about 2 km. Both parts of the community connects dusty road. Along the path there is a field belonging to the community. Given the most common economic activities and lifestyle community Llaquepata is typical settlement on district Taray. Local residents are focused mainly on growing potatoes, corn and quinoa but they use these resources only for their own consumption. For the same purpose most of families breed guinea pigs, mostly, as

regards cattle they rare sheep in the community, but only in very small quantities. Women from the community are also engaged in manufacturing knitted textiles and handicrafts, which sold together with products that deliver other communities, in the trade in Pisac. All the houses are built from adobe, they are usually one or two floors constructions and to each house belongs dry or flush toilet, which is located outside the house. There is a primary school, where currently two teachers provide education to thirty pupils.
The culture of the community is based on the typical Andean-Quechua principles that have a character rather of cooperation and solidarity In comparison with it, therefore, the Western world seems to be a more individualistic, predatory and competitive (Macháčková, 2014).

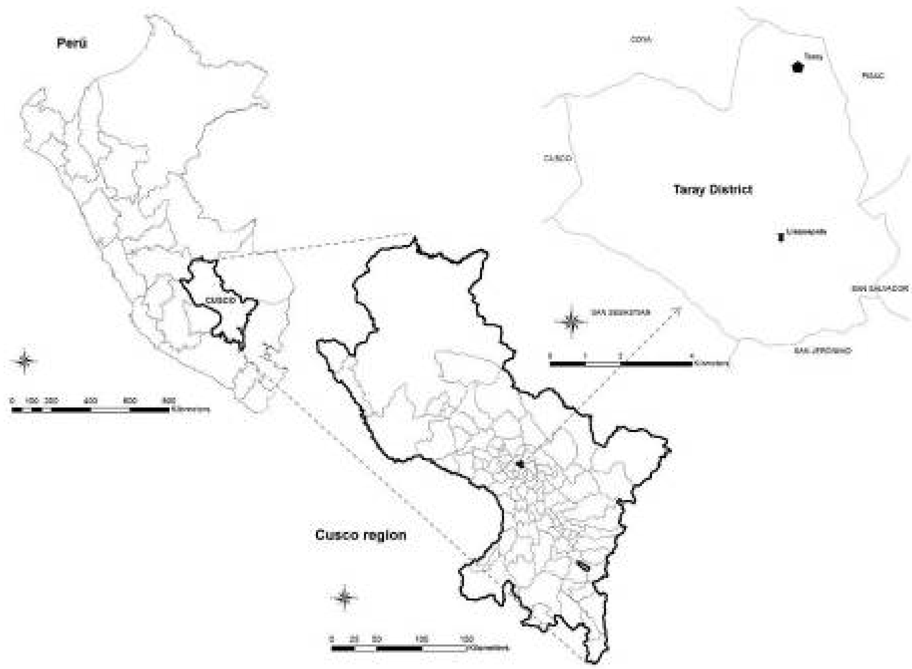


Fig. 2: Location of Llaquepata community

Results
This project is aimed to develop community-based tourism in the community Llaquepata through creating the business and marketing plan for tourism development, establishing the “Capacity building program”, creating tourism programmes and programme for volunteers.
In first year of implementation of this project into a community the direct employment will be 9 people. 4 of them for full time job and for 5 community members it will be in a various part time employment. Other members of the community will be involved in activities as well but indirectly with contact with tourists. For example they will supply fresh ingredients for meals, help. They are also involved in decision of committee so they have all rights to decide about programmes about touristic management, they can cooperate in more spheres if they want and in the next years start to do similar business but now they will be mainly working as usual (on the field, harvesting, fishing, in the store, in Cusco).

It has positive impact also for other communities because of our tourist package offering trips to other communities.
The income from this new type of business in addition will be use to sustaina-ble development of the project also of living conditions in the community, to in-vestment into small reparation or construction in area. This effect will be spread over the community because whole community redistribute all profits always equally. They have old Andean system, using it for centuries. There will be a saving fund of extra benefits which will be used in exceptional cases (bad harvest, financial losses).

Project plan
Implementation or realization of this project includes:
• Intensive training courses and workshop for community Llaquepata – that means: Intensive business and marketing training course for a month for two personsIntensive accounted and tax course for a month, for a person
Workshop at Potatoes farm (Andes org.) for whole group (15 persons)
These training courses ensured 3 certificates into the community which will qualify these members of the community to make a business in the tourist ser-vices. Then it will ensured for one member of the community who will be at-tending of the English language course and then will be qualified as a language teacher.
• Revitalization of the place
• Equipment purchase
• Processing of promotion
• Establishing of the specialized committee for run of the project and for management of the project in the final phase -This means that there will be selected the specialized committee. This committee will be solving questions like: where and how to divided profits, potential problems, solve future ques-tions and discuss about other development and innovation in the community.
• Propagation
• Constructing of the building In the end of this part should be done a building which will serve as an accommodation for the visitors. (The connecting project proposal of MENDELU.)

The budget of the project
The project proposal calculates with two possibilites of budgets. The first one budget is for the project by itself. About “start-up” costs where it will be answered about how much money is necessary to get into the beginning of the project. It concerns one-time in-vestment with the total amount 10 500 USD dollars.
The second budget is focused on the own business by itself. This is one-year cost estimate within optimistic, realistic and pessimistic models and it is including CF and calculations of the products.

Discussion
The project is based on thoughts of sustainable tourism what is called “clean indus-try” so it has to deal with and also support environmentally-friendly practices sus-tainability as well. That is why this project will not have any negative impact on the environment. What is more that this project will pay attention to take care about environment and assert sustainable practices during its existence.
The flow of visitors is not expected in high numbers, there is not expectation of increasing of noise, litter or pollution.

For example the most important contents of the program for volunteers are: planting small trees, cleaning areas, composting etc. In community it will be also paying atten-tion on waste separation. After the end of certain visit of tourists they are required to bring their litter to Cusco. Also there will be thoughtfully treating with wrappers - thanks to domestic growing, breeding there is not so big need for wrapped goods, everything will be doing in the usual fashion. Also in the community will be allowed only using soaps, washing-up liquids etc. from organic materials, composting and there will be also implemented a special ecologic-friendly model of a solid waste management by non-profit organization Andes “Reduce, Reuse, Recycle”.
Community is highly motivated to do these activities based on protecting their environment because it is the prerequisite for sustainability of community-based tourism but what´s more for their natural and cultural heritage.

Conclusion

This project proposal is aimed to develop community-based tourism in the community Llaquepata through creating the business and marketing plan for tourism develop-ment, establishing the “Capacity building program”, creating tourism programmes and programme for volunteers. It sould be subserve following partial goals: 1) To Increase presence of sustainable tourism on the economic prosperity of the district, 2) To protect of unique cultural heritage of Quechua people and protecting of nature, 3) To Improve qualification of community members to provide professional tourist services. The solution is based on establishment of a tourist programme and ensuring its promotion and preparing the community members to arrivals of external visitors.
Expected results of the realization project are:

- Educated members of the community with certain skills, knowledge for nec-essary operations in rural tourism development
- An efficient community-based tourism enterprise services
- Creation of Promotion of the community-based tourism enterprise services
- Interested tourists and volunteers coming into community
- Access to a prepared market
- An adventure tour operator from the point of product development
- Implement of Capacity building system for members of community Llaqque-pata but also for other community (this community will be provide training in 3 years)

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Acknowledgement
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Souhrn
Článek prezentuje možnosti rozvoje chudé andské venkovské komunity Llaquepata (Region Cusco, Peru) prostřednictvím programu na podporu tzv. community-based turismu. Potenciál lokality spočívá v tom, že se nachází v Posvátném údolí Inků na cestě mezi Cuscem a Pisacem. To však je i hlavní nevýhoda, neboť kolem vesnice se většinou pouze projíždí na cestě za podstatně atraktivnějšími turistickými cíli (Pisac, Machu Picchu). Problematika je zpracována do formy návrhu projektu. Realizace projektu je zaměřena na vytvoření atraktivních volnočasových aktivit, které by absolvovali návštěvníci během pobytu v komunitě. Tématem je jednak prezentace tradic a filozofie Pachamama, druhak seznámení s běžným způsobem života ve venkovské andské vesnici. Členové komunity budou zapojeni do realizace projektu, jak péčí o turisty, tak produkcí plodin a výrobou artesanií. V přípravné fázi budou seznámení se specifiky pravidelného užšího kontaktu s návštěvníky z jiných kultur. Praktickým přínosem pro komunitu komunitu je rozšíření možnosti zaměstnání a příjmů. Důležité je rovněž to, že příjmy primárně zůstanou v komunitě. Projekt potřebuje menší vstupní investici, dále by měl být udržitelný samofinancováním.

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THE EVALUATION OF THE BARRIER-FREE PASSABILITY OF THE NATURE TRAILS OF CITY OF PRAGUE (CZECH REPUBLIC)

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Abstract
Nature trails nowadays belong to the standard infrastructure accompanying valuable nature sites. In capital city of Prague take place about five dozens of these trails at present time. This paper deals with far less accentuated issues of wheelchair throughput of nature trails located on the territory of Prague. Outcome of this work supposed to be an evaluation of wheelchair throughput of nature trails based on my own research survey, which considered the technical requirements of the population in categories of people using wheelchairs/strollers - seniors and families with small children.

Key words: visitor, nature trail, social integration, Prague

Introduction
The City of Prague is famous for the chance to visit cultural and historical monuments, which are currently available information, such as guides. Other interesting places, especially the natural character that visitors are often unappreciated, made more attractive nature trails. They are now an integral part of environmental education and interpretation. Nature trails through nature parks, monuments, reserves, but also the urbanized area. Visitors will get information on the location, history, natural attractions specific locations. The creators of these trails may be not only experts, but their creation may be involved in other population groups, such as students or locals. Nature trails should inspire people to care about the environment in which they live or where they move. Nature trails for visitors are publicly accessible place, but may be less accessible place for some groups of people with reduced mobility, which are people, for example, an orthopedic wheelchair, seniors, parents with children. You can visit these sites often only with the help of others. For these groups of people it is important to plan the route already with the previous reading of options of barrier-free passability.

Materials and methods
This article is prepared on the basis of the currently processed bachelor thesis (2016), which was developed at the Department of Applied Ecology, Faculty of Environmental Sciences of CULS Prague.

<u>To determine the basic procedures to arrive at a result, the work was divided into several steps, which are:</u>

- categorization of target groups,
- field survey,
- evaluation of data.

<u>Categorization of target groups</u>
To categorize the target groups were contacted organizations that work with people with limited mobility or orientation, that are listed in Decree no. 398/2009 Coll. of

CZE, On general technical requirements, which ensure barrier-free use of buildings of the Ministry for Regional Development, in §1 as "people with mobility, visual, hearing and mental disabilities, the elderly, pregnant women and persons accompanying a child in a stroller or baby within three years." (POV, 2012; Kateřina Novotná, VI. 2015, in verb)

Field survey

Field surveys were subjected to all nature trail in the capital city of Prague, which were traced from available books and Internet resources and recorded on 31st of December 2014.

Book sources to date 31st of December 2014

- Cerovsky J., et al., 1982: Classrooms al fresco brief guide to the nature trails of state protection in Czechoslovakia. Mlada fronta, Prague
- Cerovsky J. et Zavesky A., 1989: Paths to nature. SPN, Praha
- Drabek K., 2005: Nature trails and routes, Prague and Central Bohemia. Dokoran, Praha.

Online information sources available to date 24th of October 2015:

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- http://www.ginkgo-praha.org/natura/cinnost/naucne-stezky.html,
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- http://www.repy.cz/naucna-stezka-repy,
- http://www.praha15.cz/mestska-cast/o-praze-15/naucna-stezka-historiihornich-mecholup,
- http://www.praha-slivenec.cz/new/aktualita-otevreni_naucne_stezky.htm,
- http://www.jedtesdetmi.cz/interaktivni-naucna-stezka-divoka-sarka-5329.

Criteria for the selection of nature trails included for evaluation:

- trails built in 31st of December 2014 due to the commencement of field investigation in January 2015
- the length of the route, which was established in relation to the assessment of accessibility in the border less than 10 km,
- assessment of the nature trails are not tolled, entrance is free of restrictions on the choice of the visitor,
- additional conditions for the assessment of the nature trail was the presence of information panels.

During of year 2015, gradually all routes mapped and projects itself authored work, or accompaniment. Field investigation involves crossing of nature trails with a pram, which allows to assess throughput wheelchair accessible.
During the fieldwork was used GPS (Garmin), which allows you to record the track. Thanks altitudes can also record from recording longitudinal gradients of the route. At the precise angle measurement route was additionally used instrument inclinometer, lent by the Prague Organisation of Wheelchair Users.

Evaluation of data

Data obtained from field research was the basis for the depiction of nature trails and evaluate throughput barrier in the City of Prague. Plotted route was performed on the substrate electronic map and will be used for further analysis.

Basic evaluation of barrier patency of nature trails through evaluation model of traffic light (Kateřina Novotná, VI. 2015, in verb):

- Color RED: nature trail hard to reach,
- Color ORANGE: nature trail partly accessible,
- Color GREEN: nature trail accessible.

Assessment of accessibility based on the aspects which are:

- barriers,
- surface,
- slope,
- lenght of trail.

Results

Categorization of target groups for visiting the nature trail is divided into three sections, according to the assessed three target groups:

- The persons with disabilities musculoskeletal (next in text Wheelchairs),
- The elderly people (persons over 75 years),
- The person accompanying a child in a stroller (or a child under three years of age).

Classification into different categories according to the evaluation of educational paths for each individual target group under the conditions specified below.

The Wheelchairs users:

- Color RED: the path is difficult to access. Not suitable for wheelchairs.
- Color ORANGE: The path partially open, it is designed to fit wheelchairs, wheelchair with assistant and electric carts.
- Color GREEN: path is accessible for less experienced wheelchair, unaccompanied wheelchairs and electric carts.

The elderly people:

- Color RED: difficult access route is recommended for persons with no disability and good physical condition.
- Color ORANGE: the path is partially open, it is feasible for elderly people, even mild physical limitations eg. with northwalking or supporting poles.
- Color GREEN: the path is accessible to elderly people over seventy-five years without limitation.
-

The Persons accompanying a child in a stroller or baby within three years:

- Color RED: difficult access route is only recommended in the absence of a stroller with a good physical condition of the child within three years.
- Color ORANGE: the path partly accessible. The passing is recommended accompaniment.
- Color GREEN: accessible route is suitable for parents with children in strollers.

Field survey

On the basis of available resources was first drawn up an inventory of nature trails at the date 31st of December 2014. Fieldwork took place from February 2015 to November 2015. Total was evaluated and pass 42 nature trails (Tab. 1).

Evaluation of the current state of the barrier-free passability of nature trails

Nature trails in the City of Prague comes from a large part of the natural landscape. For this reason, mostly unpaved surface. This surface is unsuitable for wheelchair movement. The remaining part of trails leads urbanized landscape where mostly paved. Nature trails are accessible, however, are not always fully accessible.

Summary results of the evaluation the barrier-free passability of Prague´s nature trails based on field surveys and accessibility aspects (obstacles, surface slope and length of routes) indicate the number of nature trails according evaluate accessibility.

Differences in the evaluation of accessibility in each category at a finite number of nature trails are influenced by individual aspects of evaluation:

- barriers: ranked in the category of persons in a wheelchair and a person accompanying a child in a stroller,,
- surface: only evaluated in the category of persons in a wheelchair,
- slope: Unranked in the category of persons of advanced age.

The model of traffic light shows the number of routes for each category of target groups: persons in wheelchair (Fig. 1), the elderly people (Fig. 2) and a person accompanying a child in a stroller (Fig. 3).

Fig. 1: The evaluation of the barrier-free passability category for wheelchair users

Fig. 2: The evaluation of the barrier-free passability category for elderly people

Fig. 3: The evaluation of the barrier-free passability category for person with child in a stoller

Tab. 1: The evaluation of the barrier-free passability of the nature trails of City of Prague

The evaluation of the barrier-free passability of the nature trails of City of Prague				
Nr. of trail	Name of trail (in Czech)	The evaluation of the barrier-free passability		
		The Wheelchairs users	The elderly people	parents with children
1	NS Petřín	hard to reach	partly accessible	hard to reach
2	NS Na vrchu Svatého Kříže	hard to reach	accessible	accessible
3	NS Centrální park Pankrác	accessible	accessible	accessible
4	NS v Kunratickém lese	partly accessible	accessible	accessible
5	NS Prokopské údolí – Butovickým hradištěm	hard to reach	hard to reach	hard to reach
6	NS Barrandovské skály	partly accessible	accessible	accessible
7	NS Sliveneckého mramoru	hard to reach	partly accessible	hard to reach
8	NS Oborou Hvězda	hard to reach	hard to reach	hard to reach
9	NS Housle	hard to reach	hard to reach	hard to reach
10	NS Roztocký háj – Tiché údolí	hard to reach	hard to reach	hard to reach
11	NS Stromovkou za poznáním	hard to reach	accessible	partly accessible
12	NS Přírodním areálem Botanické zahrady Praha	hard to reach	partly accessible	hard to reach
13	NS Košinka	hard to reach	partly accessible	hard to reach
14	NS Thomayerovy sady	hard to reach	partly accessible	hard to reach
15	NS MČ Praha 9 – jihovýchodní stezka	hard to reach	partly accessible	partly accessible
16	NS MČ Praha 9 – severozápadní stezka	hard to reach	partly accessible	partly accessible
17	NS Svatého Josefa	hard to reach	partly accessible	partly accessible
18	NS Strašnice	partly accessible	accessible	accessible
19	NS Milíčov	hard to reach	accessible	accessible
20	NS Neleníme v zeleni	hard to reach	accessible	partly accessible
21	NS Modřanská rokle	hard to reach	accessible	accessible
22	Fitness stezka u Vltavy	accessible	accessible	accessible
23	NS Počítáme s vodou	hard to reach	accessible	partly accessible
24	Keltská stezka	hard to reach	hard to reach	hard to reach
25	NS Údolím Dalejského potoka	hard to reach	partly accessible	hard to reach

26	NS v Praze - Stodůlkách	partly accessible	accessible	accessible
27	NS Dolní Počernice	hard to reach	accessible	partly accessible
28	NS Historií Hostivaře	hard to reach	partly accessible	partly accessible
29	NS Povodím Botiče	hard to reach	partly accessible	hard to reach
30	NS Toulcův dvůr	hard to reach	partly accessible	hard to reach
31	NS Problémy životního prostředí ve městě	hard to reach	accessible	accessible
32	NS Historií Horních Měcholup	hard to reach	partly accessible	partly accessible
33	NS Chuchelský háj	hard to reach	partly accessible	hard to reach
34	NS Řepy	hard to reach	partly accessible	hard to reach
35	NS Vinořský park – Satalická bažantnice	hard to reach	hard to reach	hard to reach
36	NS Vinoř – Jenštejn	hard to reach	hard to reach	hard to reach
37	NS ZŠ Stoliňská	partly accessible	accessible	accessible
38	NS Klánovickým lesem	partly accessible	accessible	accessible
39	Lesní galerie aneb Tam a zpátky za zvířátky	hard to reach	accessible	accessible
40	NS MČ Praha-Běchovice	partly accessible	accessible	accessible
41	NS Dubeč – Uhříněves	hard to reach	partly accessible	hard to reach
42	NS Mýto	hard to reach	partly accessible	partly accessible

Conclusion

In the capital city of Prague is located approximately 50 nature trails with a total length of 177 km with approximately 500 spot information panels. It was evaluated barrier-free passability at 42 tracks. The major part of nature trails are wheelchair accessible due to the location in the rugged natural terrain, often in specially protected areas. Those territories passes half of the assessed routes. Nature trails, which make up 60% of the NS, persons with reduced mobility to visit the most part only in exceptional barrier-free sections. Conversely, urban trails, thanks to a suitable surface, people with limited mobility of the majority of the entire visit. Creating a barrier-free environment in the Czech Republic is still done mostly in larger urban units. Extending the network of paths for people with limited mobility and the creation of decent and pleasant conditions for exploring nature trails is beneficial to the future vision.

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This paper was based on processed bachelor thesis at the Faculty of Environmental Sciences of CULS Prague. Supervisor was Assoc Prof. Emilie Pecharova. External consultations gave Katerina Novotna, MSc from Prague Organisation of Wheelchair Users.

Souhrn
Naučné stezky dnes patří mezi standardní infrastrukturu provázející cennými přírodními lokalitami. V hlavním městě Praze se v současné době nachází na pět desítek takových to tras. Tento článek se zabývá doposud méně akcentovanou problematikou bezbariérové průchodnosti naučných stezek nacházejících se na území Prahy. Výstupem práce je předkládané vyhodnocení na základě vlastního terénního šetření, které zohlednilo technické nároky pro osoby s omezenou mobilitou.

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THE POSSIBILITY OF BANK STABILIZATION OF RESERVOIRS WITH RECREATIONAL USE

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Abstract
The paper deals with problems of abrasive caverns in case of Brno dam reservoir in Osada area, in relation of recreology. Brno dam reservoir is attractive area for a wide range, not only for residents of Brno. People are visiting this area throughout the whole year with varying intensity. This area is created by several meters high caverns – as a danger for visitors and erosion unstable place. The caverns are specific thanks to occurrence of kingfisher (*Alcedo atthis, L.)* whose nest is located directly on the banks are subject to special protection statute under which the banks are not allowed to alter. From this reasons is suitable to use active anti-abrasive protection of banks.

Key words: bank erosion, caverns, protection, recreology

Introduction

Abrasion is a process that can be described as surface abrasion of bottom and banks by the movement of the water level (waving) associated with transporting and storing loose material. Due to this process may cause abrasion caverns; loose material is transported into the reservoir. This situation is undesirable (Šlezingr, 2011).

Development of bank erosion is conditioned by several factors: the movement of the water level and the material forming the reservoir shore. The movement of water levels may be caused by the movement of vessels or by wind (wawe growth is closely related to the fetch length - Pelikán, 2013). The problem of wind-driven waves was investigated by many scientists worldwide, e.g.: Miles (1957), and Lukáč and Abaffy (1972, 1980). The Czech scientists due to wave in their works dealt with e.g.: Kratochvil (1970), Šlezingr (2004, 2007, 2011) and Pelikán (2013).

In case of Brno dam reservoir the process of bank erosion is most noticeable in the Osada area. This recreational area represents the locality extremely affected by abrasion process due to combination of adverse factors (fetch length and dominant wind speed and direction above the water level, the geological structure and morphology of banks, shipping). The banks of the dam are continuously damaged in an approximate length of 250 m where the steep to vertical abrasion caverns reach a height of 5 meters. The others parts of reservoir do not show such damage to the banks.

The suburban area is popular with a wide range of tourists, various visitors due to nearby cities and good accessibility (infrastructure).In Osada, the situation has reached a state where abrasion caverns, caused primarily by human activities (construction and operation on reservoir), represent habitat of kingfisher (*Alcedo attis, L.*). As a result, there is a conflict of interests – the banks are subject to special protection statute under which the banks are not allowed to alter.

Materials and methods

In the Osada area were built-up several offshore experimental structures for which examined the effectiveness of reduction of waves due to the effects of wind and boat traffic in the framework project IGA “Minimizing losses of forest and agricultural land due to erosion and abrasion processes in the landscape”. Low-cost offshore technical, biotechnical and biological solution on the principle of breakwater, were preferred. The experimental measurements were realized on the simple and double willow wattling, willow stand and short gabion wall.

The following results of the experiment are related to the gabion structure which was built-up in the distance of 2.5 m from the toe of abrasion cavern (height of approximately 4–5 m) in parallel to the shoreline. The works were accomplished in March 2015 when the water level in Brno reservoir is usually still operated 4 m below its standard conditions. The altitudinal establishment was adjusted with respect to the most occurring water level in reservoir during the period of April to September. The value of 228.80 m.a.s.l. was derived by means of statistics (data of water levels from years 2010–2014). In the main season, the structure is partially swamped but the top edge is approximately 10 cm above the water surface. The dimension of gabion wall are 0.5 x 0.3 x 3.0 m (height x width x length). The gabion wall was built-up from prefabricated components from welded zinc-coated wire – meshes with openings of 5 x 10 cm. The compiled cages were fulfilled by local rock aggregate (consumption of 0.15 m^3 per meter) of proper size due to the mesh openings. The technical structure was appended by biological components – willow cuttings from local sources. The material for construction costs approximately 35 Euro per meter.

The irregular wave theory was used for purposes of the research. An irregular wave train is constructed by linear superposition of a number of linear wave components. Wave train analysis is based on statistical processing of measured data (CERC, 1984, USACE, 2009). The data are represented by records of water table motion in a given point. The individual waves are identified by local maxima (wave crest) and local minima (wave trough) of water level fluctuation (Lukáč, Abaffy, 1980).

A measured wave record never repeats itself exactly, due to the random appearance of the water surface. But if the surface state is “stationary”, the statistical properties of the distribution of periods and heights will be similar from one record to another. The most appropriate parameters to describe the sea state from a measured wave record are therefore statistical (WMO, 1998, Ozeren, Wren, 2009).

The theory handles with concept of significant (characteristic) wave height ($\overline{H_{1/3}}$). That is the mean height of one third of the highest waves in a wave train (record), i.e. the wave with the height coming up to the 13% probability of occurrence.

The data are represented by wave train records. The records of water surface motion were realized with the aid of two synchronized (windward and leeward) continuous fluid level sensors on the base of electric resistance, anchored to the bottom.

Results

Wave-by-wave analysis determines wave properties by finding statistical quantities (i.e., wave heights) of the individual wave components present in the wave record. It is recommended the wave records must be of sufficient length to contain several hundred waves for the calculated statistics to be reliable. The presented results were prepared from continual data collection, realized during the time of 35 minutes.

The data set contained approximately 27 500 records of elevation of water surface for each sensor (about 13 records per second with time stamp).

Wave train analysis is essentially a manual process of identifying the heights and periods of the individual wave components followed by a simple counting of zero-crossings (the point where the wave surface crosses theoretical still water level) and wave crests in the wave record. The process begins by dissecting the entire record into a series of subsets for which individual wave heights were determined. In the interest of reducing manual effort, it is customary to define wave height as the vertical distance between the highest and lowest points (USACE, 2008). In this analysis, all local maxima and minima not crossing the zero-line were discarded (Fig. 1).

Approximately 3200 waves (1800 waves for windward sensor and 1400 waves for leeward sensor) were extracted by means of zero-crossing method in total. The value of height *H* was calculated for each wave.

Subsequently, the obtained datasets of wave heights were statistically processed with emphasis on the determination of following values related to the specific probability of occurrence: mean wave height $H_{50\%}$, characteristic wave height $H_{13\%}$ and maximal wave height $H_{1\%}$ (i.e. wave heights referring to the50th, 87th and 99th percentile in datasets).

The obtained data were provided for better clarity in the following table (Tab. 1). Whole record of wave course was divided into individual time segments with an interval of 5 minutes (data in table are featured in seconds) for each sensor separately (*I.* – data from sensor on the windward side; *II.* – data from sensor on the leeward side). There are also the values of mean wave height, characteristic wave height and maximal wave height. Comparison of the values of both sensors within the same time period shows the effect of the stabilizing structure consisting inthe wave height reduction. In case of main wave height ($H_{50\%}$) it was reached the reduction of 29 % in average, the characteristic wave height ($H_{13\%}$) was reduced by 35 % and the maximal wave height ($H_{1\%}$) was reduced by 38 %. These average values show interesting finding that the higher the wave on windward side the greater the reduction of its height by structure.

The general principle of wave height reduction shows the Fig. 2. When the windward waves reach the structure, the process of wave breaking happens. Since the structure is permeable, not all energy of original waves is reduced. So we can observe waves with reduced parameters also on the leeward side of structure. The difference between windward and leeward wave parameters in relative form should be considered as the effectivity of structure. The reduction of proceeding wave energy by offshore structure may mitigate effects of scouring in the point of interaction between water level and cavern on the shore.

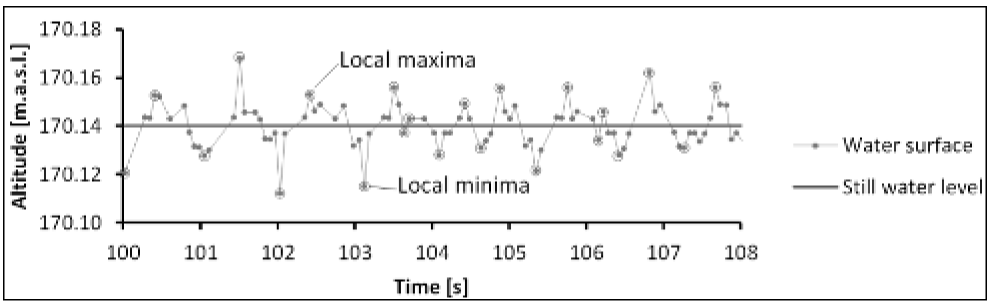

Fig. 1: Segment of water surface record and zero-crossing technique in detail

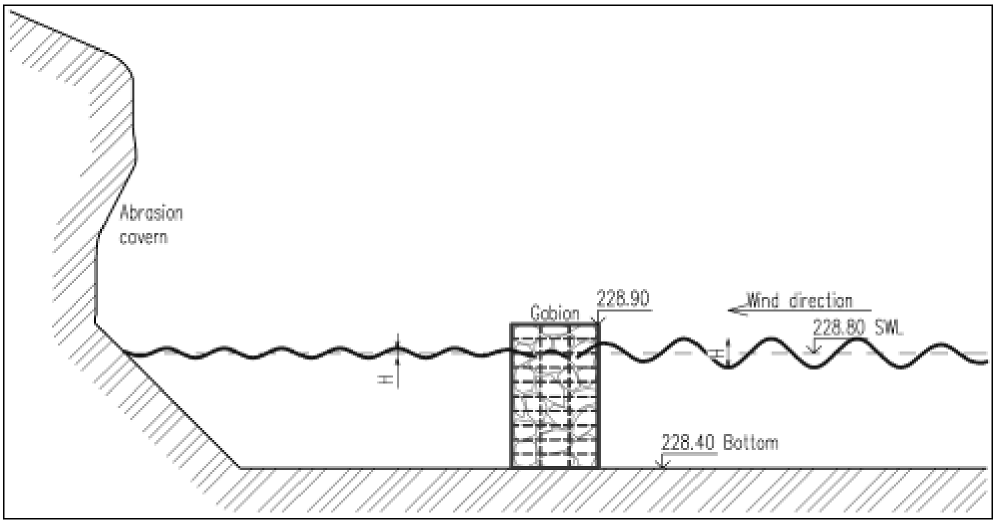

Fig. 2: Scheme of structure effectivity: wave height reduction by active stabilization structure

Tab. 1: Results of statistical processing of wave records and structure effectivity

Time segment	Sensor	$H_{50\%}$	Reduction	$H_{13\%}$	Reduction	$H_{1\%}$	Reduction
[s]		[m]	[%]	[m]	[%]	[m]	[%]
0–300	I.	0.025	-22	0.040	-29	0.064	-41
	II.	0.019		0.029		0.038	
300–600	I.	0.025	-22	0.043	-34	0.072	-48
	II.	0.019		0.029		0.038	
600–900	I.	0.030	-35	0.045	-36	0.064	-25
	II.	0.019		0.029		0.048	
900–1200	I.	0.030	-35	0.050	-41	0.072	-35
	II.	0.019		0.029		0.047	
1200–1500	I.	0.030	-35	0.050	-42	0.072	-47
	II.	0.019		0.029		0.039	
1500–1800	I.	0.029	-33	0.049	-40	0.078	-39
	II.	0.019		0.029		0.048	
1800–2100	I.	0.026	-24	0.050	-24	0.067	-28
	II.	0.019		0.038		0.048	
Averagereduction [%]		-29		-35		-38	

Conclusion

The article dealt with issue of using active stabilization structures like protection of the banks in particular locality of water reservoir Brno – Osada area. There were built-up several offshore experimental structures for which examined the effectiveness of reduction of waves due to the effects of wind and boat traffic – technical, biotechnical and biological solution. The article focused just on one technical solution – short gabion wall which works on principle of breakwater.

The gabion structure was built-up in the distance of 2.5 m from the toe of abrasion cavern. Subsequently, on this structure the records of water motion were realized with the aid of two synchronized (windward and leeward) continuous fluid level sensors. The continual data collection was realized during the time of 35 minutes. The data set contained approximately 27 500 records of water surface for each sensor. Subsequently, the obtained datasets of wave heights were statistically processed with emphasis on the determination of following values related to the specific probability of occurrence: mean wave height $H_{50\%}$, characteristic wave height $H_{13\%}$ and maximal wave height $H_{1\%}$. Comparison of values of both sensors within the same time period shows the effect of the stabilizing structure consisting in the wave height reduction. In case of main wave height ($H_{50\%}$) it was reached the reduction of 29 % in average, the characteristic wave height ($H_{13\%}$) was reduced by 35 % and the maximal wave height ($H_{1\%}$) was reduced by 38 %. The results may contribute to the discussion about possible shoreline stabilization measures of localities in special conflict of interests where traditional passive stabilization is not allowed.

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Souhrn
Předkládaný článek se zabýval problematikou projevů abraze v rekreační oblasti Osada Vodní nádrže Brno v kontextu rekreologie. Vodní nádrž Brno je celoročně atraktivním místem, pro celou řadu návštěvníků nejen z Brna. A právě rekreační oblast Osada je postižena břehovou erozí, která se zde projevuje ve formě až 5 m vysokých abrazních srubů. Tyto sruby jsou dále specifické díky výskytu ledňáčka říčního (*Alcedo attis*, L.), který hnízdí právě na kolmých stěnách břehů, navíc jsou tyto břehy chráněny stavební uzávěrou. Z toho důvodu je vhodné právě na těchto lokalitách použít aktivních stabilizačních prvků.

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THE UTILIZATION OF GREEN WEDGES AS MEANS OF INCREASING BIOLOGICAL DIVERSITY OF AGRICULTURAL LANDSCAPE - A CASE STUDY IN THE PŘEROVSKO AREA, CZECH REPUBLIC

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Abstract
This paper presents partial results from the project "Increasing biological diversity of agricultural landscape in selected cadastral units in the Přerovsko area" mainly a proposal for the construction of green wedges. It was engineered so that it would both fit the ecological needs of grey partridge (*Perdix perdix*) as an umbrella species for other small field animals and also, so that it could be realized in the natural conditions of the Přerovsko area. It also contains a proposal for the decision analysis of identification of the selected cadastral units where the implementation of similar landscape measures would be the most effective.

Key words: Grey partridge (*Perdix perdix*), umbrella species, small field animals

Introduction

The paper deals with the construction of a so called "green wedge" as a landscape measure that is supposed to increase the state of the landscape mainly by supporting the reintroduction of small field animals (grey partridge) to agricultural landscape. Grey partridge is used as an indicator species for both structurally and functional healthy landscape. All the presented results can be related to the project "Increasing biological diversity of agricultural landscape in chosen cadastral units in the Přerovsko area" elaborated by the institution "Naše společná krajina, z.s." where one of the copartners is the Department of Landscape management of the Faculty of Forestry and Wood Technology of MENDELU in Brno.

The intense agriculture during the second half of 20th century resulted in a radical alteration of the agricultural landscape that up to that time constituted of a mosaic of small fields, field trails, small forests, hedgerows etc. The change in structure of the landscape as well as the schedule of field works, usage of heavy machinery and chemicals in agronomy led to a severe decrease of occurrence of a number of small field birds and extensive extinction of local populations of grey partridge. The situation is even worse because during the last 20 years, intensive building activities (highways and speed roads, hypermarkets, shopping centers, warehouses, production halls, etc.) take place in the landscape.

The biggest area of the country today (54%) is formed by so called "cultural steppe" - an agro-ecological system or in other words agricultural landscape that has been a subject to human activities and alterations for long centuries. Human activities thus enabled an expansion and domestication of some wild steppe animals. The most common is among others Grey Partridge (*Perdix perdix*), Common Pheasant (*Phasianus colchicus*) and Brown Hare (*Lepus europaeus).*

During the last 25 years in the Czech Republic, 5 species of field birds extinct, in some regions Grey Partridge (*Perdix perdix*) or Brown Hare (*Lepus europaeus)* are also closing to extinction. In the western European countries efforts to reintroduce extinct or declining bird species grow in importance. One of these species is Grey

Partridge. The main reason for this species is the potential of using it as a bio-indicator of the current state of the environment (Hromas, 1995).
Significant portion of current populations of Grey Partridge are bound to synantropic areas close to industrial zones, brown-fields, civil engineering buildings (airports, railway embankments etc.) and so on. These ecotone areas can function as the source points for the expansion of Partridge to surrounding agricultural landscape.
The so called "green wedges" can become another landscape element for the transfer of Grey Partridge back to the landscape. If the right conditions are met during their construction, they can create permanent residential areas for Grey Partridge. Their importance in the landscape is undeniable.
The linear green structures can be defined as vegetated strips where its width is lower than 30% of its length with significant ecotone effect (Supuka et al., 1999). The linear green-structures in rural landscape are vegetated zones interposed between fields, usually following streams, roads or terrain breaks. They are able to fulfill many environmental functions, for example by reducing and filtering surface and groundwater runoff, reducing water and wind erosion (Dosskey, 2001), allowing migration and survival of species, affecting microclimate, producing wood, improving orientation, acting as sinks for atmospheric CO2 and enhancing the beauty of the landscape (Borin et al, 2010). Hence, they are typical multi-functional elements in the rural landscape which is both a curse and a blessing. In the Czech Republic such green-structures are usually recognized as outstanding landscape elements incorporated within the territorial system of ecological stability as ecological corridors (The Nature Law, 1992).

Materials and methods

The former Přerov District is composed of three municipalities with extended jurisdiction (MEJ - Přerov, Lipník nad Bečvou and Hranice). The district is located on the southern border of the Olomouc Region. A total number of 154 cadastral units can be found here. The district covers an area of 845 km2. Of which, 70 % is made up by agricultural land, 57 % arable land, 16 % forest land and non-agricultural land is 30 %. The district is mostly flat, only in its northern and southeastern parts uplands can be found. The lowest point on the Morava River reaches 192 meters and the highest the Humenec Peak reaches 629 meters.
The main spatial unit for the evaluation and selection of project localities was a cadastral unit. The decision tree was three levels deep. During the first step all cadastral units in the district were evaluated. The main goal was to obtain a group of cadastral units with intense agronomy and low ecological stability. In the second step only the cadastral units obtained during the first step were further evaluated. The main evaluation criterion was ecological stability. During the third step the selection from the second step was further evaluated. Supplementary criteria that evaluate cadastral units within the above mentioned MEJs such as the activity of target groups (gamekeepers, farmers etc.), were used.

The second part of the determination process was the ecological needs of Partridge as an umbrella species.
The third and most important part was the definition of basic limits for the construction of the green wedges, notably:

1. Ownership relations:

- Planted trees and bushes must be at least 3 m and 1.5 m respectively away from neighboring parcels

2. Ecological needs of Partridge

- Bush strips with suitable grass-herbal sowing mix are preferred
- Trees are not preferred due to potential predator roosts
- Drier, sunny spots with proper micro-climate are preferred
- The predation possibilities should be altered by placing the wedges away from forest stands

Results

Tab. 1: Results of the decision process of the selection of target cadastral units where landscape measures to support Partridge should be implemented

Cadast. unit	H1	H2	H3	V1	V2	D1	D2	D3	D4	D5	D6	Dsum
ORP Hranice, locality Černotín - Hluzov												6
Černotín	61	65	0,21	No	0,0	No	No	No	0	5	3	
Hluzov	71	77	0,40	No	34,5	No	No	Yes	1	9	2	
ORP Hranice, locality Skalička - Ústí												6
Skalička	77	76	0,40	No	24,3	No	Yes	Yes	5	9	1	
Ústí	72	77	0,55	No	31,8	No	Yes	Yes	0	4	0	
ORP Lipník nad Bečvou, locality Osek - Nové Dvory												8
Osek	83	89	0,13	No	28,3	No	Yes	Yes	2	45	10	
Nové Dvory	91	78	0,23	No	66,8	No	Yes	No	0	6	2	
ORP Lipník nad Bečvou, locality Radotín - Soběchleby												5
Radotín	90	89	0,15	No	0,0	No	No	No	0	8	4	
Soběchleby	87	86	0,21	No	0,0	No	No	No	5	8	2	
ORP Přerov, locality Beňov - Prusy												10
Beňov	84	94	0,17	No	14,4	Yes	Yes	No	5	15	4	
Prusy	89	82	0,10	No	17,4	Yes	Yes	No	2	10	3	
ORP Přerov, locality Nelešovice - Penčice												9
Nelešovice	93	83	0,03	No	0,0	Yes	Yes	No	4	6	2	
Penčice	84	73	0,33	No	0,0	Yes	Yes	No	0	5	2	

H1 - main selective criterion - density of agricultural lands (%)
H2 - main selective criterion - density of arable lands (%)
H3 - main selective criterion - coefficient of ecological stability
V1 - additional selective criterion - complex land consolidation
V2 - additional selective criterion - floods in 1997 (the relative flooded area of the cadastral unit)
D1 - supplementary selective criterion - game management of Partridge
D2 - supplementary selective criterion - usage of grants for game keeping
D3 - supplementary selective criterion - usage of European grants by the municipality
D4 - supplementary selective criterion - usage of national grants by the municipality
D5 - supplementary selective criterion - the number of agronomy companies
D6 - supplementary selective criterion - usage of grants for agro-environmental measures
Dsum - supplementary selective criterion - the overall evaluation of the cadastral unit.

As can be seen in picture 1 the plantings consist of two basic measures. An enclosed bush element and an open bush element (oriented towards south). The enclosed element consists of thorny bushes of natural species composition - Hawthorn (*Crataegus monogyna*), Blackthorn (*Prunus spinosa*) and Canine Rose (*Rosa canina*) planted along the perimeter in rectangular shape. It consists of 50 saplings one meter away from each other. The southern part of the element consists of 20 roses, the northern shady part of 20 blackthorns. The lateral parts are shaped triangularly and consist of 5 hawthorns each. In cases where local habits enable it, saplings can be planted on the parcel boundaries. The open element consists of 50 bush sapling of natural species composition - Hawthorn (*Crataegus monogyna*), Blackthorn (*Prunus spinosa*) and Canine Rose (*Rosa canina*) planted in S-shaped line which creates little segments open towards south. The saplings are planted one meter away from each other always 10 saplings of each species in the line. Individual S-shapes have a perimeter two meters. In both cases, maximal potential heterogeneity of the elements must be emphasized together with the orientation towards the South.

Discussion

The purpose of the project was to propose an optimal green wedge that would fit the ecological needs of Grey Partridge and thus would lead to the improvement of functional capabilities of the agricultural landscape. The aim is to present a concept that can be followed and implemented in the urban and landscape planning.

In the early stages, three different possible structural schemes of the green wedge were consulted:

1. Standard linear planting - easily realized, easily maintained, expected lower ecological stability mainly because of the continuous and unnatural character of the planted elements
2. Linear planting of periodic circular elements - bushes create enclosed elements in the middle of which tranquil retreats for Partridge can be found, relatively more complex planting, more complex demarcation, complex maintenance
3. S-shaped line - individual S-shapes increase ecological value of the element (significant spatial heterogeneity - sun exposure, wind cover, eyesight etc.), very difficult to plant properly, complex maintenance

In all cases, interruptions of the lines were proposed to allow the travel of farming machinery. After the discussion within the collective of authors and the feedback from gamekeepers and stakeholders, the third option seems to be the optimum and is presented as a result of this paper.

Conclusion

This paper presents partial results of the project “Increasing biological diversity of agricultural landscape in selected cadastral units in the Přerovsko area” mainly a proposal for the construction of green wedges. It was engineered so that it would both fit the ecological needs of grey partridge (Perdix perdix) as an umbrella species for other small field animals and also, so that it could be realized in the natural conditions of the Přerovsko area. It also contains a proposal for the decision analysis of identification of the selected cadastral units where the implementation of similar landscape measures would be the most effective. The structure of S-shaped linear green wedge that consisted of elements open towards the south and enclosed elements was proposed to be optimal for this purpose. It should consist of thorny bushes of the natural species composition, in this case mainly Hawthorn (Crataegus monogyna), Blackthorn (Prunus spinosa) and Canine Rose (Rosa canina).

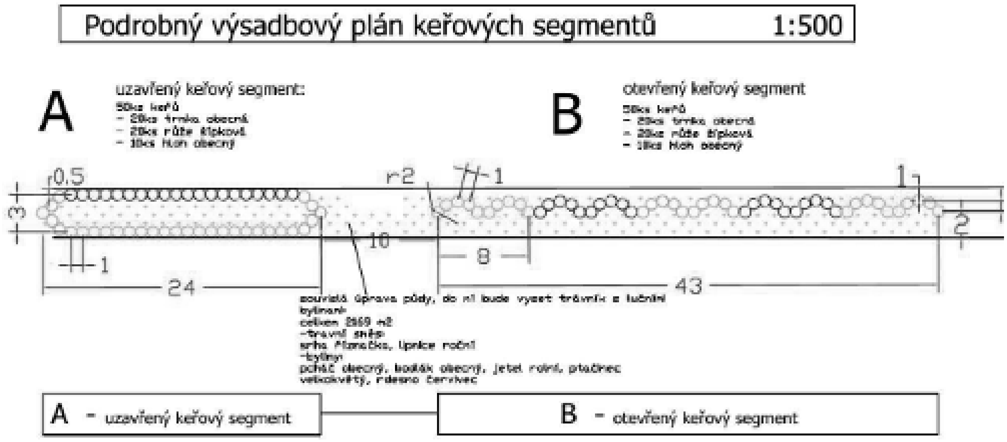

Fig. 1: Ideal green wedge according to the criteria defined in the methodology section.

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Souhrn
Článek prezentuje část výsledků projektu "Zvýšení biologické diverzity zemědělské krajiny ve vybraných lokalitách Přerovska", konkrétně návrh konstrukce živého plotu v krajině. Ta je navržena tak, aby jednak vyhovovala ekologickým nárokům koroptve polní jakožto deštníkového druhu drobné polní zvěře a dále aby byla realizovatelná v přírodních podmínkách Přerovska.
Součástí návrhu je rovněž návrh rozhodovací analýzy identifikující katastrální území Přerovska, kde je účelné krajinářská opatření realizovat. Byl navržen liniový esovitý prvek tvořený z uzavřeného a k jihu otevřeného keřového segmentu. Prvek tvoří hloh (*Crataegus monogyna*), trnka (*Prunus spinosa*) a růže šípková (*Rosa canina*).

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VERIFICATION OF TECHNICAL PARAMETERS AND EXPERIENCES IN ACCESS TO TOURISTIC POLYGONS FOR WHEELCHAIR PEOPLE IN SLOVAKIA

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Abstract
We present the questionnaire survey in Slovakia with answers of 57 respondents with disabilities in wheelchair of all ages. Verification of accessibility of hiking trails in the natural country for the wheelchair people is important from various reasons. Verification on the basis of actual experience is the best method to wheelchair access design of hiking trails in the country in compliance with required standards, the requirements and the needs of wheelchair users. We investigated their preferences and opinions which concerning walking trails. The survey was carried in Slovakia in October 2015. The questionnaire survey was distributed via the Internet with the assistance of clients of National Rehabilitation Centre in Kováčová and Slovak Association of the Disabled. The research was carried exclusively among wheelchair users who have spent their leisure in nature. All of 57 questionnaires with 1311 answers were obtained. To the interpretation of results we used the collected materials, graphical, comparative and statistical methods.

Key words: disabled people, questionnaire survey, forest country

Introduction
„Nature holds the key to our aesthetic, intellectual, cognitive and even spiritual satisfaction.“

E. O. Wilson

The WHO's (World Health Organization) priority is therefore the fulfillment of the Millennium Development Goals in health. In 2015 the Millennium Development Goals (MDGs) come to the end of their term, and a post 2015 agenda, comprising 17 Sustainable Development Goals (SDGs), takes their place. This issues is closely linked to the healthy lifestyle, which also means physical activities in an ecologically valuable environment. Very important document, which deals with the rights of people with disabilities, is the UN Convention on the Rights of Persons with Disabilities (the Convention). In order to fulfill one of the objectives of the Convention, all spaces (the architectural and outdoors) should be wheelchair accessible, including hiking trails dedicated to physical activities and relaxation. Many disabled people have not barrier free tourism with the related services therefore only systemic solutions are the key to accomplish the objectives set out (Jakubis 2013, 2015).

Materials and methods
Overview the legislation on designing roads and technical parameters
Legislation in Slovakia: STN 73 6101 Design of Roads and Motorways; STN 73 6108 Forest Transpor-tation Network; STN 73 6110 Design of Local Roads; TP 10/2011 Technical Conditions – Design of debarrierization measures for persons with reduced mobility and orientation on roads, MDVRR SR: 2011; ResAP(2007)3:

Resolution ResAP(2007)3 “Achieving full participation through Universal Design”; Decree of the Ministry of Interior (MV) of the Slovak Republic No. 9/2009 Coll. implementing the Act on Road Traffic and amending and supplementing certain acts, as amended; Decree of the Ministry of Environment (MŽP) of the Slovak Republic No. 532/2002 Coll. specifying details of general technical requirements for construction and general technical requirements for structures utilized by persons with limited movement and orientation abilities.

Design of a walking route having the character of a trail with regards to movement of wheelchair people, is based on a necessary manoeuvring capability. The minimum manoeuvring space according to technical parameters (TP 10/2011) for the motion of wheelchair is follows: a minimum clearance width of 900 mm; with the assistance is the need minimally 1,300 mm; the necessary manoeuvring area – a circle with a minimum diameter of 1,500 mm, optimum diameter of 1,800 mm (for the average dimensions of a person in a wheelchair: width 938 mm, height 1,076 mm to 1,374 mm, length 1,200 mm to 1,250 mm,); the path width of 1,500 mm (with assistance of a walking person); the maximum reachable zone of a wheelchair user in terms of location of equipment, operating devices and signalling device control is between 1,200 mm and 1,400 mm with a comfortably reachable zone from 900 mm to 1,200 mm; longitudinal slope of a BHT section is at most 1:21 (4.8%) and the section with such slope should not be longer than 20 meters. If the longitudinal slope of a trail section exceeds 1:21, it must be designed and equipped as a ramp with handrails within the meaning of construction laws; cross slope of the trail may be at most 1:50 (2%); if is longer, it should be interrupted by a horizontal plane with relaxing bench; the minimum wheelchair accessible toilet cubicle layout dimensions are 1,400 x 1,800 mm; the minimum dimensions and layout of a parking place reserved for passenger car are 3,500 x 5,000 mm. The surface of trails accessible by physically disabled persons should be non-slip, and free of obstacles, ditches, or dangerous interruptions (Jakubis, Jakubisová 2010).

The questionnaire survey

The questionnaire survey was distributed in October 2015, mostly using the Internet and published on Google pages. The questionnaire included 23 questions with alternative answers. The research was carried exclusively among wheelchair users who have spent their leisure in nature. All of 57 questionnaires with 1311 answers were obtained in Slovakia. The organization that helped with distribution in the Slovakia was National Rehabilitation Center Kováčová and Slovak Association of Persons with Physical Disabilities. We reviewed the issues of the accessible "trails" and paths in the wild based on existing legislation and empirical experience of respondents who replied to the questions formulated in the questionnaire survey (Fialová et al. 2015).

Results

We present the most important results of the questionnaire survey. On the questions in Slovakia answered 57 of respondents with different age ranges: under 17 years – 7%, 8 – 25 years – 7%, 55 – 64 years – 17.5%, 26 – 39 years – 19.3%, 40 – 54 years – 19.3%, 65 years and over – 29.8%. There was a predominance of respondents from medium large communities and towns, with populations between 5,000 and 50,000 inhabitants – 40.4%. The interest from larger towns with populations between 50,000 to 100,000 inhabitants was low (5.2%). Individual disabled wheelchair users stated that used wheelchairs for between 1 and 42 years. Among the total, 18 respondents used the wheelchair for more than 12.5 years, 5 respondents for over 25 years and one respondent for 42 years. The most numerous respondents are tetraplegics with 57.9% of all responders, further 28.1% are paraplegics, and 14% have other disabilities. Up to 71.9% of respondents used mechanical wheelchairs to move in the countryside and only 1.8% have access to tricycles with a wider wheelbase that are best suited to movement in the terrain. 52.6% of respondents stated that most frequently visits trails with family and 28.1% reported doing it with family and friends. Interesting information is that 43.9% of respondents are transported to the routes in a wheelchair and 38.6% by car. About 40% of respondents liked routes between 2 km and 4 km, while other interesting data suggest that up to 19.3% of respondents liked routes over 4 km long. Regarding the preference of the seasons and their popularity, the most preferences has the summertime (56.1%). Most respondents (47.4%) reported that the average time which spend on trails is to 2 hours and 38.6% reported that their time ranges between from 2 to 4 hours. Three respondents indicated that they would welcome these elements on the route to be about 1,000 to 2,000 m apart, 11 respondents suggested distances from 500 to 1,000 m, while most respondents (43) would like to see these elements on the trail to be about 100 to 500 m apart. As for the parameters of the pavement, 71.9% said that they find it difficult to go uphill than downhill. 94.7% respondents indicated as the "best surface" the asphalt. As a "very important factor" is considered gradient of the slope (attributed importance up to 50.9%), further the visibility (50.9%), its width (49.1%) and signposting intersections to bicycles or equestrian trails (45.6%). Great difficulty causes overcoming barriers such as stairs (87.7%), follows the deep potholes (77.2%), frequent potholes (70.2%), very narrow trails (66.7%), the crossing bodies of water (57.9%), protruding rocks (57.9%) and ruts (56.1%). To the question "What other factors are causing you problems?" in overcoming barriers on trails, the respondents agreed that the decisive criteria include the trail parameters, such as surface quality and traffic conditions. Other factors are: defining and marking the trail for wheelchair movement, maintenance and care of the trail, its accessibility, density of trails and their interconnectedness, symbols marking accessibility, as well as markings along the trail. Some respondents would welcome the possibility of obtaining an exemption for the disabled to move by car to their destination accordig mobile aplication. To the question "How would you like to be informed about the trails and their options?", the most respondents (20.4%) answered that would like to be informed by leaflets e.t.c. From the reasons of the scope of the paper presents selected examples of the evaluation questionnaire (see Figure 1-3).

Discussion

Slovak Statistical Office (2014) states that Slovakia has about 8% of persons with disabilities of the total population. Figures about the number of persons with disabilities is informative (based on registered applications), because not every citizen has access to and uses solidarity support system. The main objective our work was monitoring the state of the trails in nature accessible to people in wheelchairs. We obtained information directly from target group, the physically disabled people in a wheelchair. In the questionnaire, disabled people was categorized by the following groups: a paraplegic, tetraplegic, other disability, by the age. In the questionnaire survey in Slovakia, we found that up 71.9% of respondents are moving on mechanical wheelchairs and 14% on electric wheelchair in the countryside and only 1.8% have access to tricycles with a wider wheelbase that are best suited to movement in the terrain. Compared to other countries such as example in the Czech Republic, 36.4% moves on mechanical wheelchairs and 50% of respondents on an electric wheelchair (Fialová et al. 2015).

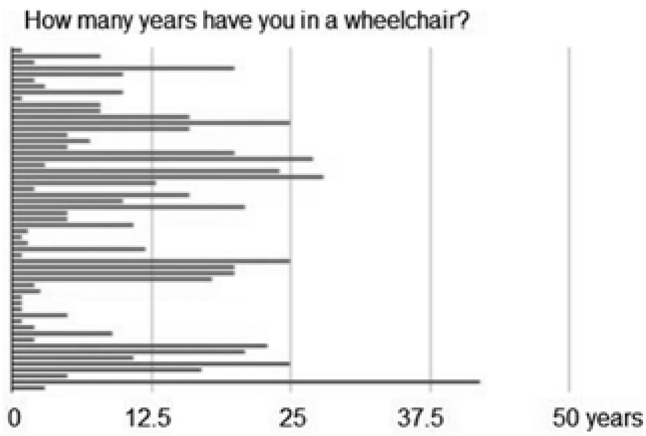

Fig. 1: Question No. 4 of the questionnaire (selected example)

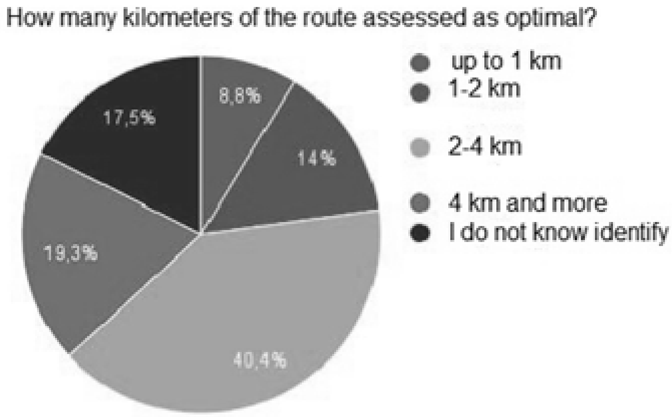

Fig. 2: Question No. 9 of the questionnaire (selected example)

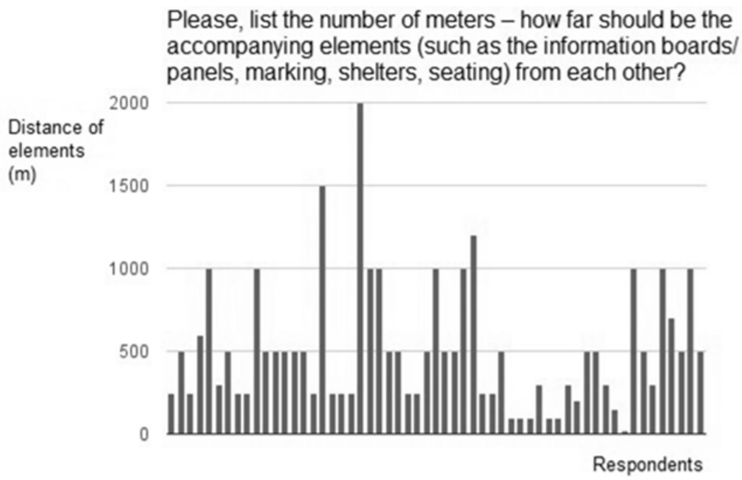

Fig. 3: Question No. 13 of the questionnaire (selected example)

We consider that these differences arise from the social conditions such as different rules of state support and low solvency of respondents. Interesting is data when 43.9% of respondents reaches the trails in a wheelchair and 38.6% by car (in Czech Republic it is up 54.5% respondents by car). I suppose that it stems from the availability and accessibility to routes from the starting station. 52.6% of respondents answered that the most frequently visits trails with family and 28,1% with family and friends, in Czech Republic 31,8% with family and 22,7% with family and friends (Fialová et al. 2015). From this examples, it is important to emphasize the family, because we assume that is most involved in the care of people wheelchair and their activities. About 40% of respondents preferred the routes between 2 km and 4 km (31,8% in Czech Republic), while other interesting data suggest that only to 19.3% (45,5% in Czech Republic) of respondents liked routes over 4 km long. By Jakubisová (2013, 2015) from the empirical point of view of the wheelchair user, based on research findings the most optimal route is a moderately difficult route, lasting 4 hours with a length of 2.605 km, within a time period of 1.56 hours and proposed wheelchair speed of 1 km/0.6 hours without stopping. Most respondents (47.4%) reported that the average time which spend on trails is to 2 hours and 38.6% reported that their time ranges between from 2 to 4 hours. The most respondents (43) would like to see accompanying elements on the trail in the range from 100 to 500 m apart. As absolutely "necessary," they consider the presence of covered shelters for rest, the presence of suitably located information boards, parking close to the sidewalk, and the use of toilets, especially at the beginning of the trail. As the "best" 94.7%) surface on the trails, the respondents indicated asphalt surface. As particularly suitable, they consider surfaces with compacted natural way.

Conclusion

Slovakia is an inland country in the central Europe and member of National Atlantic Treaty Organization since 1999 and European Union since 2004. The Slovak territory is characteristic with its extensive forest cover. In Slovakia are 9 national parks (NP): the Tatra NP, the Pieniny NP, the Poloniny NP, the Muránska planina NP, the Nízke Tatry NP, the Veľká Fatra NP, the Malá Fatra NP, the Slovenský raj NP, the Slovenský kras NP and 14 Protected Landscape Areas. It represents the potential for tourism development without barriers and borders. Surveys and mobilities of tourism support enhances professional interventions, new relationships, new features, the mental and movement ability, the social solidarity and justice. It provides the manual how professional and systematically solve in proposals of barrier free designing.

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STN 73 6101 Design of Roads and Motorways
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ResAP(2007):3: Resolution ResAP(2007):3 "Achieving full participation through Universal Design"; Decree of the Ministry of Interior (MV) of the Slovak Republic No. 9/2009 Coll. implementing the Act on Road Traffic and amending and supplementing certain acts, as amended

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Visegrad Fund

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Souhrn

Představujeme dotazníkový průzkum na Slovensku s odpověďmi od 57 respondentů se zdravotním postižením na invalidním vozíku všech věkových kategorií. Ověření dostupnosti turistických tras v přírodní krajině pro lidi na invalidním vozíku je důležitá z různých důvodů. Ověřování na základě skutečných zkušeností je nejlepší metodou, jak navrhovat turistické trasy s bezbariérovým přístupem v souladu s požadovanými normami, požadavky a potřebami vozíčkářů. Zkoumali jsme preference a názory týkající se turistických tras. Průzkum byl proveden na Slovensku v říjnu 2015. Dotazník byl distribuován přes internet za pomoci klientům Národního rehabilitačního centra v Kováčové, a Slovenského svazu osob se zdravotním postižením. Výzkum byl proveden výhradně mezi vozíčkáři, kteří strávili svůj volný čas v přírodě. Získáno bylo 57 dotazníků s 1311 odpověďmi. K interpretaci výsledků jsme použili shromážděné materiály, grafické, srovnávací a statistické metody.
Slovensko jako země střední Evropy a člen Evropské unie od roku 2004 má velký potenciál rozvoje vysokohorského turismu. Území je charakteristické rozsáhlými lesními porosty s 9 národními parky a 14 chráněnými krajinnými oblastmi. Bezbariérové zpřístupňování, průzkumy a mobility posilují rozvoj cestovního ruchu, zvyšují profesionální intervenci, nové vztahy, nové funkce, mentální a pohybové schopnosti, sociální solidaritu a spravedlnost.

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VISITOR MONITORING BY AUTOMATIC COUNTERS IN THE TFE MASARYK FOREST KŘTINY IN 2015

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Abstract
In 2015, as in 2013 and 2014, visitor monitoring using automatic counters took place in the territory of the Training forest enterprise Masaryk Forest Křtiny (hereinafter TFE MF Křtiny). Counters were installed by a specialized company. Counters were installed at five localities in three forest district of the TFE MF Křtiny. The most frequented paths and cycle trails were selected. The counting of visitors is based on the difference of thermal radiation of the human body and the environment. A movement direction of visitors is possible to record by counters (IN and OUT). Data evaluation was performed at hourly intervals. In the first month (in the week from 13th to 19th of July) students also performed a calibration of the counters. Using the calibration was found out categories of visitors at localities. Overall, the selected sites were visited by nearly 89 thousand visitors. In terms of total number of visitors of all localities, the highest attendance was recorded in September. The most frequent day in week was Sunday. The calibration found out that the largest group of visitors was cyclists (about 60 %) and the second largest was hikers.

Key words: attendance, forestry, Eco-counter, forest roads, visitor category

Introduction

Forest roads, in former times planned and constructed for the needs of wood harvesting and transport, are the key factor for recreational access to and activities in forests environments (Janowsky, Berker, 2003). To understand recreational requirements we need detailed information about area usage and the preferences of different target groups (Chiesura, 2004). Monitoring and analysing the flows of visitor in areas is key to understanding visitor behaviour which in turn is needed for effective management of these areas (Mckercher and Lau, 2008; Muhar, Arnberger and Brandenburg, 2002). Monitoring the movement of people during their visits to a recreational area can help to identify which places they visit most or least, how much time they spend in each place and which kind of attraction different target groups prefer (Orellana et al., 2012).
Some forest roads show a heavy frequentation by the city-dwellers, but actual and exact data of visitor numbers resulting from long-term studies do not exist in the most cases (Janowsky, Berker, 2003).
Only when detailed information on the leisure and recreational usage of the area is available is it possible to blend these with findings from natural science and sociology to attain ecologically and economically sustainable management of recreation and conservation areas (Coch and Hirnschall 1998; Eagles and Hornback, 1999). Best-practice visitor-monitoring techniques are crucial for the assessment of tourism-related impacts in natural areas of high conservation value (Wolf, Hagenloh, Croft, 2012). These techniques can also be used for visitor monitoring in forests. These are mostly suburban forests (see Janowsky, Berker,

2003). There are several methods for visitor monitoring in forests (see e.g. Cessford, Mulhar, 2003; Watson et. al. 2000; Wolf, Hagenloh, Croft, 2012; Janowsky, Becker, 2003; Kettler, 1970; Volk, 1992).

The article is focused on visitors monitoring in the area of the Training Forest Enterprise Masaryk Forest Křtiny. Forests of the Training Forest Enterprise Masaryk Forest Křtiny are suburban forests that are widely used for recreation. The objective is to present chosen results of monitoring of the visitors realized by a pyroelectric sensor. The counting of visitors is based on the difference of thermal radiation of the human body and the environment.

Material and methods

The Training Forest Enterprise Masaryk Forest Křtiny was chosen as an area of interest, where similar research was carried out in the years 2013 and 2014 but in different localities. The area is located close to the second largest city in the Czech Republic (Brno), and therefore it is highly used for recreation. The total area of the TFE Křtiny 10,495 ha.

In order to monitor the visitors at chosen forest paths and trails there were 5 automatic counters installed in five localities by a specialized company. Selection of localites was based on characteristics of used technology and rules for relevance of measured data. The reference period was from July to November 2015. Automatic counters, which are used for counting of all users of paths without distinguishing a type of user, were used for monitoring.

The counting of visitors is based on the difference of thermal radiation of the human body and the environment. A movement direction of visitors is possible to record by counters (IN and OUT). Movement in both directions was researched in three of five localities. Data evaluation was performed at hourly intervals. In order to find out categories of visitors in the area, manual calibration counting was carried out by students from the Faculty of Forestry and Wood Technology of Mendel University in Brno. The calibration was carried out in the first month (in the week from 13^{th} to 19^{th} of July). By comparison of results of manual and automatic counting, a so-called calibration coefficient was determined for individual localities, by which data from automatic counting were recalculated. Calibrated data were used for detailed evaluation of individual localities. In case of affecting data (loading of units, covering of a sensor) of a counter there is extrapolation of data carried out in a given period, and it is based on combination of spatial and time correlation of data.

Results

Visitors monitoring of chosen forest paths and trails took place in 5 localities. In terms of distance of the localities from Brno, the closest was the locality 3 followed by 2 and 5 and the most remote were localities 1 and 4. Results of counting according to individual localities and months are stated in table 1.

The selected localities were visited by 88 812 visitors. The most users were recorded in the locality 3, which is the closest to the city of Brno and it was in total (over 36 thousand) as well as in individual months.

Overall, the most frequent day in week was Sunday. Comparison of a number of users of chosen paths in the TFE Křtiny in the period from July to October by individual months is stated in figure 1.

Tab. 1: Chosen indicators of the visitors monitoring of forest paths and trails

Indicator	Locality 1	Locality 2	Locality 3	Locality 4	Locality 5
Total number of visitors	8 643	19 295	36 054	10 036	14 784
Daily maximum	370	352	631	366	527
Daily minimum	1	0	22	0	4
Most frequent day	Saturday	Sunday	Sunday	Sunday	Saturday
Monthly average	1 719	3 839	7 173	1 997	2 941

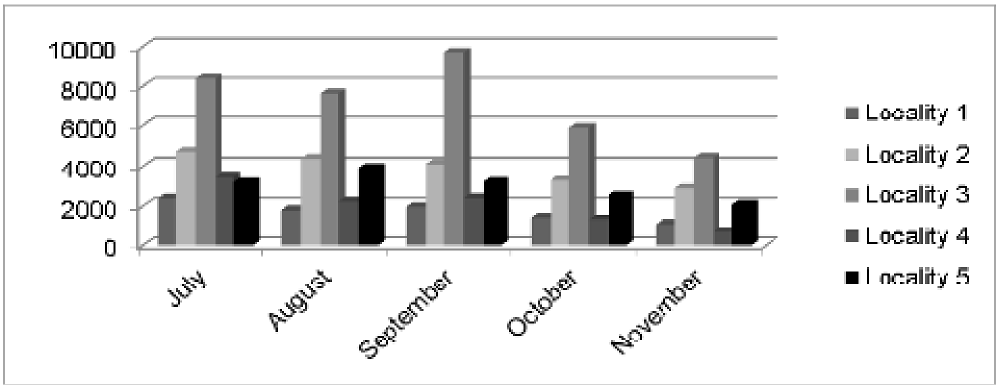

Fig. 1: Comparison of a number of visitors of the localities according to individual months

In terms of total number of visitors of all localities, the highest attendance was recorded in September. In localities 4 and 3 there was recorded a significant effect of vacations, i.e. a high number of users especially in the months July and August. In the other localities there are not so significant differences in the visit rate in individual months. The most users in one month (approximately 9.7 thousand) were recorded by a counter in September in the locality 3, on the contrary, the lowest value (685) was recorded in October by a counter in the locality 4.
Furthermore, categories of users were determined through calibration by students. The visitors were divided into six groups – hikers, cyclists, in-line, cars, horses, others. The “other” group includes prams, wheelchair user for example. Figure 2 states a ratio of individual categories in the overall quantity of visitors of all localities. Because of a low number of in-line skaters and horses, these categories are not stated separately but included in the category others.
The calibration found out that the largest group of visitors was cyclists (59.2%) and the second largest was hikers (30.8%). However, there are differences among individual categories as it is stated in the graph in Figure 2. In three localities s there are prevailing cyclists (localities 2, 3, 4). In case of the locality 4 cyclists significantly prevail, which is given by the fact that local bike trails go through the locality. In case of the locality 1 the ratio of hikers and cyclists is almost equal (the category of hikers takes 44.3%). However, in case of the locality 5, hikers strongly prevail. This category takes 64.6%. There is a dense network of touristic trails for hikers in this part of the TFE Křtiny.

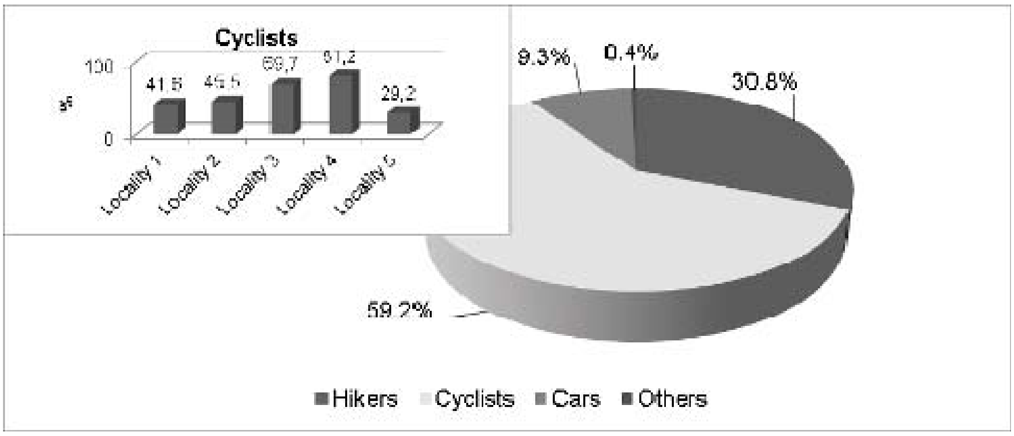

Fig. 2: Share of visitor's categories

Discussion

Several methods exist for visitor monitoring. Each of these has its advantages and disadvantages. Firstly, visitor counts in forest are carried out on single days by a couple of people, standing at different points – mostly entrances – in the forest (Kettler, 1970; Volk, 1992). This method needs high manpower and presents data for only a few days, which cannot be extended for longer period (Janowsky, Berker, 2003). The second method is monitoring with automatic counter. The use of automatic counting devices enables managers to expand data collection over a long time, but needs a long calibration phase and the correlation between hourly visitor sums and corresponding sensor signals is quite week (Muhar, Arnberger and Brandenburg, 2002), distinction between user group is mostly impossible. This method was chosen for our research. But the most precise data concerning visitor number and special use patterns result from video recording (Muhar, Arnberger and Brandenburg, 2002; Arnberger, Hinterberger, 2003). This method is demanding for device equipment.

The method of visitors monitoring of an area of interest by automatic counters was selected for the area of the Training Forest Enterprise Masaryk Forest Křtiny. With the use of calibration of these devices by students it was possible to determine not only a number of visitors but also their categories in the localities. The method was evaluated as the most suitable for the area of interest.

Conclusion

The paper is focused on a part of research which took place in 2015 within a project of the Internal Grant Agency of the Faculty of Forestry and Wood Technology of Mendel University in Brno, specifically regarding the analysis of the recreational use of the territory of the Training Forest Enterprise Masaryk Forest Křtiny. The main part of the analysis of the recreational use of the territory consisted of visitor monitoring of the TFE Křtiny territory. The monitoring was performed at five localities of the three forest districts of the TFE Křtiny in two ways. The paper presents the results of one of these ways – visitor monitoring by specialized company. In the referent period (from July to November 2015), the total number of visitor on the monitored road and trails recorded by the counters in both directions was about 89 thousand people at 5 localities. During calibration counting, the categories of the visitors were determined. The territory of the TFE Křtiny is mostly used for sports and recreational activities, especially for hiking and biking.

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Souhrn

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tyto lokality automatické sčítače. V prvním týdnu měření (tedy v termínu 13. – 19. července) byla zařízení kalibrována studenty v čase 9 – 17 h. Na základě kalibrace byl vypočítán korelační koeficient, který sloužil především pro zjištění kategorií návštěvníků území. Celkový počet návštěvníků monitorovaných lesních cest a cyklostezek zaznamenaný sčítači v obou směrech za referenční období na pěti lokalitách byl téměř 89 tis. lidí. Kalibrací bylo zjištěno, že největší skupinu návštěvníků tvoří cyklisté (59,2 %), druhou největší skupinou jsou pěší turisté (30,8 %). Mezi jednotlivými kategoriemi jsou však velké rozdíly na jednotlivých lokalitách. Z výsledků výzkumu je zřejmé, že území Školního lesního podniku Masarykův les Křtiny je využíváno pro sportovně-rekreační aktivity, především pro cyklo a pěší turistiku.

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WATER CONSTRUCTIONS AS A PLACE FOR EDUCATION, ARTS OR RECREATION

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Abstract
Water constructions consist of notable buildings in many countries around the world, which is arousing interest and curiosity in humans from time immemorial. Water structures can form a complex monumental works that interested people for centuries, as it can only be just small structures in the country that perform or fulfil their functions related to water management. This post offers a look at three selected water works as well from a different perspective than they are, or their original function is. At each water work can be viewed through the eyes of designers, architects, operators of a waterworks or also students, artists and tourists. Water works that are preserved thousands, hundreds or even just dozens of years worked in the landscape breathtaking scenery, not only for water enthusiasts, but also for artists and curious tourists.

Key words: water constructions, water work, function

Introduction
Water structures are objects that are used to capture, aggregation, accumulation, impoundment, transportation, treatment and purification of water, to regulate flows, water transport, water power utilization, prevent floods and other harmful effects of water.
The beginnings of water management and water engineering can be found in the early days of the development of the famous ancient civilizations.
On each of the then water work can be seen as the original building with its functions, which for centuries were added or changed, depending on the needs of society. If you look into history, when in the European territory, mainly in the areas of the former Roman Empire, the first water and sewer lines began to emerge. The town development was in line with the needs of the population - and its expansion in the number of inhabitants and the then infrastructure. Big city consumed many litres of water a day. Water distribution served as for drinking purposes and operation of urban fountains. The first aqueduct in Rome began to build in the year 312 BC and was called Aqua Appia, when the springs of Rome located about 17 km were a source of water. Aqueducts, which were used to transport clean water from springs or rivers to the residents of big cities, inherently belong to the Roman water supplies.
Consequently, we can move into the heart of Europe, where many years later in the Middle Ages the first primitive but functional water works began to emerge, which like in the territory of the Roman Empire solve drinking water supply for urban populations. The first water pipes were still simply kept on the surface or shaft mains and fed the fountains or underground storage tanks. Vyšehrad aqueduct from the 12th century was probably the oldest water main in our area. It led from spring and well to the fountain at Vyšehrad and was made of wood ovens. At the same time another wooden water main led to the Strahov monastery. Water main to the Prague Castle was brought during the reign of Charles IV. The gradual development of new

techniques and technologies being added to water supplies also water towers, initially for the fast accumulation of water (Kořínek, 2013).
Water reservoirs are the latest water management structures introduced in the paper. It is a waterworks that produced artificial damming the watercourse by a dike. The advent of technology of tanks is dating back to thousands of years, although its exact origin is unknown (White at all.,2014). Water detention for its subsequent use in the growing season or draining wetlands for further development of civilization was the original functions of reservoirs.
By speleologists first dam work is located in the Krasnodar region of southern Russia. Age of discovery is more than 10 000 years. Spelunkers of Russian Geographical Society appeared in one of the caves in Krasnodar region unique clay dikes. Scientists with certainty assert that it is the work of people from the Neolithic period. These hydraulic structures should accumulate water flowing down from the cavern walls (sputniknews.com).

Aqueducts

Aqueducts are waterworks to transport clean water to the inhabitants of ancient cities. These are buildings designed as the perfect works of Roman builders, which was used to supply clean water to the cities from great distances. These buildings were part of the entire water supply system since antiquity. Aqueducts were built where it was necessary to bridge the valley in terms of the route of the water system. These are mainly multi-storey arch buildings similar to bridge structures where water resulted in the highest echelons of the bridge, because of compliance with the specified gradient entire water system (Fig.1.).

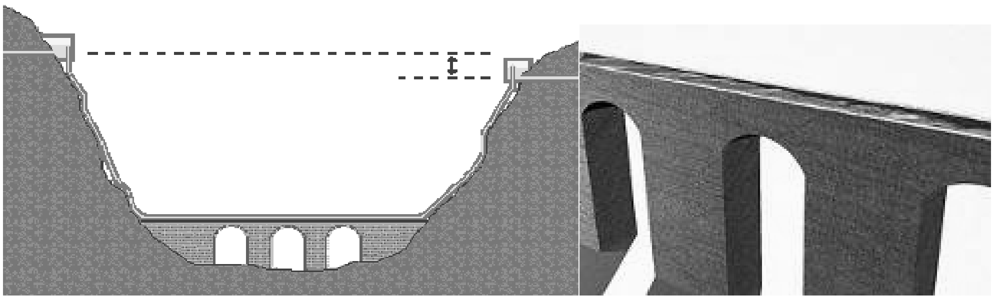

Fig.1: Aqueducts - technology (Source: google.com)

Parts of these water projects is most often found or even located on the territory of present-day Italy, France, Spain, Greece, North Africa and Asia Minor. It is interesting that alone aqueducts (bridges) accounted for less than 20% of the total length of water mains. Aqueducts were a pillar of infrastructure that allowed the large-scale urbanization of its time. Even now, those of us fascinated by water works primarily from a structural point of view, their perfection has never been surpassed, and therefore it is possible to see the remains of these buildings at several locations in Europe. Pont du Gard, located in France, not far from Nimes, is one such preserved Roman work (Fig.2.).

Fig. 2: Aqueducts Pont du Gard in France (Source: V. Hubačíková)

This marvel of Roman engineering is 275 m long and reaches a height of 49 meters; it consists of three rows of arches standing on each other. There is six arcs in the bottom row, eleven arcs in the middle one and thirty-five arcs in upper one. Individual limestone blocks weighing up to six tons. Pillars in the middle floor stands just above the pillars of the lowest floor, thereby preventing excessive loads on the lower arches. From the centre towards the river banks, the margin of pillars shrinks. It is interesting that the whole aqueduct was built without mortar. An old water main, which is 1.8 meters high and 1.2 meters wide, was led on the top floor. It is covered with stone slabs, which prevented the debris falling into the water. In 1985 the Pont du Gard was for their exceptional historical value enrolled on the UNESCO World Heritage Site. For its uniqueness, this property is a very popular tourist destination. This stone structure spanning the river valley, looks very impressive and rightfully often served as a motive for the work of painters, as well as modern artists today use it as a backdrop for an impressive evening illumination show (Fig.3.).

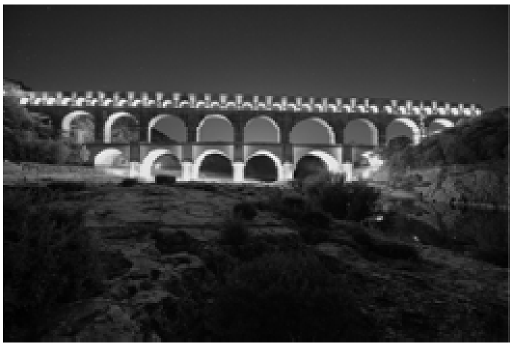

Fig. 3: Pont du Gard - artist (Source: lucnix.be and aldermanarts.typepad.com)

Water towers

Water reservoirs are objects for water accumulation. The purpose of the reservoir is to offset differences between the tributaries from the water source and subscriptions consumers, provide necessary pressure in the water network and ensure sufficient reserves of water in case of fire.

Visual or written mention of the water tanks on our territory belongs to the late Gothic and Renaissance. At that time, the settlement reached relatively high degree of urbanization, cities were expanded, crafts were developed, and the technique came perfected so it was necessary to solve the question of infrastructure, which included the water supply. The first known water lines from 12th century were still simply kept on the surface or shaft mains and fed the fountains or underground storage tanks. Aqueducts gradually improved by being kept wooden pipes leading water from source to public or private consumption points. Water towers were built on the water supply system to supply water to users come continuous and necessary pressure has been reached. At that time, it was mostly on the construction square or rectangular ground plan, built near water sources - rivers, ponds. In the early days the towers were built of wood, later from stone blocks and quarried stone. Water is supplied to the tower often swept by means of a piston pump, which was driven by a water wheel. There was a pond with a small volume mostly made of wood or metal in the last floor of the tower, which is characterized by small volume and water flowed over it with a small delays continued on to the water network (Kořínek, 2013). The most important water tower of the historic water towers in Prague stands on Novotny's footbridge. The first extant treatise of this waterworks comes from 1489.

Over time, the fountain ceased to perform its function and the development of techniques and technologies remarked pumping, storage and transportation and distribution of drinking water. Steam engines and later petrol, gas and electric motors abolished the dependence on hydropower and water bikes. Water towers no longer had to be close to the source, but built in places where it was technically and economically better. Volume of reservoirs has increased as well. Masonry reservoirs were initially brick and reservoirs had a square shape. Gradually builders switched to concrete and circular plan, tanks were made of steel, riveted later reinforced concrete. Famous architect Jan Kotěra made major changes in the approach to implementation tower reservoirs, with exaggeration, stripped water tower and showed bare wall as an aesthetic ideal.

In the early 20th century Třeboň lacked a good source of drinking water. Construction of the municipal water supply in 1909 was a quality breakthrough. Prague firm Karel Kress built the tower reservoir in the same year by their own project. The architectural design is by Jan Kotěra and resembling very similar reservoir in Prague – Michle (Kořínek, 2013). Water is pumped into the reservoir from 10 m deep well by pump gasoline. After the First World War, there was a drop in water level, therefore the reservoir was in the years 1922 to 1925 connected to the new artesian well. Třeboň reservoir is perfect proof of the technical and aesthetic thinking of his time. The bottom part of the reservoir is walled by stonework. Reinforced concrete frame and brick masonry root is the main building Article ponds that form in the shaft reservoir effect eight supporting pillars ending in corbels under the tank. The entrance to the reservoir in a massive lining is from the southeast, above the entrance there is a sign of Třeboň. Cylindrical mantle reservoir holds regularly spaced four small circular lighting triple windows.

Třeboň water tower was decommissioned after World War II. In 2005 the city Třeboň leased the building of water tower to private entrepreneurs for symbolic amount for a period of 50 years. He reconstructed the whole object at its expense and creating another Mongolian Buddhist art gallery, which was ceremoniously opened in 2013 (asian-center.cz).

(Source: V. Hubačíková)

(Source: V. Hubačíková)

(Source: asian-center.cz)

Fig. 4: Water tower in Třeboň

Dams

Dams are the water tank that are created by the artificial damming the watercourse by a dike. They are used to water supply, power generation, flood protection, load balancing, partly for recreation, water sports, fishing, etc. The water works mainly allow customizing volatile natural river flow regime.

The most important period of the construction of dams in the Czech Republic to protect against flooding is the turn of the 19th and 20th century and early 20th century, when a large number of dams have been built, many of which are now declared a cultural monument. These were mainly the construction dike walled from quarry stone, and later earthmoving and concrete Dam Les Království on the river Elbe near Dvůr Králové nad Labem is due to towering architectural elements of the nicest and most visited in our country (Fig.6.).

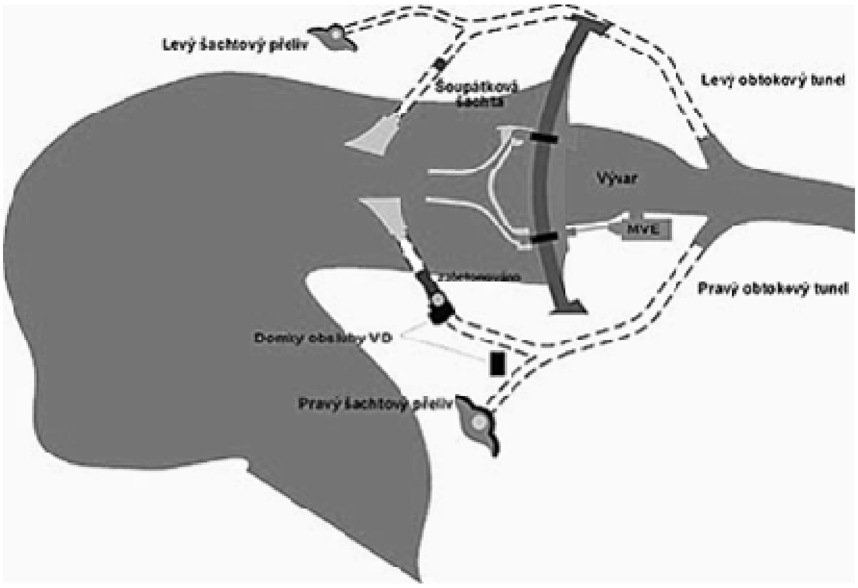

Fig. 5: Situational schema of the dam Les Království (Source: pla.cz)

In 1964 it was declared a technical monument. Catastrophic flood in July 1897 was the impetus for the construction of dams on the upper reaches of the Elbe. The legal basis for initiating systematic regulation from Špindlerův mlýn to Jaroměř including the construction of dams in the upper part of the stream has been given by provincial law no. 31 of 1903. Construction took place between 1910 - 1919, the first World War greatly influenced the extension of construction time. In its time it was the largest reservoir in the Czechoslovak Republic, if concerned seized quantities of water, and the longest dam in length masonry dam. Dam body, which is built in an arc with a radius of 200 m, is built of sandstone on the terraced cement-mortar (Fig.5.)(www.pla.cz). Elevation of the dam is 327.71 m above sea level.
Hydro power plant was built in 1920 - 1923 on the right bank below the dam. The whole water work including power station is an immovable monument since 1958. For its uniqueness, this dam is a popular place for tourists and artists.


Fig. 6: The dam Les Království (Source: V. Hubačíková)

Fig. 7: The dam Les království - painting (Source: Ing. Jiří Frýda)

Conclusion

Water construction as presented in the paper, are remarkable works that may even thousands of years to prove their excellence in design using indigenous technology at the time of their creation. Also deserve our admiration younger age structures built on our territory, some of which serves as a monument not as water management construction. Conversely, there are those that even after many decades still fulfils its function of water management as well as a place for education, arts and recreation.

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Souhrn
Vodohospodářské stavby, jak bylo představeno v příspěvku, jsou pozoruhodná díla, která mohou i po tisíce let dokazovat svoji dokonalost v konstrukci při použití původních technologií v době jejich vzniku. Skládají z pozoruhodných objektů v mnoha zemích po celém světě, což u lidí vzbuzuje zájem a zvědavost od nepaměti. Tento příspěvek nabízí pohled na tři vybraná vodohospodářská díla i z jiného úhlu pohledu, než jsou nebo byla jejich původní funkce. Na každé vodní dílo lze nahlížet očima projektantů, architektů, provozovatelů těchto vodních děl nebo též studentů, umělců či turistů. Vodní díla, která jsou dochována tisíce, stovky nebo jen desítky let vytvářejí v krajině úchvatné scenérie nejen pro vodohospodářské nadšence, ale i pro umělce nebo zvědavé turisty.

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WINTER RECREATION AND SNOW

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Abstract

Climate assessment should not be limited to just statistical analysis, but also look at relationships in data and its uses in other areas of everyday life. One such area is tourism and recreation, which is also to a great extent influenced by the weather. This paper focuses on the winter season and the related possibilities for tourism. One of the key factors is snow conditions of the particular place. This analysis takes into account the amount of new snow and maximum snow depth and changes in these parameters as a result of the current global climate change. Especially in the last 15 years, years with less snow are more frequent and this is especially seen at highest altitudes of the country. The study also analyzed outputs of climate models with regards to winter season, including calculations of the number of melting days.

Key words: new snow, total snow depth, climate change, climate models

Introduction

Tourism and recreation is one of the most important global industries and also one of the fastest growing. In many places it is the most important source of incomes, spanning over many fields such as aviation industry, travel agencies, accommodation services, car hires, souvenirs etc. Recreation and tourism climatology has over 50-year long tradition. As Lamb (2002) described, research in this field began in the period known as "climate revolution" in the 1960s and 1970s. Snow is an important climate characteristic, which affects both the natural environment, and human activities. It is a presumption for sufficient amount of surface and ground water, acts as an insulator for plant cover, increases albedo, which in turn increases the intensity of reflected radiation and overall it is the fundamental element in winter recreation. However, one must also remember that too much snow can cause significant problems. It can negatively affect transportation, increase costs for maintaining building constructions, causewindfalls and during sudden rapid melting can lead to floods. Even in the Czech Republic, at highest altitudes there is a danger of avalanches (Tolasz et al. 2007).

This work follows up on a previous study that focused on the effects of air temperature on summer recreation (Rožnovský, Zahradníček, 2014). This time it is focused on the other, colder, half of the year, when the most important factor for recreation is snow, which however is also important in many other areas (Pokladníková et al. 2005). Probably the most common and favorite winter activity is skiing. This obviously requires conditions, which were often not ideal in the last few years, not just in the Czech Republic. Many ski resort owners invest substantial amount of money into improving their resorts, including purchasing snow guns.

In this study, the goal was to analyze the change in snow conditions and predict future trends.
Information related to snow conditions in the Czech Republic can be found in the basic climatology sources. Podnebí ČSSR – Tabulky (Climate of Czechoslovakia – Tables, 1960) contains information about the number of days with snow and the snow depth for years 1920/1921 to 1949/1950. Podnebí – Souborná studie (Climate study, 1969) gives information about snow for selected stations for the period 1931/1932 to 1960/1961.

Materials and Methods

Analysis of snow conditions in the Czech Republic and its effects on winter recreation was performed mostly using data about the amount of new snow (SNO) and also the maximum snow depth (SCE). Within the weather station network of CHMU, the amount of new snow is determined every day at 7AM. The total snow depth is reported in whole centimeters and measured using a snow stake, usually placed next to the station and in a place, where it well characterizes the snow conditions of that area and is as little as possible affected by wind. The total snow depth is also measured in centimeters using a ruler and a snow plate and the amount of solid precipitation from the last 24 hours is reported. After each measurement, the snow is removed from the plate. It is also placed so that it is least affected by wind (Slabá 1960, Žídek, Lipina 2014). The measured data is then carefully validated by CHMU employees, including spatial comparison with nearby stations.
The spatial comparison of changes in snow conditions used all the available stations in the CHMU database. Stations which have a long series of measurement without any major gaps in data were used to calculate the long-term average from 1961 to 2000. The total number of these stations is approximately 400. Then, 8 particular stations were selected, each located in a region with potentially suitable conditions for winter activities (high altitude or current ski resorts) and also with a long series of measurements. These stations were used for the analysis of long-term variability in the amount of snow. The assessment was performed for winter, i.e. the months December, January and February, and for the cold half-year (Oct-Mar).
The study also focuses on possible future trends, especially with regards to air temperature during winter, which will influence the amount of snow and how long it will remain on the ground. Two types of climate models were used for the analysis. Firsttype is outputs from the older ALADIN-Climate/CZ model, which works at a resolution of 10 km and was developed as part of the EU FP6 CECILIA project (http://www.cecilia-eu.org). Future climate projection is available for two time spans. Near future, which includes period from 2021 to 2050, and distant future, which models data for 2071 to 2100. The projection is based on the A1B climate scenario (Farda et al. 2007, Farda 2008). The second type of models used in the analysis were the more recent RCM models, part of the EURO-CORDEX. These use two emission scenarios – the RCP 4.5 (reduction of GHG emissions) and RCP 8.5 (continuous economic growth with no GHG emission reduction) and the outputs are for the entire period until 2100.

Results

The amount of new snow that falls in the Czech Republic during winter depends on the altitude, exposition, but also synoptic situations, which occur during the season. This characteristic can serve as a good indicator of potentially suitable locations for winter sports. Places with lower snow fall amount during winter are probably not ideal, because it could be that there is no snow on the ground for most of the time in winter, and vice versa. The average amount of new snow per year for the period between 1961 and 2000 and for locations with altitude below 300 m above sea level, was 42 cm. At higher altitudes of 301-600 m, this average increases by 60 % (Table 1). Locations lying 600 to 900 meters above sea level have on average 116 cm of snow fall per year. For mountain areas above 900 and 1200 m above sea level this average increases to 198 cm and 277 cm respectively. Highest amount of snow fall in the Czech Republic is in the mountain areas along the borders (Krkonoše, Jeseníky, Šumava, Beskydy, Krušnéhory) and in contrast, the lowest amount of snow is observed in the area of Southern Moravia and Polabí.

Tab. 1: Amount of annual new snow grouped by altitude, for the period between 1961 and 2000, and 2001 and 2015, in the region of the Czech Republic

ALTITUDE (m)	AREA (%)	SNO 1961-2000	SNO 2001-2015	SNO DIF (%)
< 300	24.2	41.8	40.2	96.1
301-600	59.2	67.1	65.1	96.9
601-900	14.5	115.9	118.0	101.8
901-1200	1.9	198.5	200.8	101.2
> 1200	0.2	276.8	247.0	89.2

Winters in the last 6 years were very scarce in terms of snowfall and so a question arises as to how this amount changed since 2001 in comparison to the long-term average, also with respect to the ongoing climate change. Locations with altitude below 600 m above sea level (83 % of total area of the Czech Republic) showed a decrease of 4%. At higher altitudes above 600 m, there was practically no change and the amount remained the same. Dramatic difference, however, is observed in the highest altitudes. Places that lie above 1200 m above sea level, have an 11 % decrease in snow precipitation in the period between 2001 and 2015, in comparison to the long-term average.

The spatial difference in the last 15 years in comparison to the long term average from 1961-2000 is not consistent. Most profound decrease in the amount of new snow is observed in the Southern and Central Moravia, but surprisingly also in the Krkonošemountains. Places with highest amount of snowfall, on the other hand, are not spatially continuous and form rather local areas. A decrease of over 20 % in the amount of new snow was observed at more than 10 % of the total area of the Czech Republic. Overall there was a lower amount of snowfall in the period 2001-2015 compared to the long-term average observed at 39% of the total area. 28% of the area had just a very minor change of 5 %. Higher amount compared to the long-term average was observed at 32 % of the total area.

Another characteristic, which can also serve as an indicator of the suitability of a particular place for winter sports, is maximum snow depth during a particular winter. This depends on the amount of snow and also the type of winter precipitation and air temperature. It is therefore affected especially by the altitude of the particular location. In the Czech Republic, there is approximately 15 cm increase of winter maximum snow depth for every 100 m increase in altitude. Another factor influencing this characteristic is the exposition to prevailing wind and solar radiation, terrain and vegetation. Important is also whether it is located on the windward or leeward side. Typical example is the frontier region of Šumava, where there is double the amount of snow in comparison to places at the same altitude, but more inland, towards the center of the country. Lowest average maximum snow depth per season is again observed in Southern and Central Moravia and in Polabí. The maximum depth here is usually less than 15 cm. In contrast the highest maximum snow depth is on average in Krkonoše, Jeseníky, Beskydy, Šumava and Krušnéhory. Long-term average maximum for regions 300 m or less above sea level is 14.9 cm. At higher altitudes this average increases to 24 cm and at altitudes between 901 and 1200 m above sea level, the maximum snow depth in winter is usually 82 cm. For even higher altitudes, i.e. places 1200 m above sea level or more, the average maximum snow depth in winter is 113 cm (Table 2).

Tab. 2: Average annual maximum snow depth (SCE) grouped by altitude in the period between 1961 and 2000, and 2001 and 2015, in the Czech Republic

ALTITUDE (m)	AREA (%)	SCE 1961-2000	SCE 2001-2016	SCE DIF (%)
< 300	24.2	14.8	14.9	100.9
301-600	59.2	24.5	24.3	99.4
601-900	14.5	46.2	46.6	100.8
901-1200	1.9	82.3	82.8	100.5
> 1200	0.2	113.4	105.8	93.3

The analysis focused on whether there was a significant change since 2001. Compared to the amount of new snow, this characteristic did not change much, both in terms of its spatial distribution and the actual value. At basically all altitudes there was no change and the average values of maximum snow depth remained the same. An exception is regions 1200 or more meters above sea level, where there is a decrease of 7 %.

Next part of the analysis focused on 8 selected stations, which illustrate the large variability between the individual places. The station in Olešnice has data about new snow available since 1931. Overall, the average amount of new snow per winter for this station is 73 cm. In the 1950s it was almost twice as much, however, in the 1930s it was only 36 cm. In the last 5 years, 2011-2015, the amount was on average 25% lower than the average for the whole period of measurement. It can be seen that there is no particular statistical trend in data. The station in Churáňov has data available since 1951. This station lies at a higher altitude, so the average is also higher, in this particular case it is on average 203 cm of new snow per winter. Lowest values were observed in the 1990s, only 168 cm. In the last 6 years, the average is 12 % lower than the long-term average. The decrease of the amount of new snow of 5 cm/10 years is not statistically significant. Station in Pec pod Sněžkou has data since 1901, but there are larger gaps in data. The average from 1901-2015 is 286 cm of new snow. In the period between 1901 and 1930, there were even years with approximately 370 cm per winter on average. In the last decade (2011-2015), the average is only 245 cm. For this station, a statistically significant decrease of 21 cm/10 years can be seen. Statistically significant trends were determined for all the winter months, including March and November. Most significant decrease is in January, approximately 9 cm/10 years. The station in Svratouch has an overall average of 126 cm of new snow in the period 1951-2015, for which there are data available. In the last 6 years there was 20 % less than the average, but no statistically significant trend is observed. Station in Červená has an average of 129 cm. Since 1990s, the amount of new snow is regularly lower, between the years 2011 and 2015, by a third. A statistically significant trend can be seen here, with the exception of November. The overall decrease per winter season is 14 cm/10 years. Most profound change can be seen in January, for which the linear trend is 5.5 cm/10 years. A long and continuous measurement of snow cover is available for the station in Lysá hora, only between 1941 and 1950 there are more gaps in data. Average value for the entire period of measurement is 272 cm of new snow per season. Highest average is for the period between 1981 and 1990, when it reached a value of 324 cm. The decrease in last years is not large and does not differ from other periods, so no statistically significant trend can be seen. Station Razmová also has a long series of measurements and unlike the other stations shows an opposite trend. The average amount of new snow for the period 1901-2015 is 177 cm. However, since 2001 it was 264 cm. In this case there is therefore a positive linear trend, i.e. an increase of 12 cm/ 10 years. January and February have similar increase of approximately 4.5 cm /10 years. Last station, which was studied in detail, is the one in Milešovka, with data available since 1931. On average there is 80 cm of new snow per winter. Differences between the individual decades are variable and there is no significant trend.

The same analysis was performed for maximal depth of snow cover for the particular season. In this case, a decrease was determined in more cases. Statistically significant trend was found in case of the station in Churáňov (-5.6 cm/10 years), Pec pod Sněžkou (-7.5cm/10 years), Červená (-6.7cm/ 10 years) and Lysá hora (-4.9 cm/10 years). Most significant trends were determined for February, but also March. In case of March we are mostly talking about station at the highest altitudes, and the maximum snow depth decreases on average by 7 cm/10 years. This suggests that the seasons are shifting and even in mountain regions February is warmer (probably its second half) and especially March, when warmer spring weather leads to quick melting of snow. When looking at the entire period of measurement and the selected stations, the lowest annual average maximum snow depth is at the station in Olešnice (approximately 27 cm) and also Milešovka (37 cm). In contrast, highest maximum snow depth is at the station in Lysá hora (161 cm). In recent years (2011-2015), the average value of maximum snow depths was 30 % lower. Most significant decrease in maximum snow depth was in Olešnice in Červená (up to 40 %). Least profound decrease was in Ramzová (approximately 20 %).

Discussion

The major problem will be the increasing temperature, which is something that the climate models agree on. The most recent EURO-CORDEX models predict for the Czech Republic an increase in air temperature of 2 °C by the end of this century based on RCP 4.5, or even 4.1 °C based on RCP 8.5. Until 2050, air temperature will rise at a steady rate no matter what the amount of greenhouse gases released will be. New climate models, however, predict that the highest increase will be in the winter season. Based on the RCP 4.5 emission scenario, there will be on average an increase by 2.4 °C, however the RCP 8.5 model would mean an increase of 4.9 °C in temperatures during winter. Snow would either melt very quickly, or most of snow would change into liquid precipitation. In case of precipitation, there is a significant difference between the older climate models (ALADIN-Climate/CZ) and the new EURO-CORDEX models. These predict increased precipitation especially in the upcoming 80 years. Most profound difference is in case of the winter period. The ALADIN-Climate-CZ model predicts decrease in winter precipitation in the period between 2021 and 2050 by up to 15 %, which corresponds to what was observed in recent years (Brázdil et al. 2015). EURO-CORDEX models on the other hand predict an increase by about 10 % in the period between 2021 and 2040 and by up to 35 % in the period between 2081 and 2100, based on the RCP 8.5 scenario (Štěpánek et al. 2016).

One of theindicators is the number of melting days. A melting day is a day when the maximum air temperature increases above 0°C during winter season. This means that the potential for snow melting is higher. During winters 1961-2000, most of these days occurred in lowlands, sometimes even 25 days per winter or more (Polabí, Southern Moravia). In mountain regions the annual number of these days is less than 10. At altitudes above 1200 m above sea level it is only 2 days. Based on the ALADIN-Climate-CZ model, the number of these days will increase in the future significantly. During 2021-2050 at altitudes 801-1200 m above sea level, the number of these days will double and at altitudes above 1200 m above sea level, it will increase four times. Most significant change will take place in the region of Moravia and in the high altitudes in Karpaty. Between 2071 and 2100, more than half of the winter at altitudes below 400 m above sea level, will have a minimum temperature above 0 °C and so most of the snow will be likely to melt. At higher altitudes 801-1200 m above sea level, the number of melting days will be 23. At highest altitudes found in the Czech Republic, the number of these days will be six times higher than what it is today.

Conclusion

Climate change will have a widespread effect on many human activities, one of which is also recreation. This study focused on winter activities and tourism. This includes especially winter sports such as skiing, for which snow is absolutely essential. As the analysis showed, the change in snow conditions is not the same for the Czech Republic as a whole and varies substantially for particular regions. Statistically significant decrease in the amount of new snow, as well as maximum snow depth, was determined at many places. The decrease was more profound in case of the maximum snow depth and this means that even at places where the total amount of snow does not change, it melts faster. Many regions experienced shortening of the winter season because a statistically significant decrease was found in March. Significant decrease in the amount of snow was especially after the year 2001 in regions at the highest altitudes in the Czech Republic. On average, the amount of new snow was 11 % lower than the long-term average and the maximum snow depth was 7 % lower.

In the future, skiing conditions and all the winter activities will be affected especially by the predicted increase in air temperature. The latest EURO-CORDEX climate models predict an increase in winter air temperature of 5 °C. This will substantially increase the number of melting days and the snow will melt much readily. At lower altitudes this could mean that the snow could only be present for a short period of time, a day or two, and then melt. In the mountains it might not be the case, but the maximum snow depth will be very low and it will probably be necessary to also use artificial snow. Another effect of increasing air temperatures could be a higher risk of dangerous avalanches, because the snow will more often be exposed to air temperatures fluctuating around freezing point.

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Souhrn

Klimatologické hodnocení by se nemělo omezovat pouze na statistický výčet čísel, ale hledat propojení a využitelnost výstupů i pro další obory zasahující do běžného života. Jedním z nich je i rekreace v přírodě, jejíž rozsah je ovlivněn také průběhem počasí. Tato studie se soustředila na zimní sezonu a s ní spjatou rekreaci. Jedním z klíčových faktorů jsou celkové sněhové podmínky daného místa. Analýza se zabývá množstvím nového sněhu a maximální sněhovou pokrývkou a její změnou v současném klimatu Hlavně v posledních 15 letech se vyskytuje větší počet let s horšími sněhovými podmínkami, a to hlavně v nejvyšších partiích našich hor. Dále jsou analyzovány výstupy klimatických modelů se zřetelem na zimu včetně výpočtu změny výšky nulové isotermy a počtu oblevových dnů.

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O naše zkušenosti získané v terénu při výsadbách se opíráme i během projekce. Umíme si tedy již od samotného nápadu vzniku nového prvku představit možná úskalí a tomu se přizpůsobujeme.

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