

## REGIONAL TOURISM ORGANIZATION TEKOV AND SUSTAINABLE TOURISM DEVELOPMENT: PREFERENCES OF LOCAL RESIDENTS AND STAKEHOLDERS

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### **Abstract**

Recently founded Regional Tourism Organization (RTO) Tekov in the Levice cadastre has been actively participating in tourism development in the studied area. As the area has high potential for tourism development and activities of the RTO Tekov are becoming more frequent and considerable, we decided to analyze awareness and opinions of local citizens and stakeholders about RTO Tekov activities and impact of the tourism development on environment, very important topic related to tourism in past decades. The research was based on two questionnaires, one for local citizens and another for stakeholders including members of RTO Tekov. According to the results of the questionnaire, most of the citizens do not notice growth of tourist numbers nor negative impact on nature. They are either comfortable with number of tourist or would welcome more of them. Because of many benefits related to rise of tourist numbers, the asked stakeholders would appreciate expansion of tourism. However, not all of them plan activities associated with tourism in relation to the environment. The research paper includes suggestions for tourism development actions with sustainable approach and proposal for increasing of awareness about the RTO Tekov based on the questionnaire answers and present biocultural values.

**Key words:** RTO Tekov, sustainable tourism development, survey, citizens, stakeholders

### **Introduction**

One of the possibilities to contribute to tourism development in regions of Slovak Republic is by founding a regional tourism organizations (RTOs). The main mission of RTO Tekov is to liaise municipalities and private subjects. Together, the members are trying to cherish cultural heritage, organize events and support cultural and social life in the region. In the contribution, we are discussing functioning of the recently founded (2017) RTO Tekov. During its short existence, the RTO Tekov has organized many events and is planning to extend range of practice. The aim of the research paper is to investigate citizen awareness of the RTO Tekov, opinions on tourism, possible negative consequences of tourism and its impact on environment in the area. However, we must have constant emphasis on societal development because all social changes eventually influence changes in landscape structure and utilisation (Izakovicova et al., 2017).

### **Basic information about RTO Tekov**

In February 2017, a city council meeting was held in Levice, where the establishment of the RTO Tekov was approved, as well as the admission of the city of Levice into this organization. The founders of the organization are towns (Levice, Želiezovce) and six municipalities as well as organizations operating in the area (e.g. Tekov Museum, accommodation units and viticulture oriented companies). The RTO Tekov's headquarter is located in Levice. The Chairman of the Board is Mr. RNDr. Ján Krtík, the deputy chairman is Ing. Ondrej Juhász and Executive Director is Mgr. Denis Marosy.

### **Activities of RTO Tekov**

Even though this organization was established only in 2017, RTO Tekov is very active in supporting tourism. Since its establishment, it has implemented several activities to support the development of the studied area. These activities of RTO Tekov are listed in the Tab. 1.

Tab. 1: Overview of implemented activities of RTO Tekov. Source: (Marosy, D., 2018).

Name	date
1. Regional wine tasting in the village Rybník	6.04.2018
2. Concert in honor of Franz Schubert	6.04.2018
3. Čajkov regional wine tasting	14.04.2018
4. Wine walks	12.05.2018
5. NIGHT OF MUSEUMS AND GALLERIES 2018	19.5.2018
6. RIDERS PARTY A.K.A. Motorcycles sprint	May 2018
7. Open Wine Cellars Day in Kráľovka	26.05.2018
8. St. Urban's Day on Krížny vrch	26.05.2018
9. Levice castle festival	9.06.2018
10. Farm Sunday in Vodný mlyn	24.06.2018, 22.07.2018, 26.08.2018, 30.09.2018
11. Fights on the Hron river	28.07.2018
12. Bátovce traditional fair	4.08.2018
13. Wine harvest in Čajkov	8.09.2018
14. Wine harvest in Rybník	15.09.2018
15. The way we are - International folklore festival, XI. year	13.9. - 16.9. 2018
16. Rafting programme of the Hron river	Throughout 2018

### Definition of the studied area

The study focuses on district of Levice, where RTO Tekov is located in. Levice district belongs to the Nitra Self-governing Region. Member municipalities and towns of RTO Tekov are displayed on Fig. 1 (Geodetický a kartografický ústav, 1997).

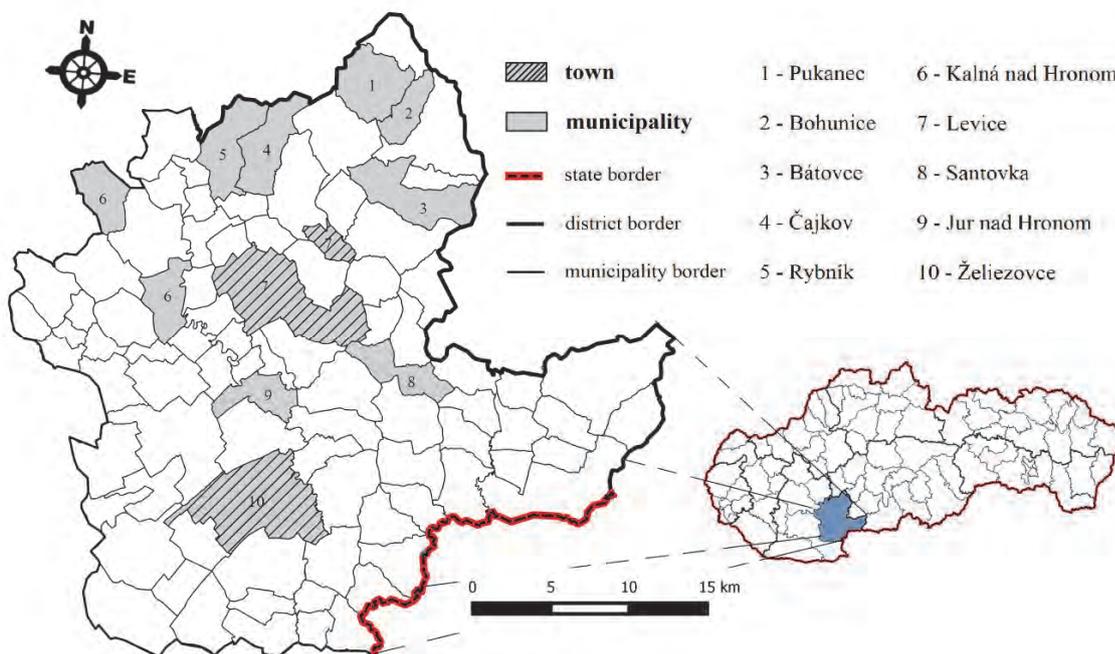


Fig. 1: Member municipalities and town of the RTO Tekov  
Source: Map of districts of the Slovak Republic - district of Levice  
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### Potential of the studied area

Many important natural attractions can be found in the surveyed area that contribute to its unique characteristics and thus create suitable conditions for tourism. Important natural attractions include e.g. Protected Site Levické rybníky, Protected Natural Monument Travertínová kopa, Protected Lime tree in Santovka, Protected Site Želiezovský park and many other natural attractions. The territory also has a cultural-historical potential, which is equally important, e.g. many secular monuments, sacral

monuments, archaeological monuments, museums as well as technical buildings (e.g. water mills or Observatory in Levice). The territory is well suited for the development of tourism. The surveyed area has suitable conditions for cyclotourism, recreational tourism, rural tourism, agrotourism and wine tourism, suburban tourism, water tourism (Camp Vodník - Jur nad Hornom) and other forms of recreation (Marosy, 2018; Levice, 2019; PRM Levice, 2016).

### Materials and methods

The results of the research were obtained through a questionnaire. Two questionnaires were worked out, one for citizens and one for stakeholders in the member municipalities of RTO Tekov with different questions for both of the groups. The individual questions were composed with consideration of RTO Tekov's needs, focused on assessing the current situation in regional tourism, RTO Tekov's activities, environmental impacts and respondents' future preferences. Answers were collected directly during field works and online. Emphasis was on receiving the data evenly from different communes, age and education groups.

### Results

Out of the total number of 124 respondents, the highest representation was in the age category of 21-30 years (21%) as shown in the Fig. 2. We also classified individual occupations of respondents into 6 categories (Fig. 3).

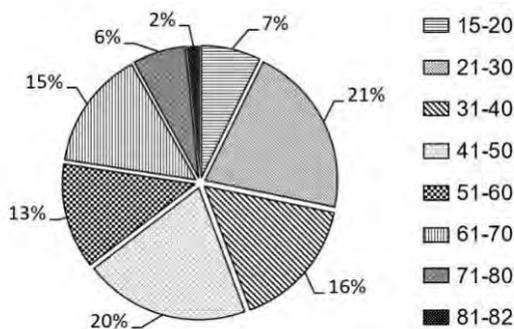


Fig. 2: Age distribution of respondents

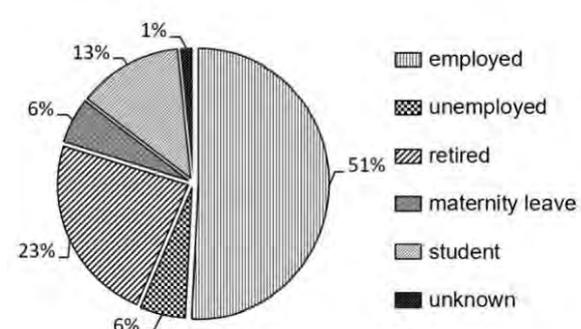


Fig. 3: Occupation

Most of the respondents (44%) came from towns of the RTO Tekov, 42% respondents from municipalities/communes of the RTO Tekov and 12% from municipalities that are not members of the RTO Tekov. When asked about future activities and events, majority of the respondents would prefer ones related to sport, culture and viniculture. 91 of respondents didn't notice any activities of RTO Tekov in the area. Other reported are aware of the following activities: rafting, viniculture, cycling. When asked how they assess tourist visit rates, up to 59,7 % would welcome higher number of tourists (Fig. 4).

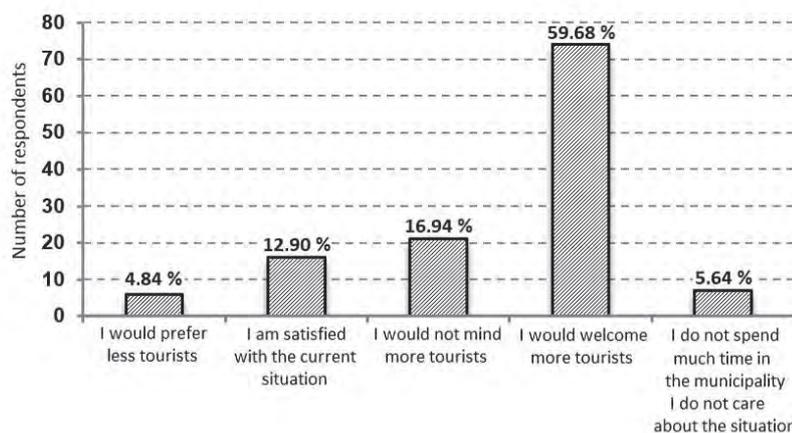


Fig. 4: How the respondents assess tourist visit rates in the studied area

Majority of asked respondents did not notice any other negative impacts of tourism on the environment, nonetheless few (6.5 %) respondents complained about waste situation in their municipality. They mainly noticed illegal dumps and increased productivity of waste, primarily by local citizens. Up to 91.9% of the respondents didn't observe increased number of tourist accommodations being built. Remaining 8.1% of respondents did, however they didn't notice any negative impacts on the environment. Stakeholders didn't notice any negative environmental impact of tourism. Events planned by stakeholders for upcoming years will be focused mainly on viticulture, history and folk. Majority of stakeholders (90.9%) are taking environmental impact into account when planning activities in the area, mainly by introducing eco-friendly packaging in the food stands during the events and improving the waste management and recycling.

## **Discussion**

The studied area has potential for tourism development, having features such as appealing nature, sites with historic significance or facilities for recreational sport (bicycle trails, river boating) and stakeholders are receptive to environmental friendly approach. We need to take into account that each factor which negatively affect the natural development of landscape ecosystems (e.g. the volume and character of waste and pollutants, noise, etc.), defined as stress factors, represent a part of ecological regulatives of the development in the region (Izakovičová, 2000). Even though there are events based on the potential aspects, the results of our survey shows that there is lack of propagation or advertisement. The propagation of the studied area as well as RTO Tekov is, according to the results of the questionnaire, also insufficient. We propose to address this issue by boosting the marketing via social networks. Current Facebook page is active, but paid advertisements could increase its reach. In order to reach youth, we propose to create Instagram account. Active social network presence could be supported by interaction with followers through sharing their photos of the district, creating own hashtags or online competitions/quizzes for prizes. Creating own brand, marketing strategy and maintaining the image of a region is useful tool for supporting the regional tourism development. (Kiři, 2019; Koščák et al., 2014; Ruiz et al., 2019). Viticulture is a befitting base for sustainable gastronomy tourism in the studied area which might be considered as really important tool for developing tourism (Chan, Huang, 2018). We suggest to organize an event oriented on traditions (the topic has been already implemented in the communes for a long time, thus it would be appealing for elderly citizens) with sustainable eco-friendly approach, including workshops for sustainable life (zero waste, circular economy, conscious consumption etc.), organized by the RTO Tekov. Eco-friendly approach has been successful marketing tool (Barbosa et al., 2018; Hellmeister, Richins, 2019, Sarmiento, Hanandeh, 2018) and captures interest of younger age-groups. Events are supposed to be focused strictly on locally sustainably produced food and goods which supports local producers oriented on sustainable agriculture by creating outlet for their products and overall contributes to sustainable development of the studied area. We propose to embrace participation of students from the young age to raise strong base for the future of conscious customers. River-based tourism is valuable tool for tourism development as well as responsible use, conservation and protection of water ecosystems (Folgado-Fernández, et al., 2018). There have been ongoing events based on river tourism and the organizers approach with regard to nature. The uncorrect utilization of landscape by society causes an entire row of landscape-ecological problems whose solution plays a primary task in ecological planning (Izakovičová, 1995).

## **Conclusion**

There is high importance in preliminary research, creating marketing strategy, which must be strictly followed in ongoing cooperation of stakeholders, local communities and local government (Koščák et al., 2014). Emphasise that during the development the anthropogenic stressors which are defined by Šúriová and Izakovičová (1995) are the phenomena that accompany anthropogenic activity. The higher the degree of stress factors, the lower is the resulting environmental quality. The results of the questionnaire show positives as well as space for improvement. The outstanding potential of the studied area together with support of the RTO Tekov offers high quality products of tourism.

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### Souhrn

Oblasťní organizace cestovního ruchu (OOCR) Tekov je během svého krátkého působení velmi aktivní v oblasti rozvoje cestovního ruchu na zkoumaném území. Cestovní ruch může být důležitou součástí finančních příjmů v regionu, ale také může mít zásadní a negativní důsledky na životní prostředí. Na základě odpovědí získaných od 124 respondentů formou online dotazníku na sociálních sítích, během terénnímu výzkumu, konzultací se stakeholdery a úspěšných příkladů ze zahraničí byly vypracované návrhy na podporu udržitelného rozvoje cestovního ruchu. Hlavní důraz by měl být kladený hlavně na propagaci OOCR Tekov, ale také určitých zajímavostí, akcí a jiných aktivit. Další navrhovanou aktivitou je pořádání takových akcí, které oživují a propagují tradice regionu se současným prodejem lokálních produktů a potravin, které jsou vyprodukované s ohledem na životní prostředí. Velký význam má i vodní turistika, kterou pokládáme za důležitou z hlediska zviditelňování regionu. Tento typ turistiky je poměrně rozšířený, proto organizátoři akcí kladou důraz na udržitelnost této činnosti. Navrhujeme výraznější zapojování žáků a studentů do výše uvedených aktivit, co podpoří výchovu další generace uvědomělých návštěvníků. Zkoumaný region má velký potenciál pro rozvoj cestovního ruchu a při cíleném plánování s ohledem na životní prostředí může turismus v regionu tvořit podstatnou podporu regionálního rozvoje.

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# RESTORING BIODIVERSITY IN A HIGHLY-INTENSIVE TOURISTIC URBAN AREA: A CASE STUDY IN THE CITY OF MATERA (SOUTHERN ITALY)

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## **Abstract**

Cities play a considerable role in landscape protection and global biodiversity conservation. They comprise several habitat types, from remnant patches of native vegetation, urban wastelands, gardens, yards, *etc.*, to highly engineered green infrastructures, such as green walls/roofs and bioswales. Landscape planners are increasingly aware about the need to re-connect, through the urban-rural gradient, the endangered urban biodiversity with the surrounding natural areas. This need is even more urgent in case of urban settlements experiencing a remarkable growth in their population due to a heavy increase of tourism flows. This is the case of the City of Matera (Southern Italy), an UNESCO site currently selected as the European Cultural Capital 2019, which is facing an impressive growth in tourism population and relevant services. Hosting a *Site of Community Importance*, as well as a *Special Protection Area*, this city urgently needs suitable actions aimed to plan and manage its Urban Green Spaces (UGS), *i.e.*, urban green areas finalized to provide ecological, environmental, recreational and economic benefits, restoring its environmental resilience. In this paper, the actual UGS surfaces in Matera have been quantified with multi-source data and GIS tools, and the pattern assessed through specific landscape metrics, implementing a Decision Support System (DSS).

**Key words:** landscape protection, touristic fruition, biodiversity restoration, ecological infrastructures, Urban Green Spaces

## **Introduction**

In recent years, there has been an increasing depopulation of small urban centers in favor of the growth of cities. This, given the considerable role of cities in landscape protection and biodiversity conservation, entails the need to redesign and rethink urban settlements, taking into account the ecological functions, urban species and habitats (Aronson et al., 2017; Grimm et al., 2008). An analysis of the impact of settlement patterns on landscape protection in areas in which there is a close relationship between rural and urban is therefore fundamental (Statuto et al., 2018/b; Olišarová et al., 2018). Currently, urban and landscape planners are moving towards a more resilient planning approach, in which they try to re-connect built-up territories with rural areas (Statuto et al., 2013), with the aim to restore suitable ecological networks with the surrounding natural environment. The approach that most emerges is based on the concept of *Urban Green Spaces (UGS)*. These UGS - such as native vegetation, urban wastelands, gardens, parks *etc.* - are finalized to provide ecological, recreational and economic benefits. Their role is fundamental to restore the environmental resilience of urban areas (Alvey A., 2006; Tian et al., 2014). In this context, it is important the awareness about the role of UGS, so as to assess the urban biodiversity pattern, implementing recommendations that can be easily applied to urban planning, design and management practices as well (Brunbjerg et al., 2018). This need is even more urgent in highly-intensive touristic urban areas, in which also important naturalistic and environmental assets are included, as in the case of the selected study area, the City of Matera (Southern Italy). This City is an UNESCO site, currently selected as the European Cultural Capital 2019, which urgently requires suitable actions safeguarding it from an impressively growth of touristic pressure, in the perspective of a sustainable management of its public recreational fruition (Cillis and Statuto, 2018).

## **Material and methods**

The City of Matera (Fig. 1) is well-known for its cave-dwelling area (so-called: "Sass"), a UNESCO World Heritage Site designated since 1993. Beside its historical and cultural aspects, the Matera landscape is made up of important naturalistic elements: the Natural Historic Archaeological Park of "Rock Churches"; a Special Area of Conservation (SAC), as well as a Special Protection Area (SPA), both included in the UE network of protected sites (Natura 2000). In the present paper, only the perimeter defined as "Urban area" by the municipal plan has been taken into consideration (about 803 ha).

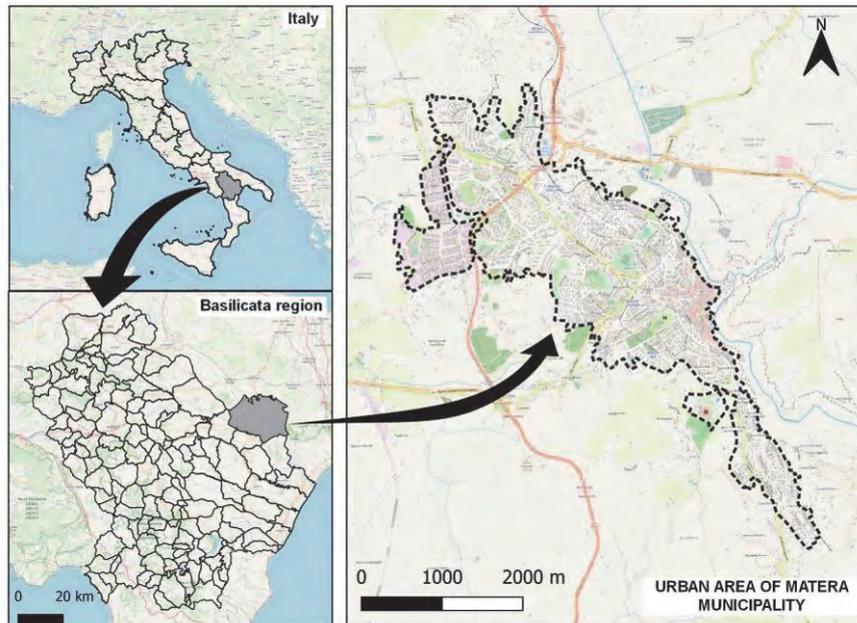


Fig. 1: Study area: the Matera urban settlement

In a first phase of the analysis (Fig. 2), the UGS detected in the study area have been spatialized through techniques of semi-automatic classification of orthophotos (Statuto et al., 2016) and satellite images, so as to evaluate their position and to calculate their relevant surface (expressed in hectares). Hence, to properly quantify and evaluate these UGS, the dataset has been implemented into a Geographical Information System, using QGIS 3.4 and the "GIMP Selection Feature" plugin. This plugin, starting from orthophotos of the year 2017, extrapolates all the polygons of the UGS to an excellent resolution, using the selection of the *green color* of the vegetation, which enables a validation directly in QGIS through a specific check. Then, in order to achieve a greater accuracy, these data have been successively integrated also with the elaboration of satellite images Sentinel-2 of the same year of the orthophoto (May 2017), so as to better classify some UGS (Kopecká et al., 2017) which were more difficult to detect. In this way, also the lawns have been classified, even if at a lower resolution, by an unsupervised classification with K-Means algorithm made with *i.cluster* of GRASS GIS.

The second phase of the analysis involved the implementation of a set of landscape metrics finalized to evaluate the qualities of the ecological network, for purposes of biodiversity restoration and landscape planning (Statuto et al., 2018/a). The generalized UGS raster without any differentiation between different typologies has been considered (Li et al., 2015). Landscape metrics have been calculated at the level of the whole landscape by Fragstats 4.2.1 (McGarigal et al., 2012), expressing the following indexes:

- *Landscape Shape Index* (LSI) provides a simple measure of class aggregation (LSI = 1 when the landscape consists of a single square);
- *Fractal Dimension Index* (FRAC\_MN) reflects shape complexity across a range of spatial scales (range is from 1 to 2, with values approaching 1 in case of shapes with very simple perimeters, approaching 2 in case of shapes with highly convoluted perimeters);
- *Euclidean Nearest Neighbor Distance* (ENN\_MN) has been used to quantify patch isolation; the values (in meters) approach 0 as the distance to the nearest neighbour decreases, which means that the patches are more close;
- *Shannon's Evenness Index* (SHEI) is a measure of the patch diversity. It ranges from 0 (no diversity) to 1 (when the area distribution among patch types is perfectly even).

Finally, the landscape metric *Connectance Index* has been calculated using the *moving window approach* of the same software (Hagen-Zanker, 2016). This Connectance Index is reported as a percentage (0-100) of the maximum possible interconnection, given the number of patches. The obtained results of this approach have enabled the creation of a raster model.

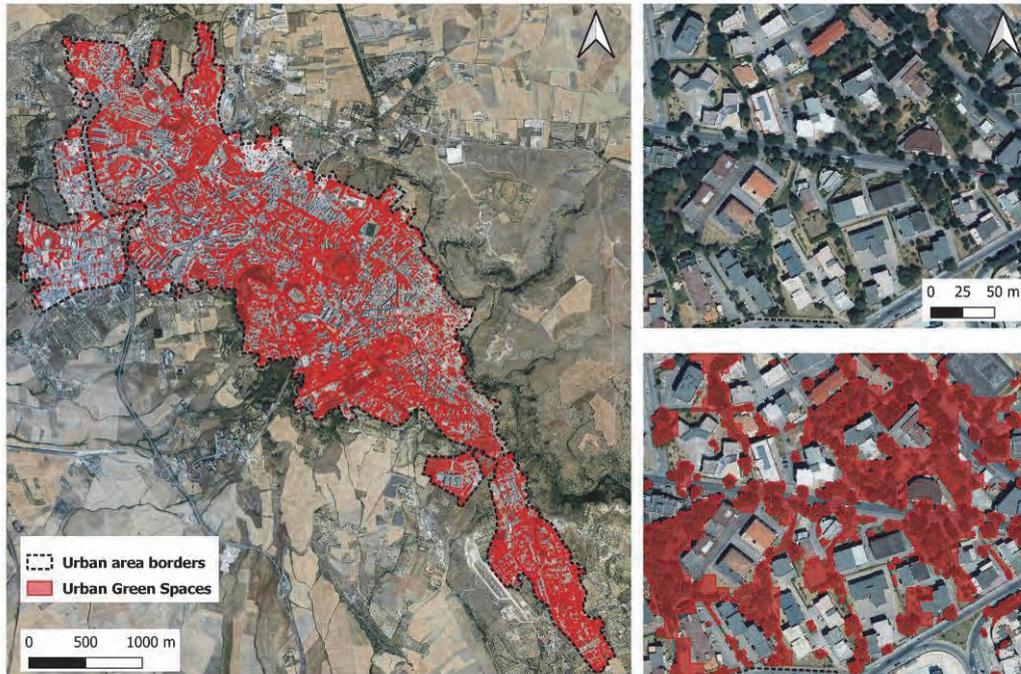


Fig. 2: Urban Green Spaces quantification and spatialization

### Results and Discussion

The quantification of the UGS shows that about 150.6 hectares – *i.e.*, about 18.7% of the total urban area - is covered by different types of vegetation (from tree-lined streets to lawns). Moreover, through the simple realization of a UGS concentration map (Fig. 3 - Left), it has been possible to highlight the areas with different spatial density of UGS.

The landscape metrics which have been calculated (Tab. 1) provide information about the theoretical potential of the land regarding the biodiversity, fragmentation and aesthetic aspects (Statuto et al., 2018/a).

Tab. 1: Landscape metrics values

LSI	FRAC MN	ENN MN	SHEI
40.81	1.62	7.98	0.69

Some of these metrics can be individually evaluated, while others need a comparative approach. The SHEI, indeed, shows a fairly high value of diversity, almost equal to 0.7, while the FRAC\_MN indicator of shape complexity shows a value (1.62) corresponding to a good level of landscape diversity, complexity and richness. On the other hand, the average distance between the nearest neighboring UGS (ENN\_MN) is such as they compose a well-structured ecological network of the UGS, their disaggregation level being not high, since the value of LSI is relatively low.

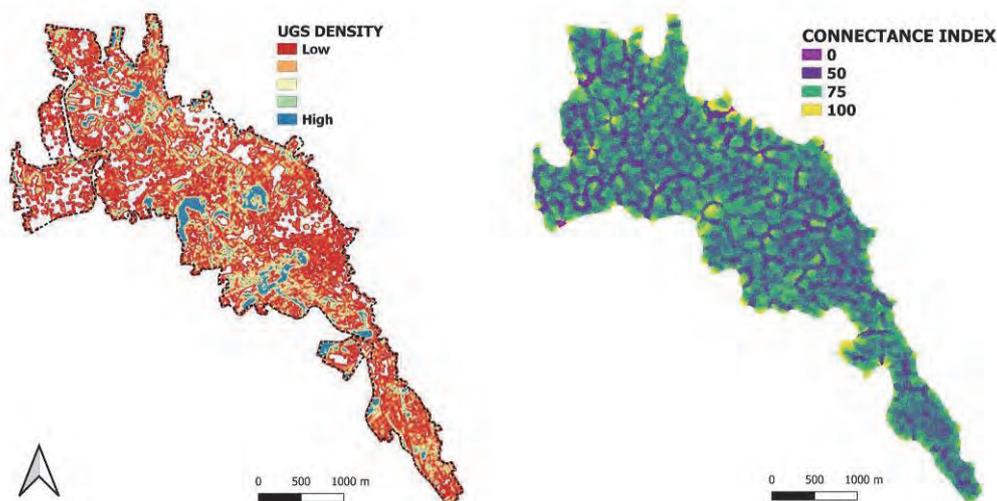


Fig. 3: UGS concentration map (Left) and Connectance index map (Right)

The spatialization of the *Connectance index* (Fig. 3 - Right) enabled to geo-localize the corridors characterised by lower values (Fig. 3 - Right). From a statistical analysis of the raster map of the *Connectance index* (value ranging from 0-100), it emerges that 23.8% of the urban area has a value of less than 50, whereas 61.8% of values is included between 50-75 and, finally, the 14.4% values exceed 75. We can finally conclude from an overall analysis of the Matera UGS that the conditions are already positive, and the improvements of vegetation could be localised in the northern area, of more recent urbanization.

### Conclusion

The UGS analysis methodology here proposed has demonstrated that the GIS approach is a fundamental tool to quantify the surface area and to evaluate the spatial and qualitative characteristics. By integrating different tools such as satellite images and landscape metrics, it has been possible to implement a complete survey of the conditions of the ecological network, assessing the state of potential biodiversity in an urban area. The values of the landscape metrics represent the information base, on which it will be possible to plan the future development of the UGS, even through the implementation of a Decision Support System (DSS).

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### **Souhrn**

V této práci byla navržena metodika pro řádné vyčíslení a vyhodnocení městských zelených prostor (UGS) s nástroji GIS. UGS vysoce intenzivní turistické městské oblasti (město Matera - jižní Itálie) byly realizovány technikami poloautomatické klasifikace ortofot a satelitních snímků, aby bylo možné zhodnotit jejich polohu a plochu v hektarech. Pak byla vypočtena množina krajinných metrik pro vyhodnocení vlastností ekologické sítě. Tímto způsobem bylo možné posoudit kvalitu ekologických vazeb mezi městskými a venkovskými oblastmi a naplánovat akce na obnovu biodiverzity a zlepšení ekologické sítě městské oblasti.

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## SERVICES QUALITY EVALUATION AS A TOOL FOR VISITOR MANAGEMENT OF PROTECTED AREAS: A CASE STUDY OF MORAVIAN KARST

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### **Abstract**

This paper deals with an evaluation of services quality in the Moravian Karst Protected Landscape Area (PLA). Moravian Karst is a popular destination not only for inhabitants of the nearby city of Brno. The intensity of tourism has been already too large in many places for effective protection of local nature and landscape, so the PLA administration is currently acquiring the necessary data for improvement of visitor management of the territory. One possible way how to disperse visitors in the PLA is to provide excellent quality of tourism services in places that have not too many visitors yet. Primary data on visitors of the PLA were obtained by a large-scale marketing survey conducted in 2018. Data from 2,100 visitors were collected using a questionnaire survey. Research results show, for example, that 13% of the respondents were not satisfied with the quality of roads and parking in the area, or that 14% were not happy with prices of local services. Outputs of our research can also serve as a key study for other protected areas that deal with the sustainable development of their territory.

**Key words:** rural tourism, sustainable development, destination management, visitors, marketing research

### **Introduction**

Protected Landscape Areas (PLAs) represent major natural tourist attractions in the Czech Republic. Every year, they receive a huge number of visitors. Staying in such unique destinations significantly improves physical and mental strength of the visitors. They can unwind, escape the daily stereotype for a while, and learn interesting facts about the area (e.g. through a nature instructive trail and/or a guided tour in a cave). Such pleasant and interesting experience results in a positive attitude towards the protected area and forms environmentally conscious tourists. This in turn contributes to preservation of these areas themselves. It is worth noting that only when these areas are accessible by broad public, people are going to understand and accept the need to protect them.

Unfortunately, tourism creates some known issues as well. They are usually caused by extreme numbers of visitors. When the capacity of a destination is repeatedly exceeded, the living environment suffers in many ways. The most important impacts include soil/water/air pollution, and increased erosion. These conditions may result in reduced population or even total extinction of both plant and animal species.

To ensure sustainable development, the management of protected areas must combine interests of both nature protection and visitors that come to admire it. This applies to Moravian Karst PLA Administration as well.

To take effective operation measures, it is necessary to know the current characteristics of visitors including their numbers, behavioral aspects, opinions and/or attitudes (Braun Kohlová, Melichar & Kaprová, 2017, p. 11). Recently, several tourism research studies have been published that analyzed visitor's satisfaction and complex experience. Pioneers in this field include Abrahams (1986), Csikszentmihalyi (1990) and Csikszentmihalyi & Kleibera (1992). There are also more recent works dealing with attendance surveys, for instance Pachrová, Janoušková & Šedivá Neckářová (2017), Samuel, Miju & Jungwoong (2008), Musa, Najmin, Thirumoorthi & Taha (2017), and Zhao & Hou (2019) analyzed visitors of karst areas. In Moravian Karst, several studies discussed possible negative impacts of visitors' activity on karst environment, e.g. Hübelová, Chalupa & Pavlík (2016) or Hübelová, Konečný, Geršl & Pavlík (2017).

With total area of nearly 100 square km, the Moravian Karst PLA was established in 1956. It is the largest karst area in the Czech Republic with more than 1,100 caves. Five cave systems are open to public with an annual attendance of as much as 400,000 people ("The Moravian Karst Administration", 2019). The area is also significant with respect to cultural-historical context, especially human society development all the way back to the Palaeolithic period. One of the main problems of tourism in the area of the Moravian Karst is that it is extremely season-dependent. Most tourists come to the PLA in summer, visiting preferably open-to-public caves and the Macocha Gorge. In these specific localities, the intensity of tourism is already too strong. To find a solution, the PLA Administration has been

collecting data for necessary corrective measures in the area. One of the options might be to promote several less visited locations and motivate the tourists to include them in their travel plans, instead.

### Materials and methods

The paper presents selected results of the research of the attendance of the Moravian Karst PLA. Special attention has been paid to quality evaluation of tourist-related services within the area. The research was carried out by the Department of Travel & Tourism of the College of Polytechnics Jihlava in cooperation with the Moravian Karst PLA Administration in a period of 5 months (May to September, 2018). Primary dataset was acquired using a questionnaire survey during which 2,100 respondents have been addressed. The respondents included visitors of the Moravian Karst PLA only. There was a personal interview with anonymous response and the actual choice of respondents was random. The interviews have been carried out repeatedly during different days/times to avoid undesired modification of results due external factors, e.g. bad weather. Respondents rated the available services in the PLA area using a simple five-point satisfaction rating system.

The acquired primary data was processed using mathematical-statistical methods in Microsoft Excel. Scientific methods included method of analysis/synthesis. The actual results of service quality evaluation in the Moravian Karst PLA were visualized using a plot of relative frequencies for individual answers in the interviews. For better convenience/usability, average values of  $x_r$  for each of the evaluated services were calculated. Every "very good" response received a value of 1, a "rather good" value of 2, a "average" value of 3, a "rather bad" value of 4, and a "very bad" value of 5. The "I cannot say" responses were discarded.

### Results and Discussion

Summarized results of service quality evaluation in the Moravian Karst PLA based on visitors' opinions are shown in Figure 1. Majority of respondents provided comments on the cleanliness/appearance of the environment, existing information centers, and information system in the field. Based on the results, it can be presumed that those services are critical for visitors' overall experience. Maximum attention should be paid to their quality. Being aware of this situation, the Moravian Karst Administration has been managing this area very well.

Figure 2 shows that the three categories of visitor services listed above were best evaluated from all of the established categories. Visitors praised the information center services ( $x_r = 1.75$ ; good by 68% respondents, bad by 2% respondents only). Information system services in the field ranked second ( $x_r = 1.79$ ). The third best rating ( $x_r = 1.82$ ) was assigned to cleanliness/appearance of the environment (satisfactory by 74% of respondents).

Prices of provided services received the worst rating ( $x_r = 2.61$ ). This means that 40% of respondents were satisfied with prices and 14% expressed their dissatisfaction. As far as road and parking quality is concerned, only 41% of respondents were satisfied and 13% expressed dissatisfaction ( $x_r = 2.59$ , see Figure 2). Shopping options represented the third worst rated service category with  $x_r = 2.45$ .



Fig. 1: Evaluation of services quality in the Moravian Karst PLA  
Source: Own research, 2019.

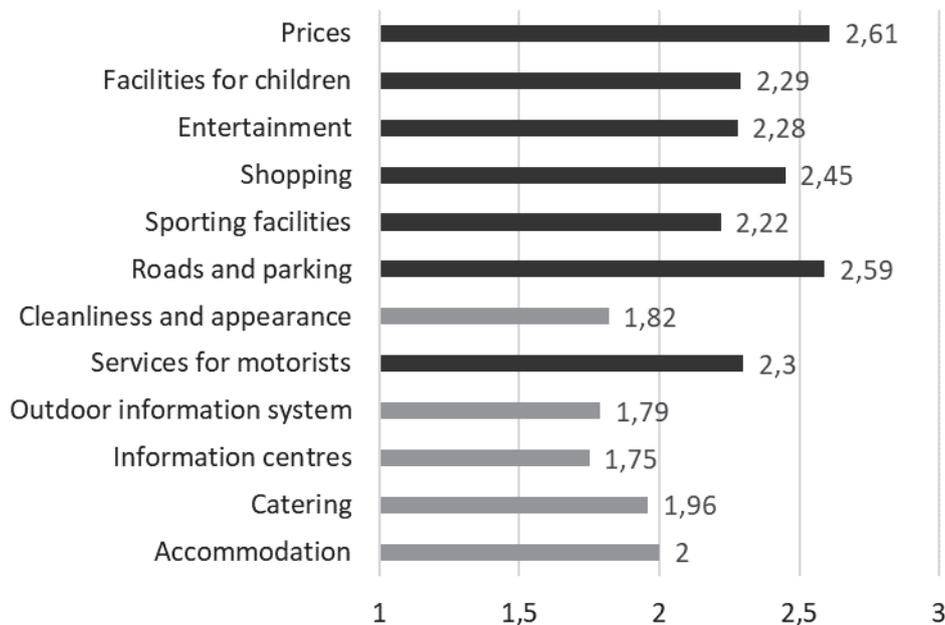


Fig. 2: Comparison of services quality in the Moravian Karst PLA

Note: daark color – service quality is under average, light color – service quality is above average (total  $x_r = 2.17$ )

Source: Own research, 2019.

There are several visitor management measures that can be utilized to disperse traffic in the PLA area. For example, better shopping opportunities and/or transport infrastructure may encourage tourists to visit places where the allowable capacity of the environment has not been exceeded. The prices of services can also be modified in heavily visited parts of the PLA. Rise of specific prices there could become a limiting factor for some visitors and make them choose another place of interest.

### Conclusion

The results of the survey indicate that visitors to the Moravian Karst PLA are satisfied with the quality of the services offered (overall  $x_r = 2.17$ ). However, there is still room for improvement in the future, especially in the area of road quality and parking. As the price of services is already high for 14% of visitors, a price increase could create a new regulatory mechanism in terms of visitors management. Obviously, the open-to-public caves and the Macocha Gorge will remain primary destinations for most visitors. Nonetheless, the above-mentioned recommendations could motivate them to visit other PLA locations as well. This effort would then significantly contribute to sustainable development of this unique protected area.

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### **Souhrn**

Příspěvek se zabývá hodnocením kvality služeb na území Chráněné krajinné oblasti (CHKO) Moravský kras z pohledu návštěvníků tohoto území. Moravský kras je největší a nejvýznamnější krasovou oblastí České republiky a je tradičním výletním cílem nejen pro obyvatele blízké brněnské metropole. Intenzita cestovního ruchu je pro účinnou ochranu přírody a krajiny Moravského krasu již na mnoha místech příliš velká a správa CHKO proto v současné době získává podklady nutné pro přijetí nápravných opatření v rámci návštěvnického managementu území. Cestovní ruch je jednou z hlavních ekonomických aktivit na území Moravského krasu a je tak nezbytné sladit jeho další rozvoj se zájmy ochrany přírody a krajiny. Jednou z možností, která by napomohla disperzi návštěvnosti v CHKO, je poskytnout návštěvníkům území kvalitní služby cestovního ruchu v místech, která dosud netrpí příliš intenzivní návštěvností. Primární data o návštěvnících území byla získána na základě rozsáhlého marketingového průzkumu, který realizovala Katedra cestovního ruchu Vysoké školy polytechnické Jihlava ve spolupráci se Správou CHKO Moravský kras v období květen – září roku 2018. Data od 2 100 návštěvníků byla získána pomocí dotazníkového šetření. Výzkumem bylo zjištěno, jak návštěvníci regionu hodnotí služby ubytovacích a stravovacích zařízení, informačních center, možnosti parkování, vybavení pro dětské návštěvníky apod. Z výsledků výzkumu lze např. uvést, že nejlépe návštěvníci hodnotili služby informačních center (68 % respondentů je označilo za dobré, pouze 2 % respondentů za špatné), dále služby informačního systému v terénu a péči o čistotu a vzhled prostředí. Na druhou stranu, 13 % dotázaných nebylo spokojeno s kvalitou silnic a parkování v CHKO a 14 % respondentů hodnotilo negativně cenovou hladinu služeb v území. Výstupy výzkumu mohou být podkladem nejen pro všechny subjekty, které v Moravském krasu v cestovním ruchu působí, ale mohou posloužit jako příkladová studie pro jiná chráněná území, která řeší udržitelný rozvoj svého území.

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## SETTLEMENT OF THE LANDSCAPE WITH EUROPEAN BEAVER (*CASTOR FIBER*) IN RELATION TO ANTHROPOGENIC INFLUENCES

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### Abstract

The European beaver (*Castor fiber*) is a protected species in the Czech Republic that has spread to the whole of Moravia. Now, it is a common species whose competitor is only human. The aim of this study was to evaluate the impact of human activity, especially tourism or transport, on the settlement of the landscape by the European Beaver. The area of the protected landscape area Litovelské Pomoraví was chosen to evaluate the settlement of the landscape by the beaver, where the beaver forms a stable population for a long time and the frequented cycling routes, hiking trails and the area are frequently visited by natural floodplain forests. The beaver settlement data were collected by means of the winter monitoring of residential stamps using the GPS system in 2017. Data on the location of cycle routes, hiking trails, human settlements and infrastructure were obtained from available GIS layers. Settlement of European beaver was evaluated in relation to the distance and intensity of interference by tourist activities, traffic or buildings. There were 200 km of watercourses in the monitored area. The inhabited beaver was 39% of the length. The beaver avoided human settlements, preferring the natural environment. The influence of tourism on the beaver settlement has not been proven.

**Key words:** landscape, protection species, recreation, infrastructure, colonization

### Introduction

The European beaver was repatriated to Litovelské Pomoraví in the 1990s. The development has reached a stable population in recent years. The entire territory is now occupied and young individuals migrate to the surrounding countryside. Infrastructure constitutes a migration barrier for animals. On the one hand, animals are killed, in the case of roads, highways and roads (Wysokowski et al. 2007). The second negative factor is animal disturbance, as in the case of hiking trails (Green, Giese, 2004). In terms of assessing site selection by European beaver, most of the studies were focused on natural sites (Slough, Sadlier, 1977, Howard, Larson, 1985, Belier, Barrett, 1987, Broschart et al. 1989). Modern studies focus on the use of GIS analyzes and environmental assessment models. Using models to evaluate habitats originally developed in a different basin often encounters a low match prediction of the animal's occurrence with reality, mainly due to the effects of other environmental characteristics on beaver occurrence than those in the area in which the model was created (Jakes et al. 2007). Most models require detailed documentation of environmental conditions. John, Kostkan (2009), report on the basis of interpretation of available aerial photographs. If it is not about the evaluation of the natural environment but about the human infrastructure, it is possible to use the available vector layers, which detail the location of the chosen factors. No need to detect field data. The advantage of detecting beaver distribution in the landscape is its dispersion (near the streams) and enough residential stamps in the winter. The main objectives of the thesis were to evaluate the distribution of beaver in the landscape, to evaluate the importance of tourism activities and infrastructure in relation to the selection of sites by the European Beaver.

### Materials and methods

The Litovelské Pomoraví Protected Landscape Area is located in the middle of the intensively cultivated agricultural landscape of Central Moravia. The area is characterized by the naturally meandering Morava River, which, together with its side arms, forms a network of natural canals with a total length of less than 200 km on an area of 96 km<sup>2</sup> (2.02 km of flow per km<sup>2</sup>). The most important types of tourism are cycling and hiking. The conditions for cycling are mainly due to a good network of relatively undemanding cyclo routes, mostly on forest paths.

In the field, all the beacon residence marks and their GPS coordinates were recorded. Residential stamps have been categorized as: bites, scent marks, dwellings and buildings, slips, sidewalks,

canals, diet remnants. The mapping was carried out in the winter period from February to March 2017, when the minimum migration of individuals occurs and the habitat characteristics of the beaver are concentrated on the minimum area. The collected data was transferred to the GIS environment (Quantum GIS). According to the spatial frequency of residential signs, individual territories, their size and distribution in the area of interest were defined in the GIS environment. The subsequent assignment of weight / value to the individual characters used the spatial statistics Kernel density estimation to distinguish the beaver territories and their distribution in the area of interest.

For the quantitative characteristics of the beaver population, the size of the territory was used, which is the sum of the flow lengths that the beaver inhabits. The second quantity used is the distance between the centers of the neighboring territories, which was calculated by the network analysis and expresses the length of the flows between the calculated centers of the neighboring territories.

All lines representing potentially suitable beaver flows were divided into points using the Split Vector Layer tool with a regular distance of 50 m. Using the Intersection tool, location information inside or outside the territory was added. The Distance to nearest hub (points) tool was used to calculate the closest distances to hiking trails, cycling routes, routes, roads, motorways, railways and human buildings.

To determine the preference of the environment, the watercourses were divided in an interval of 1000 m. By means of the Buffer tool, a packing zone of 200 m was created from each environmental parameter and the points belonging to the individual polygons were selected with Intersect. The number of points in the kilometer section represented the intensity of a given factor. Subsequently, each segment was categorized as a dominant factor (more than 20% points). If no factor was dominant, the section was designated as a natural landscape.

Environment preference was expressed by Jacobs modification of Ivlev's index of electricity.

## Results

A total of 194 km of watercourses, 253 km of cyclo routes, 225 km of marked and unmarked hiking trails, 116 km of roads, 212 km of other roads, 12 km of motorways, 39 km of railways and 4133 residential buildings and other buildings were evaluated within Litovelské Pomoraví.

A total of 4010 points characterizing places that could potentially be populated by the beaver were evaluated within the studied area. 39% of the sites were inhabited by beaver. The population density is 2.1 territories per 10 km of flow.

When comparing distances from environmental factors, it is demonstrable that beaver populated sites are on average further away from railways, roads and human settlements (Fig 1, Fig 2). The impact of hiking trails, cyclo routes and other routes has not been proven.

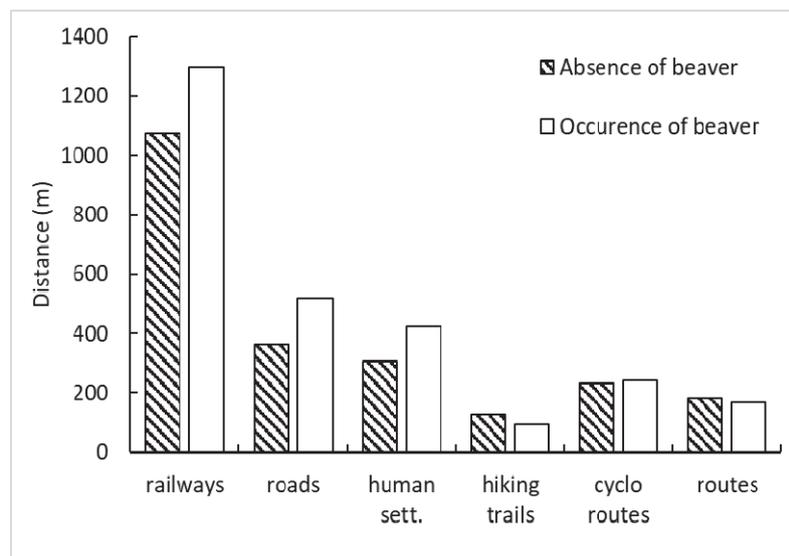


Fig. 1: Comparison of average distances from environmental factors

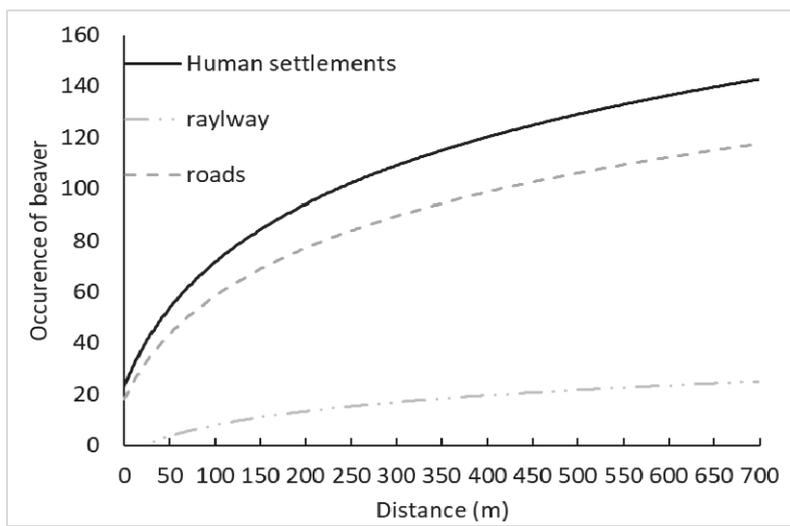


Fig. 2: The occurrence of beaver in relation to the distance of environmental parameters

The environment in the monitored area was divided into 194 sections. In 50% of cases the beaver occurred in the natural environment, in the environment with other paths (21%), with hiking trails in (14%) and cyclo routes in (8%) (Fig 3). In other areas it was sporadic. According to Jacobson's modification of the Ivlev index, the beaver preferred the natural environment. Hiking trails, other trails and cyclo routes had no effect on beaver land occupancy. The environment, which was influenced by railways, highways, roads and buildings, was neglected by the beaver.



Fig. 3: Beaver environment preferences in relation to environmental factors

### Discussion

The beaver in Litovelské Pomoraví inhabits 39% of the watercourses. Compared to other areas in the Czech Republic, this is a lower density. The population is stable in this area for a long time. The results show that the settlement of beaver environment is influenced mainly by buildings, buildings or industrial areas. The beaver also avoids busy roads and railways. Fustec et al. 2003 states that settlement is declining with increasing anthropogenic activities. Emphasis was placed on the importance of tourism. The area is visited by tens of thousands of visitors a year. Attendance is concentrated mainly on spring and summer. There were 253 km of cyclo routes in the monitored area, some were used together as forest roads or as hiking trails. In addition, there were 225 km of marked and unmarked hiking trails. Both of these environmental factors did not have a significant effect on the beaver population. In the case of several territories, the home nora was found right next to the hiking trail or cyclo routes. The neutral effect on the beaver may be due to the fact that it is an animal with nocturnal activity. So the beaver moves in an environment when tourism is zero. Neutral influence was also found in relation to other routes. Mostly they were forest or field roads, which are used irregularly and with low frequency. Generally, beaver avoids human factors. This rule applies to natural or near-natural habitats. In the case of population saturation, beavers migrate to less comfortable areas, such as sites close to cities and roads (Baker et al. 2006). The beaver most often prefers the natural

environment, which is minimally influenced by human activity, this is also confirmed in this locality (John & Kostkan 2009), who describe the availability of soft woody plants as the main factor.

### **Conclusion**

The study summarizes selected anthropogenic factors that influence the site selection by European beaver. Litovelské Pomoraví Protected Landscape Area was chosen for testing, where the natural environment for beaver intersects with a network of hiking trails, human settlements, roads and railways. It demonstrates the significant negative impact of human settlements, roads and railways on beaver settlement. On the contrary, it contradicts the possible impact of tourism (cyclo routes and hiking trails).

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### **Souhrn**

Studie shrnuje vybrané antropogenní faktory s důrazem na turistický ruch, které působí na výběr lokality bobrem evropským. Pro testování byla zvolena Chráněná krajinná oblast Litovelské Pomoraví, kde přirozené prostředí pro bobra protkáno sítí turistických tras, lidských sídel, cest a železnic. V terénu byly zaznamenávány všechny pobytové známky bobra a jejich souřadnice v GPS. Sesbíraná data byla převedena do GIS prostředí (Quantum GIS) a dále podrobena detailní prostorové analýze. Výsledky prokazují významný negativní vliv lidských sídel, silnic a železnic na osídlení bobrem. Naopak vyvrací možný vliv turistiky (cyklostezek a turistických tras).

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## SILVER HAIR TOURIST - NEW TRENDS IN TOURISM AND RECREATION

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### **Abstract**

The aging of European societies causes completely new social, economic and demographic problems. The increasing number of people of retirement age poses silver economy challenges for almost all EU countries.

One of the issues that is becoming more and more important in view of the current demographic situation is the development of the surplus of free time of older people. The growing requirements are also important as to attractiveness and diversity, as well as the degree of professionalism of offers for seniors and their growing awareness in this regard. The answer to this trend is the silver hair tourist concept, which assumes targeting of profiled services for people aged 50+. Silver tourist is a segment with a distinct diversity of needs, and people in this age group are demanding a variety of products and services. Zsarnoczky writes (2016, p. 556) "As a result of the growing demand, senior tourists are foreseen to become a powerful consumer group in the near future". Especially in Europe, where silver tourism will develop most dynamically.

The objective of the presented article is to indicate that the silver tourist assumptions are currently extremely important from the point of view of the issue of ageing Polish population. To this end, the needs of people from the oldest age groups as to the ways of spending free time will be diagnosed. In addition, it is important to point out that a good recognition and understanding of the needs of seniors is very important for people involved in the creation of tourist offers. It is also crucial for the elderly that their requirements help to co-create the tourist offer.

**Key words:** aging, silver economy, silver tourist, free time, old people

### **Introduction**

The issue of ageing populations which Western European countries are currently struggle with has been initiated by the concept of the second demographic transition. This theory was created by Dutch demographers, D.J. Van de Kaa (2002) and R. Lesthaeghe (2010, pp. 211-251).

This theory assumes that current demographic changes are observed primarily through the prism of changes in procreative behaviour which lead to a decrease in fertility. This change takes the form dangerous from the demographic point of view as it assumes a drop below the level guaranteeing generational replacement. This is related to the functioning of the family model in which, as S. Kurek (2012, p. 217) notes, "the principles of its creation and disintegration are the result of transformations in the sphere of values, norms, attitudes and behaviour of societies."

Some features characterising the second demographic transition in a quite distinct way can be distinguished. In the first place, features associated with the changing procreative models existing in modern societies are important from the point of view of socio-economic changes. First of all the decline in the value of the total fertility rate and the trend of increase in average age of the mother at the time of birth of the first child are observed. At present, we can note an increase in the fertility rate of women over the age of 30 (Majdzińska 2012, pp. 232-233). Changes in the fertility models also include a decreasing percentage of families with many children as well as childlessness by choice, and an increase in the share of extra-marital births (Janiszewska 2013, p. 23).

All of the changes discussed above, forcing the formation of new procreative models and at the same time an increase in the percentage of people in the oldest age groups, cause unfavourable ageing processes of modern societies. Currently, in Europe almost every sixth inhabitant is in the age of 65+, and forecasts predict that in 2035 it will be every fourth person. It is estimated that in 2035 the highest share of older people will be recorded by: Germany (31%), Italy (29%) and Austria (27%), while in Poland it will be almost 23% and in relation to other countries it will be an average result (Janigova, Kowalska 2017, p. 113).

The ageing of European societies causes completely new social, economic and demographic problems. The growing number of people of retirement age poses challenges for almost all EU countries in the field of silver economy. The starting point of this concept is the assumption that an ageing society means not only burden for the state, e.g. due to the necessity to pay social benefits, and thus a growing group of pensioners. In this approach, the ageing process assumes mainly negative effects on the economy. However, there is a concept of silver economy in which, according to

G. Wunsch (Kowalska 2017, p. 119), “the issue of ageing populations, apart from obvious weaknesses, may also have a positive impact on the economy, which is directly related to targeting new products and services at the elderly as a specific category of consumers.”

The silver economy concept applies to various issues and areas. It covers both professional activity of older people, and more specifically its extension by creating opportunities for raising qualifications and gaining knowledge, and ensuring their independence as long as possible or carrying out actions to improve their health and physical fitness and ensuring social inclusion (Kowalska 2017, p. 119). Yet another issue which is part of the silver economy concept is certainly the management of free time by seniors and the management of its surpluses. This is directly related to the current tourist offer addressed to this specific age category. The growing requirements as to the attractiveness and diversity, as well as the degree of professionalism of offers for seniors and their growing awareness in this regard are also important. The answer to this trend is the silver hair tourist concept which assumes targeting of profiled services at people in the age of 50+.

The objective of the presented article is to indicate that the silver tourist assumptions are currently extremely important from the point of view of the issue of ageing Polish population. To this end, the needs of people from the oldest age groups as to the ways of spending free time will be diagnosed. In addition, it is important to point out that a good recognition and understanding of the needs of seniors is very important for people involved in the creation of tourist offers. It is also crucial for the elderly that their requirements help to co-create the tourist offer.

### **Material and methods**

The purpose of this study is to present the results of a survey conducted among residents in the area of two districts: of Myślenice and Nowy Targ. The study was carried out in 2017 on a sample of 150 people in the age of 60+ using a questionnaire. It included issues in the field of activities which seniors are the most likely to undertake after retiring or plan to undertake when they retire. In addition, the issue of choosing active forms of recreation and the most attractive tourist offer available and chosen by older people will be discussed.

### **Results**

Silver tourist is a segment with a clear diversity of needs, and people from the oldest age groups are demanding a variety of products and services. As Zsarnoczky (2016, p. 556) writes, “As a result of growing demand, senior tourists are foreseen to become a powerful consumer group in the near future.” Especially in Europe where silver tourism will develop the most dynamically. The benefits which result from the separation of silver tourism as a specific form of tourism can be grouped as follows:

- promote active and healthy ageing,
- an enriching experience or a discovery,
- creative and playful learning,
- grooming for transnational travelling,
- interaction with the environment,
- intercultural contact/social interaction,
- social integration of seniors (Silver tourism is the future: <https://ceoworld.biz/2017/08/03/silver-tourism-is-the-future/>, date of access 18.03.2019).

In addition, there are a number of personal benefits for seniors such as: the fight against loneliness, improvement in the condition and mood, improvement of the quality of life or preventing social exclusion.

The category of free time, and thus silver tourism, can certainly be combined with activities and plans related to the retirement of respondents. Seniors from two districts: of Myślenice and Nowy Targ, who took part in the research, most often indicated those which are related to family life (help in caring for grandchildren or keeping a house) and spending time passively (watching TV, reading, listening to the radio, using the computer). However, they were much less likely to choose answers related to physical activity and tourism and recreation. Activity in the garden or on the allotment was the most often indicated form of activity (44% of responses). In turn, forms of sports practised by the studied people are mainly gymnastics and walking (a total of about 14% of respondents). Other forms of active recreation, such as Nordic walking and other outdoor activities were mentioned even less frequently (by only 10% of seniors). Respondents take no interest in activities such as cycling or team sports or individual sports at all. The fact that a very large group of seniors declares that they do not undertake any physical activity (over 30%) is particularly worrying.

During research, plans for spending leisure time related to tourist trips were declared by relatively few seniors – slightly more than one fifth of respondents indicated travels around the country and only about 7% of people declared their willingness to travel around Europe and around the world. In turn, the forms which assume self-development and participation in culture were of marginal interest.

Currently, the surveyed people are most interested in the tourist and recreational offer in their closest surroundings (within the commune or district), and directly related to the history and cultural heritage of the region or to the tourist and natural values.

Forms of tourism which could interest them in the future include primarily pilgrimage and cultural tourism (for almost half of seniors). However, they certainly would not like to use the services of agri-tourism farms (“because they have it at home”) and spa and wellness facilities (mainly for financial reasons). In turn, forms of tourism such as cycling, cognitive tourism (i.e. observing nature) and hiking generate moderate interest among the respondents.

For comparison, it is worth citing research carried out among elderly people in Hungary the results of which indicate that now significant increase in the interest of seniors in the broadly understood medical and pro-health tourism is already observed. Additionally, mainly among wealthy foreign guests, interest in spa and wellness services offered by Hungarian resorts and hotels is increasing. The authors assume that in relation to elderly tourists, these types of tourism will develop in the near future the most dynamically (Zsarnoczky et al. 2016, p. 231).

In addition, research of the authors indicated that elderly people are usually interested in packages for a longer stay in a selected place, with an emphasis on learning about new cultures and local cuisine (Zsarnoczky et al. 2016, p. 228).

## Conclusion

The research results presented in this study indicate unambiguously that the silver tourism segment will grow intensively in the following years. In the case of seniors, it is important for local communities to focus on the promotion of active recreation and, what is particularly important, be able to create conditions for practising it.

The second issue is the tourist offer for the elderly. It is evident that the respondents are not interested in staying at agri-tourism farms because they live in an exceptionally attractive area where agri-tourism is common. On the other hand, the exclusive offer of hotels with spa is unachievable for them for financial reasons but probably also partly mental. Therefore, an important signal for people preparing a tourist offer for seniors is the fact that trips the most attractive for them are those related to visiting places of religious worship (pilgrimage tourism) as well as visiting historic and attractive places (cultural tourism). It seems that the combination of these two forms is a great idea for tourist trips for the elderly. And what is important, it does not seem that this trend will change in the coming years.

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Silver tourism is the future: <https://ceoworld.biz/2017/08/03/silver-tourism-is-the-future/>, data dostępu 18.03.2019.

### **Souhrn**

Stárnutí evropských společností způsobuje zcela nové sociální, ekonomické a demografické problémy. Rostoucí počet lidí ve věku odchodu do důchodu představuje pro téměř všechny země EU výzvy stříbrné ekonomiky.

Z hlediska současné demografické situace je jednou z otázek, která je stále důležitější, rozvoj nadbytku volného času starších lidí. Rostoucí požadavky jsou také důležité z hlediska přitažlivosti a rozmanitosti, stejně jako míry profesionality nabídek pro seniory a jejich rostoucí povědomí v tomto ohledu. Odpověď na tento trend je turistický koncept stříbrných vlasů, který předpokládá cílení profilovaných služeb pro osoby ve věku 50+. Stříbrný turista je segment s výraznou rozmanitostí potřeb a lidé v této věkové skupině požadují různé produkty a služby. Zsarnoczky píše [2016, s. 556] „V důsledku rostoucí poptávky se předpokládá, že se v blízké budoucnosti stanou silnější spotřebitelskou skupinou starší turisté“. Zejména v Evropě, kde se bude nejdynamičtěji rozvíjet stříbrný cestovní ruch.

Cílem předkládaného článku je ukázat, že stříbrné turistické předpoklady jsou v současné době velmi důležité z hlediska problematiky stárnutí polského obyvatelstva. Za tímto účelem budou diagnostikovány potřeby lidí z nejstarších věkových skupin z hlediska způsobu trávení volného času. Dále je důležité zdůraznit, že dobré uznání a porozumění potřebám seniorů je velmi důležité pro osoby zapojené do tvorby turistických nabídek. Pro seniory je také důležité, aby jejich požadavky pomohly spoluvytvářet turistickou nabídku.

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## **SLOPE STABILITY IN URBAN PARKS - TREES VERS. LOANS, CASE STUDY NORTHERN TERRACES LOCALITY, HRADEC KRÁLOVÉ, CZECH REPUBLIC**

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### **Abstract**

Article presents the results of the measurement campaign conducted in 2015 on the locality of urban park Northern Terraces, Hradec Králové, Czech Republic. Main goal of mentioned campaign was to prove assumption that tree covered slopes reach higher grade of slope stability than loan covered ones especially due to more effective influencing of the water regime by the trees (influencing of surface runoff by the processes of evapotranspiration). The differences of the evapotranspiration and runoff of loan and tree covers were measured too. The results of the study were then provided to the decision-making authorities as the base for the Northern Terraces urban park management designing.

**Key words:** anthropogenic soils, hydrological function of vegetation, runoff modelling, urban greenery.

### **Introduction**

Slope stability is affected mainly by the soil type, soil structure, soil water content, soil volume changes during the year influenced by water content and vegetation type, morphology of the slope, its gradient and height (Perry et al. 2003). Vegetation can influence slope stability in either way, positive and negative. There is always a conjunction of synergistic factors how trees influence slope stability, the changes to hydrological regime, mechanical reinforcement by root system and compaction by the weight of biomass. The removal of slope vegetation does oftentimes have a significant negative impact on its stability and erosion (Sidle a Dhakal, 2002, Dijkstra et al., 2000). Immediately after trees removal a decrease in shear force can be observed (Brown and Sheu, 1975). Over the long term, tree removal leads to a gradual decrease in slope stability, mainly due to the decay of roots that earlier functioned as stabilization anchors (Brown, 1975; Wu, 1976; Sidle, 1991; Gray, 2009).

There are differences in interception and transpiration among different vegetation structures. Tree stands can retain 1 – 3 mm of rain per event by interception, which in European condition corresponds to 15 – 50 % of total precipitation during the growing season (Bréda et al., 1995; Alavil et al., 2011). The interception of grassland is lower by up to five times less (Thurow et al., 1987). The evapotranspiration of tree stands is also higher than that of grasslands usually by up to 30 % (Jetten, 1994).

### **Material and methods**

Study area:

The study is located on slopes part of the Northern Terraces locality in the city Hradec Králové, Czech Republic. The locality Northern Terraces is a city park directly in the city center (Fig. 1). Its original goal was to assess whether there is a risk to slope stability in connection to potential trees removal.

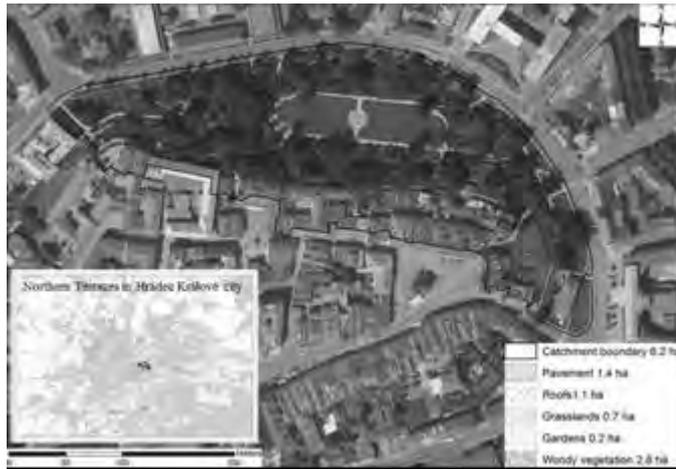


Fig. 1: Study area

The Northern Terrace locality is on a steep slope up to 45 % with northern to east-northern orientation. The vegetation can be characterized as a mosaic of trees, shrubs and grassland of different origin on artificial slopes. The boundary of the locality was defined to represent a functional discharge basin. The study was composed of field work during late summer and autumn in 2015 and following data processing and hydrological modelling. During the field work the soils of the locality were studied together with the actual vegetation cover. Potential evapotranspiration of the current vegetation was calculated divided into specific types of vegetation (grassland, grassland with shrubs, trees). A

Landuse	Description	Area (m <sup>2</sup> )	Percentage
Pavement	Paved areas with no infiltration nor transpiration. Runoff takes solely the form of surface runoff.	13723	20%
Roofs	Parts of roofs of houses on the southern border of the model catchment that gravitate towards it. There is no infiltration nor transpiration. The surface runoff	10622	15%
Lawn	Areas covered with short grass with limited or no woody vegetation. During the season, the lawn is intensively managed (approximately every 14 days). Interception and transpiration are limited due to the intense management. Infiltration and subsurface runoff can occur just below ground as the roots do not reach deep.	7493	11%
Garden	Areas of a combination of lawn and woody vegetation on private land on the borders of the catchment. Some interception, transpiration and infiltration occurs.	2052	3%
<b>Functional landuse</b>	<b>Areas of trees and shrubs with dense canopy. Interception and transpiration are the highest. Some infiltration occurs. Subsurface runoff is limited due to intense water</b>	<b>28045</b>	<b>40%</b>
Woody vegetation			
<b>Total</b>	Woody vegetation + Gardens	<b>30291</b>	<b>100%</b>
Grassland	Lawn	7493	12%
<b>Total</b>		<b>61907</b>	<b>100%</b>

hydrological model PERSiST was used to extrapolate the hydrological balance of the locality during a climatic “standard” year.

## Results

Within the locality the boundary of the functional discharge basin was identified by the delineation of the catchment divide. In this catchment, different types of landuse were described in terms of vegetation and rainfall-runoff processes (Fig. 1, Tab. 1)

Tab. 1: The landuse of the Northern terraces locality

The above mentioned landuse categories were merged into three “functional landuse” categories according to their expected behavior in the rainfall-runoff process (Tab. 2)

Tab. 2: Distinguished functional landuse categories

Potential evapotranspiration under full supply of water was calculated using the Penman – Monteith model method (Allen et al., 1998) for the growing seasons 2013 – 2015 for the above described functional landuse categories – grassland and forest (see Fig. 2).

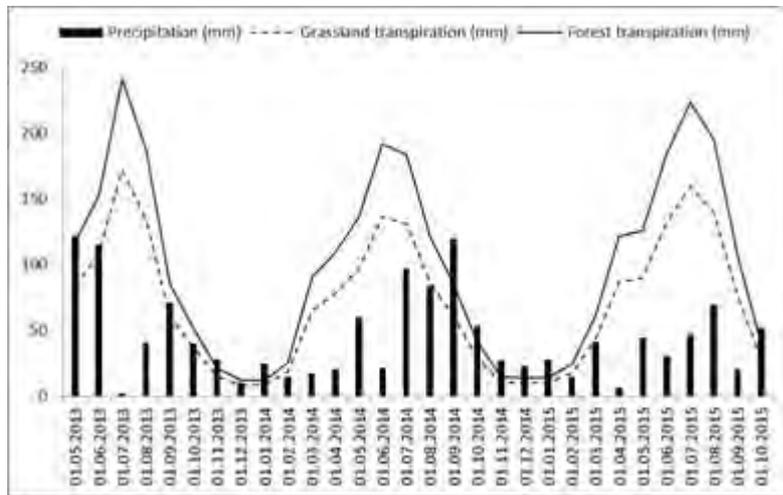


Fig. 2: Potential evapotranspiration of present vegetation types under full supply of water

As can be seen (Fig. 2) the forest transpiration is approximately 30% higher than that of grassland. The PERSiST model was used then for to simulate the movement of rainfall water through soil towards the discharge outlet (Fig. 3).

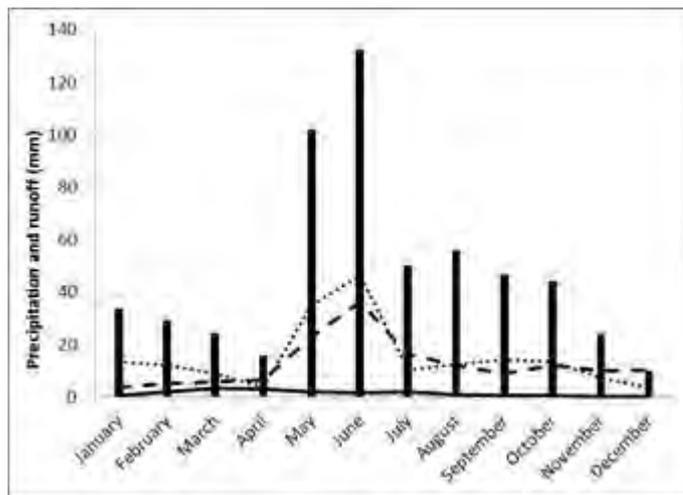


Fig. 3: Comparison of monthly runoff from different functional landscape categories

(full line – forests, dashed line – grasslands, dotted line – paved surfaces)

### **Discussion and conclusion**

The obtained results indicate that the soil on the locality consists mainly of anthroposol that did not originate by natural pedogenesis but rather was transported there during the development of the city throughout its history (probably are not older than 600 years). As such, it can be characterized as low cohesive and highly permeable. In areas of woody vegetation, the soil is more compact due to the weight of the biomass and thanks to the fixation of the root systems. Woody vegetation creates a significant armature in the low cohesive anthroposols and functions as ground anchor.

The locality is found on a steep slope and its functional basin is fed also by water from a number of adjacent paved areas (roofs and pavements). Together with the low cohesive anthroposols, these are the main factors that increase the potential risk of slope failure, erosion and local floods. Woody vegetation has a significant positive effect on the hydrologic regime of the locality, mainly due to its interception, transpiration and retention by transforming surface runoff into subsurface runoff.

In the case of a potential replacement of woody vegetation by park lawn, under the climatic conditions of a “standard” year (e.g. 2013), a significant increase in runoff could occur from the actual minimal 49 mm/per year up to the potential 448 mm/year.

It is obvious that potential replacement of woody vegetation on the locality is going to cause not only “technical” losses but influence also its recreational potentials. Except of changes of the aesthetic perception of the locality also its recreational safety will be changed by the decreasing of the slope stability.

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## Souhrn

Článek popisuje výsledky studie zaměřené na vliv dřevinné vegetace na stabilitu svahů v lokalitě městského parku Severní terasy v Hradci Králové. Výsledky prezentované v článku byly získány na základě dat měřické kampaně realizované na lokalitě ve vegetačním období roku 2015 a dále na základě jejich modelování na pomoci modelu PERSiST. Smyslem studie bylo prokázat původní ideu, že stromová vegetace v parku nejen že svými kořeny kotví půdu, čímž mechanicky posiluje stabilitu svahů a tato je pak vyšší než stabilita svahů pokrytých pouze travinnou, či bylinnou vegetací, ale dokázat, že pomocí hospodaření s vodou je stromová vegetace schopná zabránit rovněž působení erozního činitele (vody) na půdu. Uvedené bylo analyzováno prostřednictvím srovnání potenciální evapotranspirace obou společenstev na lokalitě, resp. jejich vlivu na povrchový odtok.

Bylo prokázáno, že dřevinná vegetace snižuje při stejných klimatických podmínkách povrchový odtok ve srovnání s vegetací bylinnou či travinnou. Tato skutečnost byla dále konfrontována nejen s „technickými“ funkcemi vegetace parku, ale rovněž s jeho funkcemi rekreačními (estetika, bezpečnost pro návštěvníky).

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# SOCIOCULTURAL ASPECTS OF CITYSCAPE DOMINANTS CHANGE AND PERCEPTION

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## Abstract

Based on the studies of famous urbanists and research results, the evolution of city dominants, their change and sociocultural aspects of perception are discussed. The research helped to identify priorities of the observed dominants, rank the importance of architectural objects, highlight the profile reading/perception of buildings.

**Key words:** local mark, urban, panorama, community, recreation

## Introduction

The history of global urban development and its models have been analyzed by numerous researchers: L. Mumford, L. Benevolo, K. Lynch, C. Sitte, E. Howard, M. Hugo-Brunt and others. According to the works of urbanists, the article deals with the evolution, change and perception of city dominants. As the term sociocultural holds a dual meaning of the word, dominated by two elements which include material (social) and spiritual (cultural) understanding of reality, both aspects are touched upon. The aim of the research is to discuss the common change features of local marks in different historical epochs and to analyze sociocultural aspects of their perception.

## Material and methods

Tackling the theme, an analysis of scientific literature and the method of empirical research - a questionnaire survey consisting of 12 closed +3 open and interpretation questions were used.

## Results

### The evolution of sociocultural aspects of city dominants

City, as the most structured element of an architectural space, has always correlated with the image of social order (in any epoch clearly visually perceived is the dominant culture, ideals, values, social and political trends of society). Thus, most of the famous urbanists considered it as a space of social processes and a direct material imprint (Mumford, Lynch, Benevolo, Chasieva and others).

According to A. Chasieva, archaeological excavations of existing settlements (urban predecessors) in the 6-7th centuries BC provide sufficient information on the available then technologies (agriculture, smithery, arms production, weaving ...), while simple, typical, uniform buildings and their layouts testify to a low-level primitive social organization (no streets, squares, temples, rulers' buildings). Urban history researcher L. Benevolo begins the evolution of urban history from the town center where the surplus of agricultural production was handled, exchange and social interactions took place, where village turned into a town community, where more diverse buildings appeared. In the book "The City in History", L. Mumford derives the first ancient towns from a sacred place (sacral center, place of rituals, meetings), which was stimulated by social processes (mixing of cultures, strengthening of cooperation, labor division etc.). In later ages, the emergence of commanders and rulers in the social structure differentiated the area of settlements, formed local dominants (fortresses, palaces), while religious thinking led to the emergence of sacral buildings.

Since **ancient towns** were characterized by extremely compactly located buildings and narrow streets, larger free areas were formed in front of palaces, sacral buildings. The emergence of the first squares was influenced by the political form of government and the way of life of citizens. There was no need for large squares in ancient Egypt (hierarchical society, political-religious management system), while ancient Greece (diversity of government forms, democracy, aristocracy, monarchy) needed a place for society to hold city council meetings, discussions, trade, courts, public sentences, etc.

The sociocultural aspects of urban development in **Medieval** Europe were similar. "The urban public space was shaped by the balance between various governmental centers: diocese, civil government, religious orders, guilds and social layers" (Samalavičius, 2007). The structure of most medieval towns was not based on a precise geometric plan (general purpose, narrow streets and squares of various forms, densely lined, compactly built up), influenced by "sociocultural characteristics of functional, utilitarian and local, socioeconomic conditions<...>" (Grunskis, 2010). "The central location of churches

was the key to medieval town planning. Towers are visible from any point, the difference in height between high walls and huts symbolized the relationship between holiness and secularity” (Mumford, 1938).

The era of **Baroque** culture at the end of the 16th century and the 1<sup>st</sup> half of the 18th century changed the face of the medieval city. "Trade, production, urban population is increasing, <...> new communication lines are being built, economic ties are being strengthened, the ecclesiastical layers of the landlords flourish" (Ado, 1989). L. Mumford also mentions a number of reasons for the development of a Baroque town: military technology, reformation, change of ideology, transition from a material (commercial) economy to a monetary economy, development of construction engineering, expanded mobility. New urban solutions, mostly volumetric dominants (palace ensembles, religious buildings, wide avenues, luxurious dwelling houses) highlighted the social problems of class differences.

Industrial revolution in the 18 – 19th centuries in developed countries brought huge socioeconomic changes. The changes of **industrialization** were closely related to technological innovations, large-scale production, hired work, improved means of communication. The effects of the industrial revolution were clearly visible in urban plans (increased production areas, large centers, railway lines). In his book "The Culture of City" Mumford regrets that this has changed the structure of the city plan which was no longer governed by common principles of welfare, <...> there were no standards and procedures, decent norms and understanding of beauty in urban planning and construction (Mumford, 1938). The forced reduction of living standards, the desire to create more living places for workers brought not only a new concept "minimum standard of living", but also a unified "box" architecture (USA, Scotland, England, etc.).

### **The most outstanding urban objects**

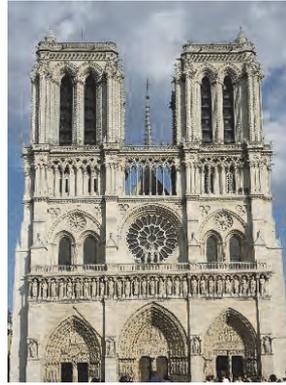
The focus of a city's spatial structure is considered to be the center. "It is customary to concentrate in it architecturally expressive and socially significant buildings and facilities, monuments. In this way, the center becomes the main focal point of the material and spiritual culture of the city, a place where intensive social activities of the population are realized. Towers, high-rise buildings, domes, peaks create an individual expression specific to a particular city (Vanagas, 2008). The most significant urban objects of the city - the signs of spirit, time, power, called dominants, mark the heart of the city.

According to K.Lynch, cityscape is perceived by highlighting individual visual accents that facilitate the "reading" of the city view, form an easily memorized system of signs. City view is characterized by objects - mental maps which consist of the main five elements - paths, edges, districts, nodes, landmarks. J. Vanagas clarifies the ability of an observer to cover only a certain part of an urban object at a glance. The artistic view of such an object is formed in the consciousness of observers as a chain of local symbols - the sum of visual nodes, spaces and volumes that make up the signs of the city and represent that object "(Vanagas, 2008). Such a view can be defined as a panorama - when a multi-plan view of an urbanized or natural environment is seen from a particular point.

For the user (natives and visitors), city views are usually perceived and remembered by easily identifiable objects - landmarks that stand out from the environment by height, volume, shape, color. Architectural theorists usually single out the most important objects of ancient towns: the cathedral, the central market square, the town hall. These three social spatial elements formed the commercial, legal and religious center of the town (Lynch K, Benevolo L., Chasieva A. C). In the evolution of world cities, one of the most important places in city centers has always been sacral buildings. '<...> sacral buildings are dominants in the landscape or on local level. The most prominent dominants are Catholic churches, which are mostly built on the axis of urban spatial composition <...>. Until now, most Catholic church belfries remain the most important vertical dominants of the historical landscape" (Buivydas, 2006). The Santa Maria del Fiore Cathedral in Florence (built in 296–1436, Italy), the Notre-Dame Cathedral of Paris (built in 1163–1345, France), the Milan Duomo Cathedral (built in 1386–1813, Italy), the Sagrada Familia Cathedral by Antoni Gaudi (started in 1882, still unfinished, Spain) belong to different historical periods, and are some of the best known and recognizable sacral buildings in the Europe (Fig. 1).



Santa Maria del Fiore



Notre-Dame



Milano Duomo



Sagrada Familia

Fig. 1: Sacral buildings - the most famous dominants of European cities

Under intensified self-government in towns in the 13-14th centuries, the construction of town halls begins. Town Hall Squares mark the civilian city center. The combination of town halls and cathedrals in European cities formed compositional system typical of the Middle Ages. The municipality hosted meetings of the magistrate members. Organizational, political, defensive city issues, civil cases were solved there, weekly markets took place, decisions were announced, therefore, town halls were rightly considered urban power centers.

### Recreational aspect of cityscape perception

The artistic view of the city is seen by the observers in parts. Typically, easily identifiable dominants - architecturally, historically, socially, politically significant buildings, squares, monuments - are easily perceived and distinguished from the environment for certain qualities. The survey was conducted in the central part of Kaunas city on 1-25 March 2019. An empirical research method - an anonymous questionnaire survey (15 questions) based on Google Forms was chosen for the study. Totally, 213 respondents were interviewed (121 women (56.6%) and 92 men (43.4%)). Respondents over 65 yr. comprised the smallest group - 7.7%, 46-65 yr. - 18.8%, 26-45 - 31.3%, under 25 yr. - 42.3%. 40.4% of respondents had secondary education, 16% higher non-university, 30% higher, 2% basic education. 46.4% of the respondents were employed, 39.3% are currently studying, 8.1% retired and 6.2% unemployed. The respondents rated their recreational activity on a five-point scale, where one was equated with passive recreational activity, five - intensive. 20 respondents (9.4%) preferred passive, 56 (23.3%) slightly active, 58 (27.2%) averagely active, 48 (22.5%) active and 31 (14.6%) very active recreation. It was also possible to mark a few answers assessing the choice to visit one or another part of the city. In most cases, respondents chose to visit the central part of the city - (63.4% - the Old Town (40.6%) and the New Town (22.8%)), quays, piers. Nearly one third of the respondents prefer quays (26,2%), outskirts (3.8%), industrial and business districts (3.5%), green areas (3.1%). Asked for a brief explanation of the choice to visit the Old Town, respondents indicated that upon arrival to a new city they usually wish to see the city center, as it is an opportunity to feel the local 'spirit', rhythm, engage in cultural life, get to know history through architecture, participate in events, etc. Quays, outskirts, green areas are chosen by those who prefer places with fewer people and beautiful views of nature, panoramas. Asked to identify the objects of interest and preference during their visit (only one answer could be chosen), most respondents pointed out buildings (46.5%), parks (36.2%), and quays (8.9%), at (3.7%) - city squares, (3.7%) various infrastructure facilities (railway, bus station, airport), and at (0.5%) - entertainment venues and (0.5%) urban forests. The respondents' choices were based on different visit goals, hobbies, trip times, friends' recommendations, financial resources. Even one fifth of respondents were influenced by social media. Ranking objects by importance in the panorama, they pointed out in the first place the height, shape, architectural style, color, volume and finally material. The factors determining the respondents' decision to visit one or another building were also ranked. In the first place was the aesthetic view, historical value, popularity, architectural style, function and the least important was accessibility.

During walks and excursions, the visitors most frequently chose castles and sacral buildings, manors, museums, supermarkets (in the 5th place, recently they have acquired a new role in public space), administrative buildings (old municipality buildings, town halls, presidencies), educational architecture, transport infrastructure, industrial buildings, and the least interesting were residential buildings. For visitors, buildings associated with time, power, and government symbols are still as important as a few hundred years ago. When inspecting buildings, the observers mostly come up with thoughts (priority sequence by importance) about the history, culture, the architect of the building, city community,

political, economic situation, location of the object, technological solutions and duration of construction.

The survey included representatives of all ages, educational backgrounds and specialties, the choice of dominants of which depends on individual preferences, however, the choice is influenced by sociocultural environment, available information, public traditions, travel time, finances and social media.

### Conclusions

1. City center is the focal point of material and spiritual culture, the most attractive and frequently visited part of the town (chosen by 63,4% of respondents).
2. The most important dominants (churches, castles, manors) associated with time, power, and government symbols are still as important as hundreds of years ago, but for recreational purposes, because the sociocultural aspects of our society are constantly shifting towards new symbols of power.
3. City dominants are distinguished by height, shape, color, attended based on the aesthetic view, historical value and popularity. The perception of an object is most closely related to history, culture, the architect, education and political situation.
4. The choice of dominants depends on individual characteristics, preferences, sociocultural environment, traditions, financial possibilities and social media.

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### Souhrn

Článek pojednává o dominantní změně panorámy, zkoumá také porozumění o sociokulturních aspektech zdůrazněním takového rekreačního potenciálu. Pozorovatelé rozlišovali dominanty v centru města podle výšky, formy, barvy, estetiky a kritérií přitažlivosti. Tento výzkum pomohl vytvořit seznam městských dominantů, které jsou nejvíce viditelné a hodnotit architektonické objekty svým významem, a také určoval asociativní vztah mezi objektem a pozorovatelem.

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# SPATIAL CONFLICTS OF WINTER SKI RESORTS WITH WILDLIFE HABITATS – CASE STUDY BESKYDY MTS. AND MORAVIAN WALLACHIA

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## **Abstract**

During the second half of 20<sup>th</sup> century the recreational functions of landscape are increasingly dominated. The development of the recreational potential of the rural mountain areas was driving force for the construction or expansion of facilities such as ski resorts, new cableways, single tracks or off-roading trails. Ski resorts are important factor limiting the living space for wildlife in mountain environment. The paper is devoted to the development of winter recreation facilities in the Beskydy Mountains after 1989, when new socio-economical paradigm brought the possibility to establish or expand winter resorts on private basis, but also the issues of nature and landscape conservation gained importance. Newly developed ski areas were analysed in relation to the habitat of selected species of large mammals in the Czech Republic in three time horizons, including the evaluation of original land use based on topographic maps. Special attention has been paid to sites identified as critical points where the permeability of the defined migration corridors is endangered due to anthropogenic activity.

**Key words:** landscape fragmentation, anthropogenic land use changes, winter recreation, biotope of large mammals

## **Introduction**

The major current threat (not only) in the Czech Republic to wildlife populations is the anthropogenic fragmentation, caused mainly by linear transport infrastructure such as roads, railway lines, shipping channels, etc. (Anděl et al., 2010; Dostál et al., 2018) and by the growth of built-up areas (Jedlička et al., 2019). Another important driving force became the recreation as the recreational functions of mountain landscapes emerged during the second half of 20<sup>th</sup> century, especially the construction of facilities such as ski resorts, new cableways, single tracks or off-roading trails (Bajer Havlíček, Dostál, 2014). Also Beskydy and the adjacent mountain ranges did not avoid this trend, indeed, as other parts of the Carpathian Mountains (Ciangă & Racasan, 2015).

## **Material and methods**

The study area was defined by borders of Protected Landscape Area Beskydy and covered Moravian-Silesian Beskids Mountains and part of Moravian Wallachia.

A list of existing ski resorts with operating ski lifts and cableways was created based on available public databases, maps and websites (<http://www.ceske-sjezdovky.cz>, <https://www.skiarealy-sjezdovky.cz>, <https://mapy.cz>).

Land use changes were analysed on the basis of old and contemporary topographic maps using GIS. Three sets of maps were used for analyses that depict the situation in the study area: Czech military topographic maps at a scale of 1:25 000 (1993), Czech topographic base maps at a scale of 1:10 000 (2006, 2017). A total of 9 basic land use categories were evaluated: arable land, permanent grassland, orchard, vineyard and hop-field, forest, water area, built-up area, recreational area and other area (Jedlička et al. 2019).

Identification of ecological corridors (The biotope for selected species of large mammals] has been done recently during the project Complex Approach to the Protection of Fauna of Terrestrial Ecosystems from Landscape Fragmentation in the Czech Republic (Zyka et al., 2017). Resulting output consists of the synthesis of partial inputs such as data on the occurrence of focal species, habitat suitability models, barrier permeability assessment and landscape connectivity analyses. Ecological corridors were mapped not only as an axis (with 250 m buffer) but as a land-cover of suitable biotopes interlinking core areas and refined by field visits in the critical sites (such as conflicts with major roads). The core areas were designated as a compact territory which hosts or have high possibility to allow long-term occurrence of large mammal's population (large carnivores, Eurasian elk) in the future. Those areas are covered by vast forests and other suitable biotopes such as meadows, shrubs or extensively used fields to provide food, shelter and space for reproduction. If we secure the landscape permeability and transport infrastructure for large mammals, then also other smaller forest species will automatically benefit from such positive measures.

## Results

There were total of 103 ski lifts and cableways in more than 50 ski resorts operated during 2018/2019 winter season throughout the study area. The development of these ski resorts is also reflected in the overall area statistics of basic land use categories, especially in the growth of recreational areas (which include also sports facilities and related accommodation). The total area occupied by recreation has increased from 14,3 sq. km in 1993 to 25,2 sq. km in 2017. The increase in built-up areas was also significant (see Tab. 1, Fig. 1).

The trend of growth of the permanent grassland and forest share can be described as positive for the migration of large mammals. However, the increase in the built up areas and recreational area, is the negative and dangerous trend, when further fragmentation barriers may arise.

Tab. 1: Categories of land use in PLA Beskydy in % (1993, 2006, 2017)

Categories of land use	1993	2006	2017
arable land	8,89	1,98	0,30
permanent grassland	14,37	16,80	16,11
orchard	0,06	0,05	0,10
vineyard and hopfield	0,00	0,00	0,00
forest	72,43	75,46	77,16
water area	0,31	0,29	0,29
built up area	2,74	3,50	3,94
recreational area	1,19	1,91	2,09
other area	0,01	0,01	0,01
Total	100,00	100,00	100,00

There are 9 cableways currently in the operation. The longest ones reach a length of over 1000 meters (see Tab. 2) and thus significantly can affect the habitat of selected species of large mammals in the Czech Republic (Fig. 3a).

Tab. 2: Cableways in PLA Beskydy

ski resort	length (m)	cadastre
Pustevny	1600	Trojanovice
Javorový	1250	Oldřichovice u Třince
Severka	1025	Dolní Lomná
Bílá	800	Bílá
Kohútka	570	Kohútka
Gruň	520	Staré Hamry
Rališka	490	Horní Bečva
Skokanský můstek	270	Frenštát pod Radhoštěm

A total of 95 ski lifts was identified on the territory of PLA Beskydy. Three of them reached the length even over the 1000 m (see Tab. 3). Especially ski lifts and downhill slopes with a length of more than 700 m can be considered as a major encroachment on the habitat of large mammals (Fig. 3b).

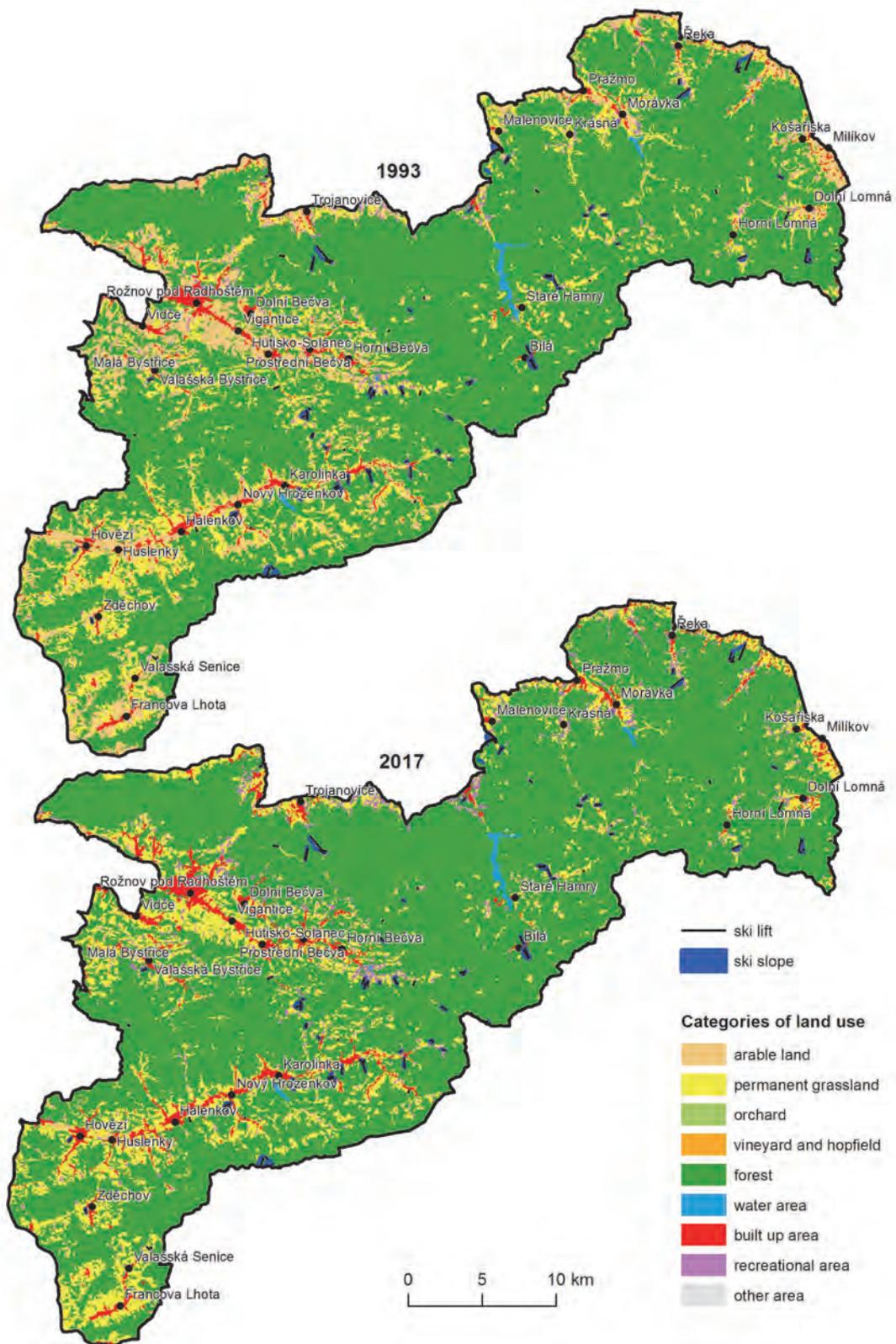


Fig. 1: Land use, ski slopes and ski lifts in PLA Beskydy (1993, 2017)

Tab. 3: Length of the longest ski lifts in PLA Beskydy

ski resort	length (m)	cadastre
Severka	1150	Dolní Lomná
Řeka	1100	Řeka
Pustevny	1000	Trojanovice
Machůzky	950	Velké Karlovice
Karolinka	800	Karolinka
Razula	800	Velké Karlovice
Bílá	750	Bílá
Soláň	700	Solanec p. Soláněm
Bílá	700	Bílá

Ski slopes in PLA Beskydy occupy an area of 188 ha. When analysed their spatial overlay with the Habitat of selected species of large mammals, it was found that 146 hectares of slopes interfere with this habitat (Fig. 2) and thus may have a negative impact on large mammals in the region during winter holiday season.

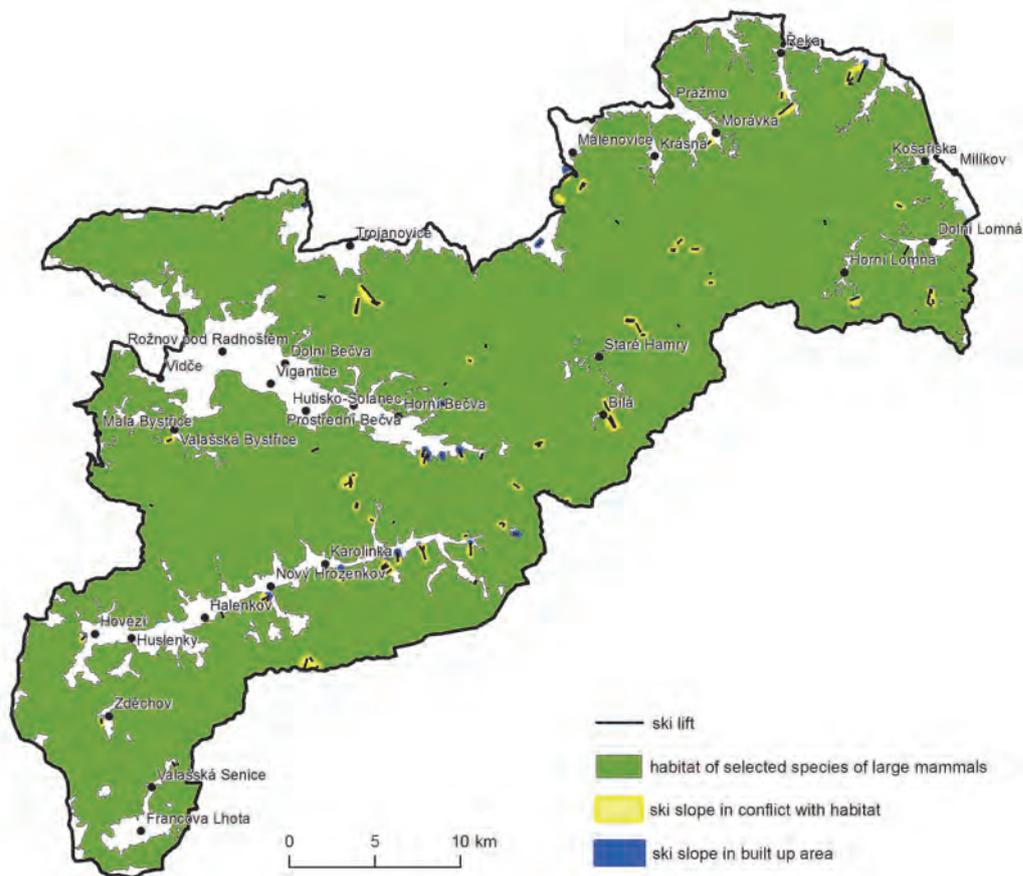


Fig. 2: Habitat of selected species of large mammals and ski resorts in PLA Beskydy



Fig. 3a: Ski resort Bílá



Fig. 3b: Ski resort Razula Velké Karlovice

## Conclusion

Significant anthropogenic risks affect the Habitat of selected species of large mammals in PLA Beskydy. Besides the construction of new linear transport infrastructure are main threats: the growth of built-up areas and recreational areas. The occupied area by these two categories has increased by more than half between 1993 and 2017. The winter operation of ski resorts may also directly encroach on large mammals and their habitat. The snowmaking is in use of most of Beskydy's ski resorts, which further extends their effective season to several months of the year. The artificial lighting and night skiing may have further harmful impact to mammals.

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## Souhrn

Lyžařská střediska jsou důležitým faktorem omezujícím životní prostor pro volně žijící zvířata v horském prostředí. Příspěvek je věnován vývoji zimních lyžařských areálů v CHKO Beskydy po roce

1989, kdy nové socioekonomické podmínky umožnily zřizování nebo rozšiřování zimních středisek. Nově budované a rozšiřované lyžařské areály byly analyzovány ve vztahu k biotopu vybraných zvláště chráněných druhů velkých savců v České republice ve třech časových horizontech, včetně vyhodnocení původního využití území na základě topografických map. Více než tři čtvrtiny sjezdovek v CHKO Beskydy zasahuje do tohoto biotopu a v zimním období může omezovat migraci velkých savců v regionu. Omezením pro migraci je také zvyšující se podíl lyžařských středisek s umělým zasněžováním, osvětlením a večerním lyžováním.

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# SPATIAL DISTRIBUTION OF NATURAL REGENERATION AT A GALE-DISASTER AREA IN THE ŠUMAVA NATIONAL PARK

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## Abstract

One of the ways afforestation gale-disaster area can be leave the spontaneous natural regeneration. The gale-disaster area was created in site with specific nature conservation management. Research plot was chosen gale-disaster area in Šumava National Park which was formed after windstorm. Two transects were created through cleared area. First transect had length 150 m and its first part (50 m) was in live spruce stand, second part (50 m) was in cleared area and third part (50 m) was in almost dead beech stand. Second transect was similar as first transect, but its length was 210 m and its second part in clear area was long 110 m. Natural regeneration was measured on the transect. According to the results the spatial distribution of the natural regeneration other tree species along transects depended on the light condition and shape and weight of seeds. The most frequently seedlings of heliophilous tree species were found on the clear area. The seedlings of other tree species were found in almost dead stands including seedlings of *Picea abies*.

**Key words:** *Picea abies*, *Fagus sylvatica*, natural regeneration, seedling, spatial distribution

## Introduction

The current structure of forests in the Czech Republic is a result of cultural, political and economic decisions. Wind, snow, frost, drought and bark beetle calamities have been present since time immemorial. Over the past 11 years, several major gale-disasters as Kyril, Emma and Herwart hurricanes hit the Czech Republic. Due to gale-disasters and subsequent bark beetle gradations a lot of cleared areas have been arise. Karjalainen (1996) presumes that cleared areas with soil preparation and planting saplings in precision spaces is the ugliest for forest visitors. On the contrary, landscape with spontaneous, local, heterogeneous natural regeneration seems to be the most aesthetic. Managements with close to nature approach in commercial forests or even unmanaged forests in National Parks seems to be more preferred than management based on even-aged monocultures cultivation (Hummel 1992, Ribe 2005). The aim of this work was to map a number of naturally regenerated tree species at cleared area occurred after Kyril hurricane in the Šumava National Park.

## Materials and methods

The locality of interest is located at a hilly area with slope of 20 % and southwest exposure in the Šumava National Park (Czech Republic; 48°46.76913' N; 13°53.08625' W). The two research transects were establish at a gale-disaster area after Kyril (in 2007). The first transect with length of 150 m was situated along the contour of mountain crest. The second one with 210 m in length was establish in parallel at lower part of hills. The width of both transects was 40 m. The transects were split into the three different parts, when the first 50 m of both transects were situated under persisting spruce forest ("spruce forest"; segments "A"-“E”), and the last 50 m of both transects were situated under mostly dead beech forest ("beech forest"; segments "K"-“O” in transect 1 and segments "Q"-“U” in transect 2). Middle parts of transects were located at open cleared area (segments "F"-“J” in transect 1 and segments "F"-“O” in transect 2). These transects were further divided on segments (sub-plots) with the size of 10 m x 10 m. Therefore, 60 segments in the 1<sup>st</sup> transect and 84 segments in the 2<sup>nd</sup> one were established, respectively. Number of seedlings and their species were counted and identified at each segment.

## Results

Surprisingly, the centre of massive natural regeneration of spruce was located at the segments under beech forest (Fig. 1 and 2). The most number of seedlings was at second and third segment of transects from the edge of beech forest and clear area. There, about 50 000 pcs.ha<sup>-1</sup> and 150 000 pcs.ha<sup>-1</sup> at transect 1 and 2 were find, respectively. Also, the centre of massive natural regeneration of beech was under disintegrated beech forest. There, about 36 000 pcs.ha<sup>-1</sup> and 8 000 pcs.ha<sup>-1</sup> at transect 1 and 2 were find, respectively. In contrary from spruce, natural regeneration of beech occurred only under beech forest in upper transect and clear area and beech forest in lower transect.

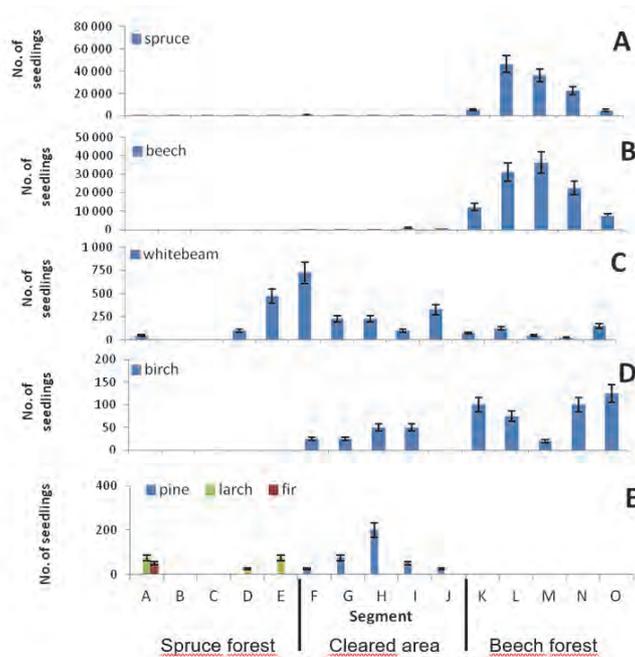


Fig. 1: Number of naturally regenerated seedlings per hectare at the research transect 1. Whiskers denote standard deviation.

Natural regeneration of whitebeam was found almost along the whole transects, but the centre of the highest density was at the clear area. There, from 250 to 750 pcs.ha<sup>-1</sup> and from 500 to 1000 pcs.ha<sup>-1</sup> at transect 1 and 2 were found, respectively. The highest density of natural regeneration of birch was located under beech forest at the end of the 1<sup>st</sup> transect (about 100 pcs.ha<sup>-1</sup>) and at the open area in the 2<sup>nd</sup> transect (about 500 pcs.ha<sup>-1</sup>). The natural regeneration of pine was identified at clear area segments of both transects (with density of 200 pcs.ha<sup>-1</sup> and 1500 pcs.ha<sup>-1</sup> at transect 1 and 2, respectively). Natural regeneration of fir was found only under spruce stands; however, it was also slightly represented at two segments located in open areas at the 2<sup>nd</sup> transect. The density of fir regeneration was about 50 pcs.ha<sup>-1</sup> at the 1<sup>st</sup> transect and from 200 to 1000 pcs.ha<sup>-1</sup> at the 2<sup>nd</sup> one. Natural regeneration of larch was found under spruce forest at the 1<sup>st</sup> transect (in the density from 25 to 75 at the 1<sup>st</sup>) and at clear areas of the 2<sup>nd</sup> transect (in the density from 100 to 600 at the 1<sup>st</sup>).

## Discussion

The natural regeneration of spruce occurred mainly under beech forest. The results are similar to those presented by Kantor (2001), who wrote that spruce gets sunny woody species in upper limit natural occurrence. However, there are sufficient light conditions on clear cut, the soil moisture is too low. Therefore, natural regeneration arises more or less sporadically. On the other hand, light and soil moisture are sufficient under almost dead beech forest. This hypothesis is confirmed also by Ulanova (2000). In addition, lying dead wood can be another important factor in the successful natural regeneration (Vávrová 2009). Natural regeneration of beech is similar to natural regeneration of spruce. Majority of natural regeneration was found under beech forest. Beech seedlings can grow up under low intensities of light, but they need higher relative air humidity (Úradníček 2009). In opposite, crowns of spruce forest leak water less than almost dead beech forest. Also, the weight of beech seeds does not allow large seed spreading. Therefore, number of beech seedlings was low under spruce forest and at the clear area. We observed that natural regeneration of pine occurred only at clear areas. According to Úradníček (2003), pine is heliophilous species and its natural regeneration is really intolerant to shade. However, more light is available under beech forest compared to spruce one. Pine did not survive after germination there. There a lot of dead wood and herbaceous cover was present. Natural regeneration of larch was at clear areas and under spruce stands. Natural regeneration of larch is common at clear areas, because larch is a sun-loving tree species (Úradníček 2003).

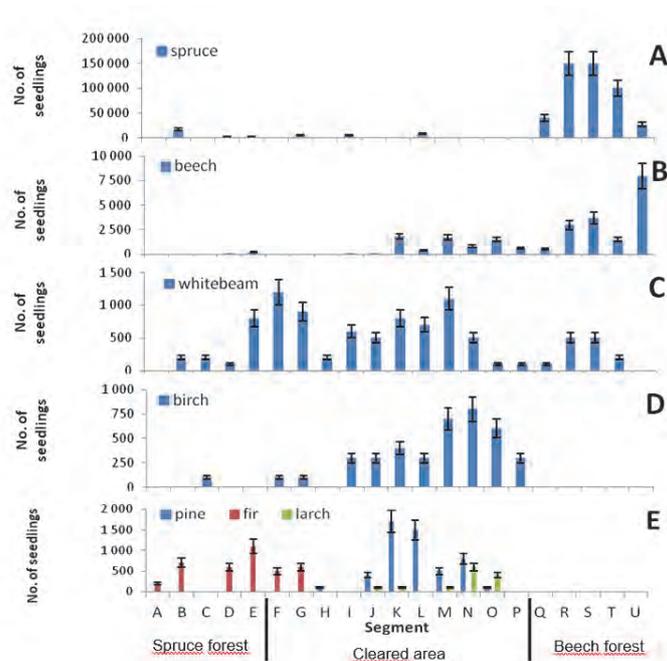


Fig. 2: Number of naturally regenerated seedlings per hectare at the research transect 1. Whiskers denote standard deviation.

Occurrence of natural regeneration of larch is temporary under close canopies according to Albert et al. (2008) and Zahradník (2014), which claim that seeds can germinate under shade of close stand canopy, but seedlings will need more light and afterwards they die. Natural regeneration of fir was found only under spruce stand in our experimental plot. Úradníček et al. (2009) wrote that fir can sustain under heavy shade without its vitality loss for a long time. Fir and its natural regeneration need sufficient soil moisture and air humidity conditions, otherwise it is sensitive to drought (Korpeľ and Vinš 1965; Úradníček, Chmelař 1995). Fir natural regeneration was present only under spruce canopy and we did not find it at clear area and under beech sparse canopy, where short-term droughts can frequently occur during the whole growing season at the site. We recorded natural regeneration of whitebeam along the whole transects due to its excellent adaptability and pioneer growing strategy (Uhlířová and Kapitola 2004, Stonawsky 2013). Natural regeneration of birch was, as expected, highly represented at clear area and less under beech forest. Many authors (e.g. Úradníček 2003, Uhlířová and Kapitola 2004) describe birch as pioneer tree species commonly occurring at clear areas and disturbed localities. Missing fir regeneration under dense spruce canopy can be by the reason of low light availability. Uhlířová and Kapitola (2004) concluded that birch seedlings early die under closed stand canopies.

### Conclusion

At investigated gale-disaster area in the Šumava National Park, natural regeneration of seven different tree species: Norway spruce, European beech, Silver fir, European larch, Scots pine, Silver birch and Common whitebeam was monitored along the two chosen transects. These transects consist from three different parts differing in Sun light availability and other microclimate conditions; i.e. open clear area, dense spruce and disintegrating beech stand conditions. The density of seedlings exceeds tens of thousands per hectare. The highest density of natural regeneration was obtained for spruce and beech as the seeds can come from the mother surrounding stands. Density of natural regeneration of other tree species was in hundreds of seedlings per hectare at maximum. The centre of massive occurrence of individual trees species differ due to species specific ecological demands and growing strategy. Spruce regenerated and grew mostly under the protection of sparse beech stand canopy. However, seedlings of beech were found under mother stand, they were present also at clear area up to about 60 m distance from the edge of the mother stand. The centre of massive natural regeneration of Common whitebeam was located at clear area, although it was present along the whole transects. Scots pine was present only at clear area. Birch occurred at clear area and under sparse beech stand canopy. In contrast, Silver fir grew only under spruce stand. Larch was found at clear area, and also it was found at the irradiated gaps under the 1<sup>st</sup> transect with less dense spruce stand. Natural regeneration can be one from the options how to afforest gale-disaster areas.

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## Souhrn

Smyslem této práce bylo vyhodnocení přirozené obnovy na kalamitní holině v NP Šumava, která vznikla v roce 2007 po orkánu Kyril. Na dané lokalitě bylo monitorováno přirozené zmlazení sedmi druhů dřevin. Nejzastoupenější byly smrkové a bukové semenáčky, jejichž hektarové počty přesahovaly desítky tisíc, což odpovídalo druhové skladbě okolních mateřských porostů. Zmlazování dalších dřevin (jedle, modřín, borovice, bříza a jeřáb) na dané ploše nebylo již tak živelné jako u smrku a buku, přičemž jednotlivé dřeviny byly zastoupeny v hustotě stovek kusů na hektar. Centrum výskytu u jednotlivých dřevin bylo rozdílné s ohledem na ekologické nároky a strategii růstu. Smrk rostl především pod ochranou téměř mrtvého bukového porostu. Bukové semenáčky byly pod tímto porostem také, avšak vyskytovaly se i na holině až do vzdálenosti cca 60 m od okraje porostu. Těžiště jeřábového zmlazení bylo na holině, ale vyskytoval se v celé délce transektu. Bříza se vyskytovala na holině a pod téměř mrtvým bukovým porostem. Jedle se podle této studie zmlazovala pouze pod smrkovým porostem a borovice pouze na holině. Modřín se vyskytoval na holině, ale i v prosvětlených místech smrkovém porostu ve výše umístěném transektu. Z práce pro praxi vyplývá, že lze na kalamitní holině využít přirozené zmlazení více druhů dřevin.

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## SPROUTING ABILITY OF TEAK TREES AFTER DIFFERENT THINNING INTENSITY APPLICATION IN THREE CHOSEN STANDS IN NICARAGUA

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### Abstract

Knowledge of the sprouting stump ability and growth of teak sprouts can be important for stand coppicing or reforestation. The influences of varying thinning intensities and age of stand on the number of sprouts and their mean height were investigated at the three different stands in Nicaragua. When the thinning intensities of 50, 60 and 75 % reduction in stand densities were applied, the stands were six, seven and eight years old. Re-sprouting of teak stumps was nearly 100 % regardless of stand age or thinning intensity. According to stand age, the lowest number of sprouts was produced in the oldest stand (2.6 – 2.9 sprouts per stump) and the highest amount in middle old stand (4.0 – 5.8 sprouts per stump). As hypothesized, the number of sprouts correlated positively with thinning intensity only in the youngest stand in Mango. The smallest height of sprouts was found in the oldest stand (52.0 – 110.0 cm), whereas the highest sprouts were in the middle old stand (95.0 – 137.0 cm). Results unfortunately showed inconsistency and impossibility of its generalization. Therefore, to confirm our hypotheses, it is necessary to repeat the experimental design and enlarge the dataset.

**Key words:** *Tectona grandis*, Nicaragua, coppice, thinning intensity

### Introduction

Teak (*Tectona grandis* L.) is one of the most widely planted hardwood timber species in the world (Ball et al. 1999). Recently, the supply of teak wood from natural forests has been decreased, thus an interest of the establishment of teak forest plantations increased (Pandey and Brown 2000). However, quite sparse spacing in plantations, teak trees show straight stem and good timber quality production. Growers cultivate teak mostly with cutting of undergrowth (Pandey and Brown 2000). Plantation is also more attractive for forest visitors comparing to stand with thin stems and bush in understory (Cook (1972). Cleaning and thinning application to eliminate bush led to an additional spacing enlargement and gaps occurrence in the stand. Then, blowing wind can cause on tree damage and continuous gap enlargement. The stand gaps are identified as not so scenic landscape by visitors (Rees 1975). General public likes a balanced, symmetric, unified and through forests (Gobster 1996). Artificial gaps creation should provoke also re-sprouting of teak stumps and thus diminishing above mentioned public demands (Riswan and Kartwawinata 1991). Troup (1921) concluded that light is a crucial resource for development of the teak coppice, because of its pioneer growth character. Jacobs (1955) and Grundwald and Karchon (1974) describe that the abilities to coppicing the teak decline with the tree age. Therefore, this study focuses on optimization of thinning intensity depending on the stand age from the point of view of number and growth of teak sprouts in Nicaragua.

### Materials and methods

Experiment was carried out in the plantation La Reserva, Nicaragua (11°49'02''N; 86°13'10''W). The soils of the experimental plots are Altiols and Ultiols and climate is classified as hot and dry with mean annual amount of precipitation varying from 1400 to 1800 mm (INETER, 2004). All measurements were conducted in the three different young teak plantations in El Corral, El Brasil and Mango. These stands were established with the initial spacing of 1x1m according to scientific purpose in 2006 (El Corral), 2007 (El Brasil) and 2008 (Mango). In time of planting, plant height and stem thickness were similar. Thinning was performed in all stands in February 2014. The stump sprouts were measured one growing season after the thinning application. A completely randomized block-design with the three treatments and two replications were applied in all stands. Size of each plot was 20 x 20 m (0.04 ha). There 20 rows with 20 trees per row were located there usually.

Applied thinning intensities (treatment) were as following:

T1: Low thinning intensity; reducing of 50 % of the initial stand density;

T2: Moderate thinning intensity; reducing of 60 % of the initial stand density;

T3: Heavy thinning intensity; reducing of 75 % of the initial stand density.

The buffer zones, surrounding all the plots as 20 m width belt. Number of sprouts per stump and sprout height were measured in each plot.

All the data were stored and processed by Microsoft Excel. Statistical analysis of data was performed using the STATISTICA software. Before statistical analysis, the normality of data distribution was tested. Main effects and interaction were tested using the univariate analysis of variance (ANOVA). After ANOVA analysis, Scheffe's test was used to identify statistically significant differences among variables. Confidence interval was set on 95%.

## Results

Vegetative, i.e. by stump sprout, regeneration occurred in all treatments by nearly 100%. No difference in mortality was found among treatments or stands ( $p=0.63$ ). Number of sprouts per stump was different. In general, similar number of sprouts per stump was found at all the plots in El Corral (sprouts per stump  $\pm$  SD); T1:  $2.9\pm 1.0$ ; T2:  $2.8\pm 0.9$ ; T3:  $2.6\pm 0.8$ , even different thinning intensity (T1-3, low-moderate-heavy) was applied. Differences among thinning intensities were not statistically significant there. The highest number of sprouts per stump was found in El Brasil; specifically, under moderate thinning intensity T2:  $5.8 (\pm 1.3)$ . It was higher about 38 % than in T1 ( $p<<0.001$ ) and about 45 % than in T3 ( $p<<0.001$ ) thinning intensities. The lowest number of sprouts per stump was found in Mango; T1:  $2.0\pm 0.6$ . It was smaller than in T2 ( $p=0.016$ ) and in T3 ( $p<<0.001$ ) about 50 % and 90 %, respectively. There, higher thinning intensity led to higher stump re-sprouting ability. According to age of stand, it was found that El Brasil and El Corral ( $p=0.0001$ ) and El Brasil and Mango ( $p<<0.001$ ) differ under T1 treatment. Under T2 treatment, difference was found between El Brasil and El Corral ( $p<<0.001$ ), and El Brasil and Mango ( $p<<0.001$ ). Difference under T3 was found between El Corral and El Brasil ( $p=0.0001$ ) and El Corral and Mango ( $p=0.0008$ ; see Fig. 1).

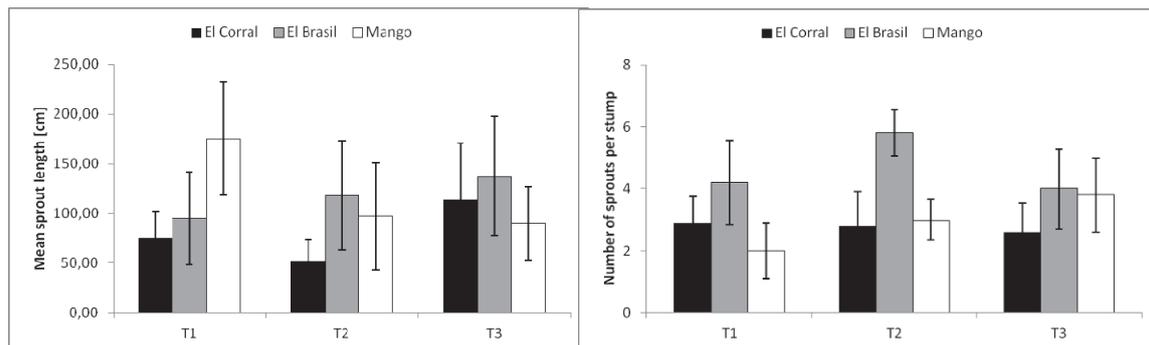


Fig. 1: Number of sprouts per stump and mean sprout height according to thinning intensity (T1- low, T2- moderate, T3- heavy) at each stand.

Mean sprout height ( $\pm$ SD) was the smallest in El Corral T2 ( $52.6\pm 21.2$  cm). It was smaller comparing to T1 and T3 about 30 % ( $p=0.0173$ ) and 54 % ( $p<<0.001$ ), respectively. In El Brasil, statistically significant difference was found only between T1 and T3 ( $p=0.032$ ), when sprout height in T1 ( $95.1\pm 46.8$  cm) was lower about 44 % than in T3. The tallest sprouts have been grown in Mango T1 ( $175.4\pm 57.2$  cm). These sprouts were highly statistically different in height from the sprouts about 45 % ( $p<<0.001$ ) about 49 % ( $p<<0.001$ ), in other treatments, i.e. in T2 and T3, respectively. Reflecting stand age, the youngest stand (Mango) shows even taller sprouts comparing to the oldest stand (El Corral) about 57 % ( $p<<0.001$ ) and about 45 % than in El Brasil ( $p<<0.001$ ), especially under T1 treatment. Mean sprout height was the smallest in El Corral under T2 treatment ( $52.6\pm 21.2$  cm). Statistically significant differences were found between El Corral and El Brasil (about 125 %;  $p<<0.001$ ) and El Corral and Mango (about 85 %;  $p=0.0046$ ). Under T3 treatment, statistically significant difference was found between El Brasil and Mango (about 34 %;  $p=0.0025$ , see Fig. 1).

## Discussion

In general, tropical evergreen forest tree species show a high variability in a sprouting ability (Kauffman 1991). According to many studies, the most of tropical deciduous forest tree species possess the ability to sprouting and coppicing (Troup 1921, Murphy and Lugo 1986, Lieberman and Mingguang 1992, Lugo 1992). Troup (1921), Grundwald and Karchon (1974), Thaitusa (1999) described the teak as a suitable tree species for coppice management, due to high sprouting ability. Zabala (1990) predicted that the light would be an important resource for development of a coppice.

Our results showed that sprouting ability of teak, i.e. stump resprouting, was 100 % over all thinning intensity treatments independently on stand age. Thinning intensity influence on amount of irradiance of the ground surface under a canopy (Chowdhury et al. 2008). Therefore, we expected the lowest amount of sprouts per stump occurrence in the oldest stand with the low thinning intensity according to Jacobs (1955) or Grundwald and Karchon (1974) results as they showed that sprouting ability declines also with the cutting tree age. Under our experiment design, these hypotheses were partially confirmed, because the smallest number of sprouts was found mostly in the oldest stand. Chowdhury et al. (2008) present that different gap sizes did not affect number of produced sprouts. The opposite result presented Sukwong (1976). They showed that the number of sprouts per stump correlate with available light as well. Our results are similar to these of Sukwong (1976) only in the youngest stand. It seems that in the older stands, amount of sprouts per stump depend on its size more than on light availability. However, Chowdhury et al. (2008) described that the sprout length did not differ after six months of growth, we found the differences after six months similarly as results of Thaiutsa et al. (2001). In the youngest stand (in Mango), height of sprout was decreased with the increasing intensity of thinning. These results are opposite than Thaiutsa et al. (2001), and our results from El Brasil. Therefore, the hypothesis, the more sprouts per stump, the smaller height of sprouts, was not valid for our data. Thaiutsa et al. (2001) present good relationship between light (thinning intensity) and the height of sprouts similarly as at the plot in El Brasil. In the Mango, the relationship shows opposite trend. In the oldest stand (El Corral), our results were similar as these of Neumann (1983). He concludes that influence of competitive conditions in light, water and nutrients affect sprout height dominantly.

### Conclusion

The three different thinning intensities (i.e. from 50 to 75 % reduction of stand density) were tested from the point of view of teak stump re-sprouting ability at three different sites in Nicaragua. These three sites differ also in age of teak stand (in one-year step). We hypothesize that re-sprouting ability of teak stumps quantified by number of sprouts per stump and their growth in height depend negatively on stand age and size of teak stumps, and positively on light availability with increasing thinning intensity, respectively. Our data only partly confirmed these hypotheses. There, no similar trends were found across the all investigated stands. Therefore, it is necessary to repeat the experimental design and enlarge the dataset at other localities and stands for possible generalization of results.

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### **Souhrn**

Teakové plantáže v Nikaragui jsou farmáři pěstovány tak, že je v intenzivních probírkách odstraňována podúroveň. Občas je díky vysoké intenzitě zásahu porost značně zředěn a následně díky větru vznikají v porostu mezery. Zvýšený přísun světla podporuje růst buňek v mezeře i hlubší zavětvení a tloušťkový přírůst stromů v okolí mezer. Zatímco tloušťkový přírůst je žádaný, růst buňek a hlubší zavětvení nikoliv, protože společně se snížením uniformity, rovnováhy a symetrie v porostu jsou vnímány návštěvníky lesa jako nepříjemný prvek. Z tohoto důvodu byl realizován experiment s vyplňováním mezer v teakových porostech pomocí stimulace tvorby výmladků probírkami různé intenzity. Byly vybrány tři porosty různého stáří (odstup jednoho roku) a v každém byla provedena probírka tří různých intenzit (redukce počtu jedinců o: 50 %, 60 % a 75 %). Výsledky vykazují rozdílné trendy u jednotlivých porostů. V mladším porostu je vliv světla důležitým faktorem. Čím větší mezera v porostu vznikne, tím více se vytvoří pařezových výmladků. Avšak čím více výmladků na pařezu tím jsou menší. Tato relace nebyla potvrzena ve starším porostu, kde je horší schopnost tvorby výmladků a výška výmladků nebyla závislá na intenzitě zásahu resp. velikosti mezery. Získaná data bude třeba rozšířit a experiment s podobným designem provést a zopakovat na větším počtu ploch tak, aby bylo možné hypotézu s vyšší pravděpodobností potvrdit či vyvrátit.

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## SUSTAINABLE BUILDINGS IN RECREATION AREAS

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### **Abstract**

Buildings are responsible for 40% of greenhouse gases production, contributing significantly to global warming. One approach to limit greenhouse gas production is construction and operation of buildings according to the principles of sustainability.

The sustainability of buildings is assessed on the basis of so-called environmental certificates. For this purpose, the LEED and BREEAM global certification programmes and one Czech certification programme, SBToolCZ, are used in the Czech Republic. The assessment criteria for obtaining certification include location, energy standard, water management and others.

Currently 186 certified buildings are assessed in the Czech Republic. In most cases, these are administrative buildings or production facilities but certification can also be obtained for other types of real estate such as recreational buildings, block of flats or residential home.

The article deals with sustainable buildings in terms of evaluation criteria. Emphasis is placed on one of the criteria - building site, especially buildings located in recreation areas. The article also includes a case study dealing with the impact of the environmental certificate on the price of real estate in recreation areas.

**Key words:** environmental buildings, valuation real estate, environmental certificate, location

### **Introduction**

Buildings produce significant amount of greenhouse gases, especially carbon dioxide. Therefore, they contribute largely to global warming and climate change. According to available science articles, the amount of CO<sub>2</sub> production by buildings varies from 25% (Brounen et al, 2011) to 30% (Cioraa et al, 2016). Buildings offer big potential for reducing greenhouse gas production. The solution lies in building and operating buildings that meet the basic aspects of sustainable construction. This applies to all buildings in general, including buildings located in recreational areas.

### **Certification programs**

As mentioned in the introduction, sustainable buildings are a fundamental approach to reduce the environmental impact of buildings and reduce carbon footprint. The sustainability issue can be tackled by the three basic pillars that need to be balanced. These are pillars covering the economy, the environment and the social area. This theory can cover virtually every human activity, including buildings (Lorenz et al, 2011).

Compliance with the aspects can be verified by an environmental certification process. At the end of the certification process building can be certified. There are many national and multinational certification programmes. These programmes are designed to distinguish and assess buildings that meet the basic requirements for sustainable construction, as well as to distinguish "green buildings" from other buildings. The first was the British Building Research Establishment Environmental Assessment Method (BREEAM). BREEAM has been used from the 1990s. Another certification programme is LEED (Leadership in Energy & Environmental Design). This programme was issued by the US Green Building Council (USGBC) in 2000. For example, the ENERGY STAR programme is used in the US (Rahman et al, 2017). SBToolCZ is the only national programme in the Czech Republic.

There are 186 certified buildings in the Czech Republic, across certification programmes and various buildings. Of the total number of certified buildings, 48.4% are office buildings, industrial sites form 29%. The third type of buildings are business centers which make 7.5%. 25% is occupied by residential buildings (apartment buildings and residential houses). The total number of certified residential buildings in the Czech Republic is 7.0% (13 apartment buildings). The houses form 6.5% (12 houses). In the case of houses, there are 11 houses in one locality (one development project) and one passive house.

### **Theoretical background - impact of certification**

A large number of studies, which investigate the impact of environmental certification on rental rates or the selling price of each type of property at the office, are available due to the widespread popularity of certification programmes abroad.

Based on a survey of the US office buildings, rent of LEED-certified buildings was 5% higher and the sell price was 25% higher (Fuerst et al, 2011). There was a 12.8% increase in rent of LEED certified office space in Shanghai (Yu et al, 2015).

The positive effect of certification on rental rates is also confirmed by a study from the Netherlands. Kok, Nils and Maarten Jennen reported that non-green buildings had a lower rent by 6,5% (Kok et al, 2012). Chegut et al. dealt with the financial efficiency of commercial and office space located in certified buildings in London. Based on the compiled database, rents higher by 19.7% were found for certified buildings as well as the sell price showed a positive effect of 14.7% (Hyland et al, 2013).

Compared to articles about certified administrative buildings, not many articles are published about certified residential buildings. One of the few studies dealing with the certification of sustainable residential buildings is a research study by Kwame Addae-Dapaah and Su Jen Chieh from Singapore. It dealt with the issue whether the market reflected building certification and its impact on residential property prices. The paper deal with this issue through a hedonic model and exploratory study in Singapore on the residential green market. The authors' results proved a statistically significant premia of the certificate. The authors further pointed out that the market itself was confused by the different degrees of certificates. The research was conducted on 13,899 apartments and 300 respondents from Singapore (Rahman et al, 2017). The research also carried out a questionnaire which found out that 33.67% of respondents knew about green certification while 83.2% of respondents did not know about differences in certification levels. The authors also examined whether a green certificate is desirable for the owner or future residents when choosing an apartment. The certification premium for individual apartments ranged from 9.61% to 27.74% for the hedonic model based on the degree of certification in Singapore and 5.47% to 6.82% based on the exploratory study. In the case of leases, certified apartments were on average 9.19% to 16.76% more expensive (Rahman et al, 2017).

The issue of the impact of certification on the price of residential buildings was studied by Brounen and Kok. (Brounen et al, 2011) In their research, they found that improving carbon efficiency in housing could be an important source of global carbon emissions reduction. The study also found that residential homes, which are green-labeled, are sold at 3.6% premium (Brounen et al, 2011).

A study in Canada focused on the LEED for Homes and BOMA-BEST certification programme, specifically whether these certificates captured a higher market price and a lower vacancy rate. However, the authors did not provide clear statistical evidence that there was a "green premium" on the market that would increase the price of real estate. The authors argued that probably valuation methods are currently not included in sustainability factors. The vacancy rate for green commercial buildings was generally lower than non-green building but the differences were not statistically significant (Kwame et al, 2011).

The particular problems of valuing "green buildings" were addressed by authors Cioraa, Maier and Anghela (Cioraa et al, 2016). They dealt with the correlation between the development of the office space market and the price of these properties and their occupancy, rental or productivity gains. The results pointed to weaknesses in the valuation of office buildings.

### Criterion location

All used certification programmes in the Czech Republic evaluate the criterion of the location. Appropriate location of the building contributes to sustainable transport of building users. Consequently, the buildings placed in near public transport, with the possibility of recharging electric vehicles, parking of bikes, etc., are positively evaluated. The priority is different depending on the type of building being assessed (resident / administrative / industrial).

The SBToolCZ certification programme evaluates group of location criteria that is structured as follows:

Tab. 1: Weight of criterias in location group (Hyland et al, 2013)

Group L - Criterion	Weight
L.01 Availability of public places to relax	16%
L.02 Service availability	16%
L.03 Availability of public transport	22%
L.04 Location risks	15%
L.05 Local air quality	16%
L.06 Criminality prevention in urban design	15%
<b>Total</b>	<b>100%</b>

The following table compares the individual criteria that are evaluated for the LEED and BREEAM transnational programmes. The LEED Certification Program assigns an area 28 points out of 110 points. The BREEAM programme does not reflect the location. On the contrary, the transport is evaluated, especially in terms of public transport and to support ecological modes of transport, eg. in the form of bicycle racks, charging of electric vehicles, etc.

Tab. 2: Evaluation criterias of LEED and BREEAM certification programmes (Lorenz et al, 2011)

LEED	Score	BREEAM	Score
Sustainable sites	28	Management	12
Water efficiency	10	Health and Wellbeing	15
Energy & Atmosphere	37	Energy	19
Materials & Resources	13	Transport	8
Indoor Environmental quality	12	Water	6
Innovation in design	6	Waste	7,5
Regional Priority	4	Pollution	10
		Land Use and Ecology	10
		Materials	12,5
		Innovation	10
<b>Total</b>	<b>110</b>	<b>Total</b>	<b>110</b>

As is stated above, certified office buildings prevail in the country. This is also due to the predominance of the location of certified buildings in Prague (66.1%) and Brno (6.5%). In the category of others (27.4%), industrial sites with good connection to motorways predominate. From the category of certified residential buildings, one can mention the construction of 11 family houses and 3 apartment buildings in Hostín near Prague. The realization of the Šumavský dvůr residential building, which is located in the protected landscape area, remains unique.

The Protected Landscape Area is an area declared by the Act no. 114/1992 Coll. It is a large area that is protected because of its character. Protected landscape areas are divided into other categories with predefined protection (Act no 114/1992). In general, constructions in a protected landscape area are very difficult. Newly planned projects must respect the nature of the landscape and meet strict construction criteria.

The recreational area is generally defined as: *“Territory with tourism services or a comprehensive complex of facilities offering multiple facilities, services and activities”* (www.chciprojekt domu.cz).

Recreational Landscape Entity - *“A territory that, by virtue of its natural characteristics, carries the same or related recreational functions. The urban area of interest is a specific recreation and tourism center”* (www.chciprojekt domu.cz).

### Case study

The case study deals with the construction of three apartment buildings in the village of Železná Ruda - Šumavský dvůr, Czech Republic. The construction process was divided into three phases. Residential buildings are located in the protected landscape area of Šumava, near the Šumava National Park. The project is unique as located in the protected landscape area and will not expand. Strict construction criteria were met to preserve the character of the landscape. In general, this project meets the requirements for a recreational area.

One of the apartment buildings (Phase 2) received the SBTToolCZ silver certificate. The location of the three apartment buildings is rare, all three buildings are of the same character, made of the same materials and they stand side by side. Only one apartment building has a certificate. Apartment buildings are built as log cabins and architecturally integrated into the landscape. All three apartment buildings meet the requirements for sustainable construction, as natural materials were used (such as wooden roof tiles, wood finishes, wooden windows and doors). Rainwater is soaked in the soil and helps to maintain groundwater levels. Facades are facing south, supporting passive solar gains and also reducing the demand for thermal energy.

The whole project is very luxurious, part of the complex is a range of facilities for leisure activities, such as wellness and playground that fulfills the general idea of a recreation area. The ski slope is about 300m from the area. In the case of property valuation or the usual price estimate, the price is made up of pricing factors that affect the final estimate. The most important pricing factor is always the

location. Equally important factors are also the equipment, apartment size, outlook, building and technical condition and others. Due to the location of the Šumavský dvůr project, the site should be the most important factor. The case study focuses on the impact of the environmental certificate on the real estate price. To determine this effect, realized prices were obtained from the Cadastre of Real Estate. The prices covered all three buildings of the Šumavský dvůr project, both the non-certified buildings (phase I and III) and the certified buildings (phase II). In total, 41 realized prices were analyzed. Out of which, 17 were from uncertified buildings and 24 from certified buildings. Realized prices were obtained at different selling dates, so it was necessary to recalculate them using the housing price index (HB index) to the same 4th Quarter 2018 price level. The apartments were divided into two categories according to the size of the apartment building, the categories were divided for each apartment building separately. Higher sales prices were recorded in the 3rd apartment building. At the same time, the positive impact of certification was not confirmed. Significant pricing factors included the location, the size of the housing unit and above-standard equipment – eg. a fireplace and the orientation of the windows overlooking the virgin nature (view). The following table summarizes the individual average prices achieved in residential buildings.

Tab. 3: Price per square metre

	category I	category II
	CZK/square metre	
Phase I	92 123	68 053
Phase II <b>certified</b>	110 120	108 664
Phase III	123 625	118 013

## Conclusion

Buildings, as a source of environmental pollution, have a great potential for reducing carbon dioxide production. Sustainable construction and operation is a solution to reduce the growing production of carbon dioxide. The process of environmental certification assesses if a building meets individual aspects of sustainable construction. The process is completed by issuing the certificate. In the Czech Republic, 3 certification programmes are widely used, namely LEED, BREEAM and SBToolCZ. The article summarizes the requirements for certified buildings in terms of location. Based on the case study, it was found that the SBToolCZ certificate did not affect the selling price of the individual housing units at the Šumavský dvůr residential building (phase II). This conclusion is in compliance with the study of Rahman et al. (Rahman et al, 2017). As they shown that there was no green premium at selling price of residential buildings.

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### **Souhrn**

Článek pojednává o udržitelných budovách v ČR. Budovy jako zdroj znečištění životního prostředí představují velký potenciál pro redukcii produkce CO<sub>2</sub>. Návrh, realizace a provoz dle zásad udržitelné výstavby je řešením, jak pomoci redukovat rostoucí produkci CO<sub>2</sub>. Do jaké míry splňuje budova jednotlivé aspekty udržitelné výstavby lze ověřit procesem environmentální certifikace, který je zakončen vydáním certifikátu. V tuzemsku jsou nejvíce rozšířeny 3 certifikační programy, a to nadnárodní certifikační programy LEED, BREEAM a národní certifikační program SBToolCZ. Z rešerše zahraničních zdrojů vyplynulo, že certifikace přináší zvýšení nájemného u pronájmu administrativních budov. U rezidenčních staveb není navýšení ceny ani nájemného jednoznačně prokázáno. Článek shrnuje požadavky pro získání certifikátu. Důraz je kladen na jedno z kritérií – lokalita stavby, zejména u budov umístěných v rekreačních oblastech. Případová studie se zabývá realizovaným projektem „Šumavský dvůr“, na jehož základě byly vystavěny tři bytové domy v obci Špičák. Realizace byla rozdělena do tří etap. Bytové domy jsou umístěny v chráněném krajinném území (CHKO) na Šumavě, v blízkosti Národního parku Šumava. Obecně lze říci, že tento projekt splňuje požadavky kladené na rekreační oblast. Pouze jeden z bytových domů (v rámci 2. etapy) získal stříbrný certifikát SBToolCZ. Bytové domy jsou vystavěny jako sruby, čímž jsou architektonicky začleněny do krajinného rázu. Celý záměr je velmi nadstandardně pojatý. V případě oceňování nemovitostí resp. odhadů obvyklé ceny, je cena tvořena cenotvornými faktory, které mají vliv na výsledný odhad. Nejvýznamnějším cenotvorným faktorem je vždy lokalita, mezi neméně důležité faktory lze řadit také například vybavení, velikost bytu, výhled, stavebně-technický stav a jiné. Případová studie byla zaměřena na vliv environmentálního certifikátu na cenu nemovité věci. Pro stanovení tohoto vlivu byly získány realizované ceny z veřejného seznamu, které byly složeny ze všech 3 budov projektu Šumavský dvůr. Celkově bylo analyzováno 41 realizovaných cen, z toho 17 z necertifikovaných budov a 24 z certifikovaných budov. Vyšší prodejní ceny byly zaznamenány v 3. bytovém domě (III. etapa). Zároveň se nepotvrdil pozitivní vliv certifikace. K významným cenotvorným faktorům patřila lokalita, velikost bytové jednotky a nadstandardní vybavení - např. krb a také orientace oken s výhledem do panenské přírody.

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## SYNERGY OF ELEMENTS FOR THE CITY TOURISM DEVELOPMENT

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### **Abstract**

In a strong competitive environment, each organizational unit needs to identify its own strengths for its development and build and "tailor" its comprehensive management system due to its uniqueness and diversity. The development of Poprad has long been associated with the benefits of tourism. However, the location of Poprad in the foreground of the three national parks was getting the city to the "platform" position for the primary offer, based on natural conditions close to the surroundings and to the position of the provider of the secondary tourism offer. In our paper, we present the opportunity to create a synergistic effect for tourism in linking natural circumstances to an attractive offer to "experience Poprad" by offering a rich cultural and historical heritage in the form of rare sacral monuments. The link between the natural and cultural-spiritual heritage to create synergies appears to be even more important under the current perspective of globalization. The paper offers city management ideas on how to use its strengths from the internal environment and opportunities offered by the external environment. The accent is given to the benefits for the city and its inhabitants in a form of strengthening the city's identity with the anticipated positive impact on increasing tourism revenues, creating new job opportunities, personal development of the population, beautifying and revitalizing the city and its cultural and historical heritage.

**Key words:** management system, sacral buildings

### **Introduction**

A strong determinant of city development is its environment. The environment creates assumptions and gives impulse to effective city management. Impulses come from macroeconomic environment, regional environment, of which external customers and other stakeholders are particularly important elements. Initiatives for self-governing bodies are also brought by internal environment, whose strength is primarily due to human potential, preferred values of people, their knowledge, and the strength of identity. The task of local government management is to respond effectively to these stimuli and to meet the requirements of its customers - residents and visitors to the city. Poprad has a huge potential for its development in the surrounding nature. However, the location of the town in the foreground of three national parks, in the foregrounds of the High Tatras, the Low Tatras and the Slovak Paradise, can also create a positive synergy effect in connection with the attractive offer of a rich cultural and historical heritage, especially rare sacral monuments. Throughout the centuries, the knowledge and values of the local communities have accumulated in them and they are a testimony of the development of spiritual culture, an expression of artistic taste and a manifestation of the dedication and tenacity of people. A set of natural conditions and cultural-spiritual preconditions can create an integrated tourism development system as one of the pillars of sustainable city development.

### **Tourism - a factor of city development**

Tourism is a sector with high added value. Its services usually contain a significant proportion of active human labour. Tourism has the potential to transform Poprad not only as a gateway to the surrounding nature parks. Tourism can also be one of attractiveness factors for tourists visiting the city. An essential aspect is the reflection of the change of the destination for which visitors seek a beautiful natural scenery in the vicinity. Cultural-spiritual traditions and values have the potential to create a new attractive content for "new" tourism. They have the potential not only to fulfil the function of an "accompanying" event during the visitor's stay, but to be the main element of attractiveness, the reason for the visitor's arrival in the region and the city with the aim of "experiencing Poprad".

The Department of Management in Poprad of the Catholic University in Ružomberok has developed a program for the development of the city Poprad through "religious tourism", using historical and spiritual heritage, materialized also in sacral buildings. The project was based on analyses of predisposition and accessibility of the objects - sacral buildings, on analyses of the existing state and trends in marketing communication and evaluation of the most important system development element - people and their potential.

### ***Sacral buildings - tourism object***

Sacred buildings appear to be one of the "attracting" factors of current visitors' expectations in tourism. Large sacral buildings (churches, monasteries) and small sacral buildings (crosses, bell towers, chapels, Marian columns, statues of saints, ...) are a unique national phenomenon of Christian material cultural heritage and an important element of local urban culture. They have the symbolic content of a whole spectrum of ideological, ideographic and social references and have the potential to be, as an object of religious tourism, part of the cultivation of national historicism and Christian awareness of the city's inhabitants and visitors. According to current World Religious Travel Association data, "about 300 million people take part in religious tourism annually. It is one of the most widespread forms of tourism that generates a turnover of around 18 billion USD worldwide, which means that it accounts for about two percent of global tourism revenue" (Srovátková, 2013).

The sacral buildings in Poprad were processed by the method of field research, characteristics of individual buildings (their exterior and interior) in the historical context and according to the fulfillment of the "accessibility criteria" (transport accessibility, parking options, barrier-free access, sanitary facilities, outdoor rest area, accessibility worship, accessibility outside the time of public Christian activities, possibility of photography).

Research has brought following basic knowledge about sacral buildings:

- there are 16 large sacral buildings in the city, of which 8 are churches owned by the Roman Catholic Church, 1 is a church owned by the Greek Catholic Church, 1 is a church owned by the Orthodox Church, and 5 are churches owned by the Evangelical Church of Augsburg confession and 1 prayer house owned by the Baptist fraternity,
- a great cultural and historical value is especially in the 5 Roman Catholic churches, whose beginnings date back to the 13th (4 churches), respectively 14th century (1 church),
- in Poprad, there are about 3,200 inhabitants per one large sacral building. With this share, the city ranks first among the larger cities (over 50 thousand inhabitants) in the Slovak Republic,
- the availability and use of large sacral buildings outside the time of public Christian activities is very low.

### ***Marketing Communication and Religious Tourism***

The customer most often composes his tourism product himself, usually by combining several services within the primary and secondary offer (Gúčik, 2006). The success of the organizational unit assumes the application of integrated marketing communication, the balanced use of all available communication mix tools. The analysis of providing information about the sacral buildings of Poprad on the website of the web service in the world of the Internet service brought the following conclusions:

- Slovak and world search engines find and place information on the sacral buildings of Poprad in good positions,
- the weakness is that search engines currently use client localization and personalization
- for marketing communication computer 3D models with varying levels of detail and many new features are not used yet,
- people, city dwellers, city workers do not have sufficient knowledge to contribute to direct marketing in improving marketing communications for sacral buildings.

### ***Using human potential to promote religious tourism***

All major economies in the world have their development based on the richness of exploiting their internal potential, especially their people's knowledge. Knowledge, information transformed into activities, into actions has become a decisive factor in the quality of life of society.

What is the potential of the citizens of Poprad and its surroundings for its development? Can they be seen as a significant potential for building the city's identity on historically proven pillars? What is their knowledge of the issue of sacral monuments as materialized elements of our spiritual values? Do they (with a certain amount of pride and enthusiasm) know to inform the city's visitors about the architectural and artistic gems in the city's territory? Is the knowledge of the subject matter a part of family or school education? Do parents and teachers consider this issue to be relevant for the future of the city? Such and many other questions can be asked in relation to clarifying the city's human potential through tourism services and its specific form - religious tourism. In this way, a questionnaire survey was conducted on a sample of 400 respondents.

From the broad research we choose (for capacity constraints) only some conclusions:

A survey aimed at respondents' awareness of sacral buildings by age groups has shown that the highest level awareness belongs to the category of respondents over 55 who have known 5 sacral

buildings on offer, this category is followed by the category of respondents in the 26-40 age group who know most often 4 to 5 of the sacral buildings offered. Information is provided in Table 1.

Tab. 1: Information in age groups

Age	$n_i$	$\Phi$
19 - 25	163	3.810
26 -40	79	4.544
41 - 55	99	3.990
> 55	59	5.136

Where  $n_i$ - is the number of respondents in the category

$\Phi$ - average achieved value

Source: own processing

Is this status statistically significant? Is there a conditionality between the age composition of the respondents and the number of known buildings? Therefore, we have formulated a basic hypothesis:

*H<sub>0</sub>: Interest in sacral buildings is not dependent on respondent age. Age is not one of the decisive factors affecting these interests. The characters being monitored are independent.*

*H<sub>1</sub>: Interest is conditioned by age. The characters are dependent.*

These assumptions were verified using the Chi-square test at a significance level of 0.05. Obtained statistical value  $\chi^2 = 73.8244$ , critical value  $\chi^2_{0.95} = 82.5287$ . The calculated probability  $p = 0.32349$  is higher than the commonly used significance levels. Based on these two results, we can conclude that the monitored characters are independent, the assumption formulated as  $H_0$  applies. Interest in sacral buildings is not conditioned by the age of respondents. Differences in frequency are not statistically significant and have the character of random variables.

## Results and Discussion

Tourism has become a very profitable industry, thanks to the increased interest of politicians, regional and municipal governments and business groups throughout the developed world. This interest is connected with the renaissance of regionalism, with the need for re-localization in the conditions of globalization, with the search for cultural uniqueness and marketing differences of regions and smaller territorial units. Religious tourism also offers such local uniqueness within tourism.

Religious tourism is formed under the influence of the specific, especially spiritual, requirements of the participants, experiencing the spiritual experience in particular. According to Syrovátková (2013), tourism connected with Christianity is most important in Europe. Sacral monuments help to understand history and the past, open the door to a new knowledge of human place in the city, region or country.

The results of the research in the conditions of the city of Poprad showed that the city has a potential for its development particularly in the sacral monuments, including the development of religious tourism. The number and attractiveness of large sacral buildings is the city's strength, but it can now be regarded as "neglecting of good". In small sacral buildings, only their historical value is often perceived; they are hardly used at all for community activities, for example with so much promoted cycling tourism (Budaj et al., 2018).

Research has identified reserves in the area of system attitude to meet the city's development goals based on the pillar of tourism. In the field of marketing communication, it can be the application of SoLoMo digital marketing, creation of 3D models and virtual tours, etc. However, the most valuable potential of the city are people - managers of municipalities and ordinary residents. Building their identity, their education and personal development and the irreplaceable role of the family, the school system and the management of self-government seem decisive in strengthening this potential.

## Conclusion

Throughout its history, human civilization has been associated with the concept of value, in philosophical, economic and marketing meaning. A person as a thinking creature is a decisive element in setting priority values and creating a ranking of values. People form them in connection with their life philosophy, their views on the environment, life processes. It is important to live in harmony with past and cultural-historical heritage. Sacral monuments help to understand the interpretation of history, open the door to a new knowledge of man's place in the history of the city and the region. In the era of globalization, at the time of pluralism of cultures, the relativization of values, the way to build a city's development in the meaning: think global, act locally seems to be the right one. It means "to tailor" the

strategic development plan of the city, in which tourism will also play an indispensable role and as a part of religious tourism in synergy with the beauty of the surrounding nature.

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### Souhrn

Každá organizační jednotka si potřebuje v silném konkurenčním prostředí identifikovat pro svůj rozvoj vlastní silné stránky a na své jedinečnosti a odlišnosti budovat a "ušít na míru" svůj ucelený systém řízení. Rozvoj města Poprad je odedávna spojován s přínosy z cestovního ruchu. Lokalita města Poprad v předpolí třech národních parků však dostávala město spíše do polohy "nástupiště" pro primární nabídku, postavenou na bázi přírodních podmínek blízkého okolí a do polohy poskytovatele sekundární nabídky pro cestovní ruch.

Ve svém příspěvku prezentuji možnost vytvořit synergický efekt pro cestovní ruch v propojení přírodních daností na atraktivní nabídku "zažít Poprad" nabídkou bohatého kulturně-historického dědictví v podobě vzácných sakrálních památek. Propojenost přírodního a kulturně-duchovního dědictví na vytváření synergických efektů se jeví ještě důležitější pod zorným úhlem probíhající globalizace. Příspěvek nabízí managementu města náměty jak využít své silné stránky z interního prostředí a příležitosti nabízené externím prostředím. Akcent je dán na přínosy pro město a jeho obyvatele v podobě posílení identity města s předpokládaným pozitivním dopadem na zvýšení příjmů z cestovního ruchu, vytváření nových pracovních příležitostí, osobnostní rozvoj obyvatel, na zkrášlování a revitalizaci města a jeho kulturně-historického dědictví.

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## THE CONCEPT OF ENVIRONMENTAL EDUCATION IN COMMUNITY-BASED SOCIAL FARMING (CSF)

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### **Abstract**

Social agriculture connects rural and municipal environments thanks to utilising the potential of agricultural farms to provide social services for local communities. This type of agriculture fosters social integration; as a business activity and a method of farm management in rural areas, it contributes to strengthening the relations between rural inhabitants, while at the same time allowing for strengthening of the relationships. The article presents the ideas of the Community-based Social Farming (CSF) project, which is based on cooperation, uses local capital, and implements education focused on such values as: health, history of the region, culture, recreation, healthy food. The primary goal of those actions is to create new social bonds, based on intergenerational and cross-environmental integration among various entities involved in social agriculture. The project is implemented in the pilot Social Farm "Oaza pod Lasem" ("Oasis by the Forest") in Daleszyn. The CSF combines many forms of operations, as well as involves various entities and engages the local community in its activities. The article more broadly discusses the educational functions performed by the CSF as part of the Educational Social Farm (ESF).

**Key words:** social farming, Community-based Social Farming (CSF), environmental education

### **Introduction**

Awareness in terms of social sciences is the understanding of your social existence and the role that the individual plays in the community. This means that every person must be aware that although all his behaviours, positions, feelings are not subjective or unique, their consequences affect other members of the given community (Reber 2000, p. 740). On the foundation of individual consciousness a collective conscience is created, which Emilié Durkheim defined as a set of views, beliefs and feelings, that are common to the average members of the given community. Collective conscience was a common value, which covered the entire spectrum of social life (Durkheim 1999, p. 69, 104, 105, 114, 129, 133). The mechanism of creating the social consciousness can also be analysed through hierarchical systems of social positions. Stanisław Ossowski emphasises the compensatory structure of these elements, which means, that the deficit e.g. related to lower social background is compensated by higher income (Ossowski 1968, p. 24). Collective conscience consists of many elements – components that are the sequence of processes occurring at the individual, group or above-group level, referring to the general public.

A specific form of a collective conscience is ecological awareness as „...a form of social consciousness that manifests itself both in thinking and experiences of specific people ,as well as in socially functioning standards of understanding, experiencing and valuing of the biosphere” (Hull 1984, p. 3-4). Ecological awareness is also the understanding of the possessed data on natural environment and the ability of the society to perceive the relationship of its (the society) existential behaviours with the state in which it (the environment) remains (Burger 2005), and it means also that it is a social consciousness, so „...the set of widely widespread views, ideas and beliefs in a given community, which become patterns or models of thinking inculcated to its members and enforced by social pressure” (Sztompka 2010, p. 307). Although many scientists believe that the term „ecological awareness” has symptoms of ambiguity, the representatives of such sciences as philosophy and economics, perceive ecological awareness as a derivative of a social awareness, that is why in their research they treat them together without separately analysing their macroeconomic influences, generalizing their impact (Papuziński 1998).

Against the background of ecological awareness there is a challenge to raise the awareness in society of the needs of the environment and to maintain a balance between ecological, economic and social goals (sustainable development) (Kowalska, Knapik, Bogusz 2016, p. 82-83). “The time of simple relationships between man and nature has already gone irrecoverably” (Stanek 1995, p. 35); in addition, a steadily progressing development of science and technology in the years of the past century has definitely influenced the existing ideas about the surrounding world, education and man. That is why an important area of social interest has become social issues related to the determinants of human life, and what connects with it – the environment of its functioning (Wolny 2002, p. 7).

The principles of ecological (nature) education can be considered on three levels: cognitive, emotional-volitional and behavioural. The cognitive level refers to the transfer of knowledge about nature. The emotional-volitional level stimulates and shapes morality to the problems of nature, while the behavioural one shapes the attitudes (Tyburski 2002, p. 22). Ecological education – interchangeably referred to as the environmental one – means the concept of education, the subject of teaching as well as educational activity, the system of forming attitudes and views towards the surrounding world based on the respect for the environment (Knapik 2018, p. 98-99). Through the multi-faceted and interdisciplinary approach: it sensitizes to the problems of the environment and its threats, makes aware of their causes and effects, teaches the methods of solving them and the responsibility for the natural environment, and it also mobilizes for active (personal or group) actions for environmental protection (Olaczek 1999; Tuszyńska 2006; Pawłowski 2008, p. 381).

### **Material and methods**

CSF is an example of the self-organization of the local community, which is social innovation. The project draws inspiration from social farming, but proposes new solutions. Social farming has been functioning in Europe for 20 years and takes advantage of plant and animal resources to provide recreation, therapy, rehabilitation and social services intended to tackle social exclusion. There are only a few forms of community-based social farming in Poland, namely care farms and educational farms. Farms performing several functions at the same time are equally hard to come by in Europe as well. CFS offers a comprehensive range of activities and health as a philosophy of life, healthy environment and healthy society are its guiding principles. Its areas of focus include: welfare and social services, consumer-supported agriculture, local food processing; intergenerational integration – by tapping into the local potential and the effect of synergy. Niches on the social services market are being explored and exploited. The project involves a range of activities focused on: 1. such social problems as: ageing society – preventing the social exclusion of the elderly, social exclusion in general, the weakening of social links, social inclusion of children and youth with special needs; 2. social needs (innovative education, care, being a part of a community); 3. economic challenges (producing “healthy” food, job creation, running a non-agricultural business, local development); 4. environmental objectives (conservation and promotion of the natural, cultural and social environment, a health-based philosophy of life). Concerted efforts are directed at various sectors of the economy and provide a response to social problems and needs.

The research method that has been employed draws on *verstehen*, the sociological method of Max Weber, with the *Ideal Type* as the conceptual tool. The theoretical grounds of the project entitled *Community-based Social Farming (CSF)* have been developed by the Author of this paper, as its pilot implementation takes place in the Social Farm “Oaza pod Lasem” (Oasis by the Forest in Daleszyn).

### **Results**

The target beneficiary groups of CSF are diverse (in terms of expectations and age), which produces the effect of synergy that drives local development. It is created by the entities providing support to and collaborating with CSF: households, farms located in greater or smaller proximity to CSF, public institutions, local government, non-governmental and non-formal organizations. The beneficiaries of CSF include: the residents of villages (home village or neighboring villages), cities and suburban areas, representing various social groups: children, youth, people at productive age and the elderly.

All the entities participate in, collaborate, or – using the services provided by CSF – create a social network, which brings together the members of this new community. CSF pursues social and economic objectives. The key social objectives are: shaping the attitudes towards the environment, health, “healthy” food; innovative education; strengthening a sense of local identity; orientation on changing the consciousness and sensitivity toward others (especially the elderly); intergenerational integration; long-term cooperation between various social actors and circles; developing sustainable social links, being open to change (e.g. new residents). Economic objectives pursued by CSF include: additional sources of income for farmers and for other village residents; optimum exploitation of potential; creating new jobs; alternative methods of management in rural areas.

CSF is primarily aimed at bringing together and integrating social circles (the residents of cities, villages and urban areas) and social groups: children, youth, people in a productive age and the elderly. Such activities are conducive to developing local cohesion and identity, but also prepare the new community (the one focused around CSF) for co-existing with new incoming residents. It creates a new community that is open to change. It enhances sensitivity to the needs of the elderly. Thus shaped attitudes and social values arrest the process of disintegrating social links and promote respect towards work and entrepreneurship. The impact of the measures that have been taken can be measured by way of: 1. evaluating the attitudes of the entities involved in the cooperation with CSF

and the beneficiaries along with the local community as the observers of new phenomena; 2. the number of created jobs; 3. the income from non-agricultural business; 4. monitoring the educational achievements of children and young people, in particular, in terms of their social competence (in general shortage); 5. the self-esteem of the elderly (CSF beneficiaries), in confrontation with the control group using the WHOQOL – BREF questionnaire and scale.

## Discussion

Community-based Social Farming (CSF) is an example of a social innovation based on community way of farming. The entity that initiated the activities in this field and remains the leader of this community is „Oaza Pod Lasem” Social Farm, which is a part of Mutual Credo Inc. In addition to the leading entity, the community includes a household and a business enterprise called „Stajnia Daleszyn”. The combination of private and business spheres, achieved by including the family members in the conduct of joint commercial activity, is linked by social mission. The overall objective is to conduct business in a sustainable way and to integrate all individuals and entities cooperating with the company (business and non-governmental organisations). Another entity forming a part of CSF community – the Do Ut Des Foundation, as a public benefit organisation together with Mutual Credo, implement the „Dajemy Radę” (we can make it) program.

Mutual relations of cooperating family members and stakeholders are based on social trust. The Do Ut Des Foundation promotes the idea of the principle of reciprocity based on the fact that this organisation supports their beneficiaries, including children suffering from cancer, and expects nothing from them in return. It conducts activities promoting health and healthy lifestyle. The primary goal of these activities is to activate the local community to undertake health activities, promote and shape pro-health attitudes, develop knowledge and skills in health care. All entities are merging business and *pro publico bono* activities. They are jointly and severally liable in the field of legal and tax matters, public law and jointly deal with logistics and financial matters related to the functioning of the entire enterprise.

The structure and the intensity of the bonding processes were difficult to predict at the time when the idea of CSF was created. At that time it was difficult to plan and predict all activities. The implementation of the undertaking verified the initial assumptions described in detail in CSF definition (<https://encyklopedia.pwn.pl/haslo/Wspolnota-gospodarstwa-spolecznego;6137506.html>, March 28, 2019), which depicted a probable direction of community development on the example of „Oaza Pod Lasem” Social Farm. The beginning of the formation of the community and the start of the research in this aspect took place in November 2016.

In the following year there were investments in the infrastructure, spatial planning, planting and construction of installations. In 2017 there was the beginning of the free access to the farm – providing children with fun, rest and environmental education, organising of neighbourhood integrating events and others. Whereas 2018 is the commercialisation of farm activities – the change of accents from free access to payment for the services provided – sales of educational and integration services. One should also emphasize the benefits achieved as a result of a personal, artistic and business development of the closest family members of the CSF leader.

## Conclusion

In the perspective of dynamic social and economic changes, the negative consequence of which is the destruction of the natural environment, the implementation of ecological education is a necessity. Educational programs at schools, at all their levels, are no longer enough. Shaping ecological awareness is a long-lasting process of a broadly understood ecological education. Its effectiveness is guaranteed by combined actions both in terms of formal and informal education (institutional and non-institutional), conducted among all age groups: children, teenagers and adults. In this article presented one of the projects implemented by CSF based on permanent non-institutional education in which the learning by doing approach is applied. Through education supported by practical classes, workshops, seminars, presentations – the roles of students and teachers are fulfilled by both children and adults.

The project is dedicated in particular to those rural areas which are fragmented and located near cities. The core of CSF is a farm not necessarily providing agricultural services, but using available resources such as utility building, land, animals. A network bringing together social actors collaborating with CSF as well as beneficiaries is created as a second step. The project is composed of the following systems: education of children and adults, which is self-learning and whose knowledge keeps expanding with new ideas and solutions; intragenerational collaboration targeted at the elderly; multifunctional social farming. The multiplication of know-how will take place through channels such as: social franchising, internet forum, social campaign, local development strategies.

The project constitutes social innovation and – as behooves every innovation – is concerned with overcoming the resistance and attitudes towards changes. Given its scope and number of engaged entities as well as the social receipt of this innovation, the following project milestones have been set: finding farm owners and persuading them to rise to the challenge; working with the local community; bringing various entities in contact with one another and encouraging them to cooperate; blending many activities within CSF; legal and administrative issues. CSF opens up new perspectives for: small farms facing profitability problems; the residents of villages with scant resources who can contribute to CSF offering a given type(s) of social services; care, education and agricultural farms – that are capable of expanding their offer.

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## Souhrn

Vzdělávání jako vyučovací proces má mnoho cílů. Ekologické vzdělávání je zvláštním případem tohoto procesu. Jeho hlavním úkolem je utvářet a posilovat sociální postoje charakterizované citlivostí k potřebám přírodního prostředí. Ekologické vzdělávání předpokládá komplexní dopad na jednotlivce a jeho mnohostranný charakter znamená kombinaci sociálních a environmentálních cílů. Ekologické povědomí se obvykle projevuje lidmi, pro které je příroda autotelickou hodnotou. V tomto povědomí jsou zahrnuty i další aktivity a životní cíle, které jsou součástí proenvironmentálního přístupu: zdraví, správné výživy a zdravého životního stylu. Péče o zdraví v tomto případě znamená jíst přírodní produkty a výrobky vyrobené s péčí o životní prostředí. Aktivní životní styl se na druhé straně projevuje především v činnostech s přírodou v pozadí a životě v okolí. Realizace neinstitutní ekologické výchovy v dané komunitě je obrovskou výzvou, protože vyžaduje kombinaci aktivit různých sociálních aktérů a zainteresovaných stran. Zahrnutí podnikatelských subjektů znamená, že dosahují měřitelných ekonomických přínosů komercializací sociálních aktivit. Sociální hodnota ekologické výchovy je prvořadá, avšak přeměna dopadů tohoto vzdělávání na konkrétní akce, které prospívají společnosti a životnímu prostředí, vyžaduje zapojení obchodních zástupců. Dalším aspektem, který určuje úspěch projektu CSF, je kombinování vzdělávacích funkcí s dalšími aktivitami, což má pozitivní vliv na každou z těchto aktivit. Účinku synergie lze dosáhnout také prostřednictvím mezigeneračního vzdělávání. Zapojení různých věkových skupin do výuky a především práce ve prospěch přirozeného prostředí posiluje smysl a efekt vzdělávání jak v utváření postojů, tak v uvědomění. Tato činnost

vyžaduje neustálé posilování vzhledem k měnícím se okolnostem a novým výzvám, kterým čelí jednotlivci, vědomi si odpovědnosti - která je na něj kladena - vůči sobě, přirozenému a sociálnímu prostředí.

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## THE FOREST THAT HEALS - FOREST ENVIRONMENT AS A SOURCE OF HERBAL MEDICINAL RAW MATERIALS

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### Abstract

The forest environment is an important source of non-wood forest products, such as edible mushrooms and fruits. The availability of such goods for many people is an important reason for choosing a forest as a place for recreation. The forest is also a place for collecting medicinal plants, most often by individual collectors; raw materials collected commercially for the purposes of pharmaceutical and herbal companies are relatively scarce. The current "European Pharmacopoeia 9.0" allows the use of medicinal plant raw materials harvested from plantations as well as from natural sites. However, the raw material obtained in the forest - the least contaminated ecosystem - meets strict health safety as well as organic farming requirements.

This article points to the high potential of the forest environment as a place for obtaining pharmacopoeial medicinal plants. However, there is a need to conduct thorough quality tests, taking into account the content of active substances, primarily in relation to the place/site/region of plants harvesting, to make possible the effective co-operation between the forest owners and the pharmaceutical industry. On the other hand, the collection of selected species of forest medicinal plants, can be considered in recreational and educational categories. It should be underlined however, that only selected species (common, not protected, easy to be recognized, and above all safe to use) may be collected by amateur gatherers. The above arguments may allow the implementation of a new, attractive concept in forest education and recreation: "the forest that heals".

**Key words:** medicinal plants, European Pharmacopoeia, non-wood forest products, forest education, forest recreation

### Introduction

The forest environment is a well-known and valued source of non-wood forest products such as mushrooms and fruits of forest undergrowth (Głowacki 1999). They are used as food, consumed immediately after harvesting, or they are industrially processed. However, relatively less attention is paid to the potential of the forest environment as a source of medicinal plants. The forest is a place where collecting these materials happens most often by individual collecting executives, in informal way and beyond the control of forest management (Staniszewski, Nowacka 2014). Plants are mostly treated as traditional agents (Staniszewski 2016) and used with inspiration of folk medicine, not modern drugs that meet the requirements of contemporary medicine that are getting more and more restrictive every year (Drozd 2012). At the same time forest environment currently considered marginal from the point of view of obtaining medicinal plants for the needs of pharmaceutical processing, which is based on raw materials contracted on plantations (Staniszewski 2010a, Staniszewski 2010b). Whereas, "European Pharmacopoeia 9.0" (Ph.Eur) allows the use of medicinal plant raw materials from both plantation, as well as natural sites, simultaneously clarifying for both groups unified quality requirements (Pharmacopoeia 2017). It is worth noting that the raw material obtained in the forest environment has a significant advantage over the product from plantations: it comes from the cleanest ecosystem available and meets strict health safety requirements, without being contaminated with residues of plant protection products or heavy metals (Staniszewski 2010a, Staniszewski 2016). After assessment of the raw material base and establishing cooperation between the forest administration and the pharmaceutical industry, medicinal raw materials can fill the niche in the offer of herbal companies, as meeting the requirements of organic production. At the same time, the highest quality of forest medicinal resources can become an important promotional element of forest management, addressed to the society. Necessary, however, is conducting educational activities, aimed, on the one hand, to prevent the devastation of resource base, on the other hand - to instruct on possible side effect of herbal drugs. The aim of this study was to evaluate the usefulness of medicinal plants found in Polish forest environment in the context of herbal drugs and herbal drugs preparations listed in the newest "European Pharmacopoeia 9" in both the industrial context and in relation to individual collection and use for collectors own needs.

## Material and methods

Assessment of the suitability of the forest environment as a source of herbal raw materials was based on the binding of 2017 "Polish Pharmacopoeia XI" representing the English version of the "European Pharmacopoeia IX" (Ph. Eur. 9). Classification of species of medicinal plants as occurring in the Polish forest environment was made on the basis of Polakowska (1987) and Szafer and Zarzycki (1977) works. Classification of herbal drugs and herbal drugs preparations to phytochemical groups is based on the Kohlmunzer (2012) classification.

## Results

"European Pharmacopoeia 9" contains 210 herbal drugs and 80 herbal drugs preparations monographs, both native and exotic. They come from 249 named plant species, with as many as 50 herbal drugs and 17 herbal drugs preparations from 59 species of medicinal plants found in Polish forest environment. 15 of the following species of medicinal plants may be found on mid-forest clearings or on the forest edge (Tab. 1).

Tab. 1: Pharmacopoeial medicinal plants occurring in forest environment and on mid-forest clearing or at the edge of the forest

Occurrence	Latin name of the resource and Latin name of plant species according to "European Pharmacopoeia 9"
Forest environment	<p><b>Herbal drugs</b>  <i>Absinthi herba</i> - <b>Artemisia absinthium</b>; <i>Agrimoniae herba</i> - <b>Agrimonia eupatoria</b>; <i>Alchemillae herba</i> - <b>Alchemilla vulgaris</b>; <i>Angelicae archangelicae radix</i> - <b>Archangelica officinalis</b>; <i>Arnicae flos</i> - <b>Arnica montana</b>; <i>Belladonnae folium</i> - <b>Atropa belladonna</b>; <i>Belladonnae pulvis normatus</i> - <b>Atropa belladonna</b>; <i>Betulae folium</i> - <b>Betula pendula</b>, <b>B. pubescens</b>; <i>Bistortiae rhizoma</i> - <b>Polygonum bistorta</b>; <i>Chelidonii herba</i> - <b>Chelidonium maius</b>; <i>Crataegi folium cum florae</i> - <b>Crataegus oxyacantha</b>, <b>C. monogyna</b>, hybrids of <i>C. oxyacantha</i> and <i>C. monogyna</i>, other European hawthorns including <b>C. pentagyna</b>, <b>C. nigra</b>, <b>C. azarolus</b>; <i>Crataegi fructus</i> - <b>Crataegus oxyacantha</b>, <b>C. monogyna</b>, hybrids of <i>C. oxyacantha</i> and <i>C. monogyna</i>; <i>Digitalis purpureae folium</i> - <b>Digitalis purpurea</b>; <i>Equiseti herba</i> - <b>Equisetum arvense</b>; <i>Filipendulae ulmariae herba</i> - <b>Filipendula ulmaria</b>; <i>Frangulae cortex</i> - <b>Frangula alnus</b>; <i>Fraxini folium</i> - <b>Fraxinus excelsior</b>, <b>F. oxyphylla</b>; <i>Hederae folium</i> - <b>Hedera helix</b>; <i>Hippocastani seminis</i> - <b>Aesculus hippocastanum</b>; <i>Hyperici herba</i> - <b>Hypericum perforatum</b>; <i>Juniperis galbulus</i> - <b>Juniperus communis</b>; <i>Lichen islandicus</i> - <b>Cetraria islandica</b>; <i>Lupuli flos</i> - <b>Humulus lupulus</b>; <i>Malvae folium</i> - <b>Malva silvestris</b>, <b>M. neglecta</b> and a mixture thereof; <i>Malvae sylvestris flos</i> - <b>Malva silvestris</b> and its cultivars; <i>Menyanthidis trifoliatae folium</i> - <b>Menyanthes trifoliata</b>; <i>Myrtilli fructus recens</i> - <b>Vaccinium myrtillus</b>; <i>Myrtilli fructus siccus</i> - <b>Vaccinium myrtillus</b>; <i>Ononidis radix</i> - <b>Ononis spinosa</b>; <i>Polygoni avicularis herba</i> - <b>Polygonum aviculare</b>; <i>Primulae radix</i> - <b>Primula veris</b>, <b>P. elatior</b>; <i>Quercus cortex</i> - <b>Quercus robur</b>, <b>Q. petraea</b>, <b>Q. pubescens</b>; <i>Ribis nigri folium</i> - <b>Ribes nigrum</b>; <i>Rosae pseudo-fructus</i> - <b>Rosa canina</b>, <b>R. pendulina</b> and other species of the genus <b>Rosa</b>; <i>Salicis cortex</i> - <b>Salix purpurea</b>, <b>S. daphnoides</b>, <b>S. fragilis</b> and other species of the genus <b>Salix</b>; <i>Sambuci flos</i> - <b>Sambucus nigra</b>; <i>Sanguisorbae radix</i> - <b>Sanguisorba officinalis</b>; <i>Serpylli herba</i> - <b>Thymus serpyllum</b>; <i>Solidaginis herba</i> - <b>Solidago gigantea</b>, <b>S. Canadensis</b>, hybrids of <i>S. gigantea</i> and <i>S. Canadensis</i>, a mixture thereof; <i>Solidaginis virgaureae herba</i> - <b>Solidago virga-aurea</b>; <i>Taraxaci officinalis herba cum radice</i> - <b>Taraxacum officinale</b>; <i>Taraxaci officinalis radix</i> - <b>Taraxacum officinale</b>; <i>Tiliae flos</i> - <b>Tilia cordata</b>, <b>T. platyphyllos</b>, <b>T. x vulgaris</b>; <i>Tormentillae rhizoma</i> - <b>Potentilla tormentilla</b>; <i>Urticae folium</i> - <b>Urtica dioica</b>, <b>U. urens</b> and a mixture thereof; <i>Urticae radix</i> - <b>Urtica dioica</b>, <b>U. urens</b> and a mixture thereof; <i>Uvae ursi folium</i> - <b>Arctostaphylos uva-ursi</b>; <i>Valerianae radix</i> - <b>Valeriana officinalis</b>; <i>Valerianae radix minutata</i> - <b>Valeriana officinalis</b>; <i>Violae herba cum flore</i> - <b>Viola tricolor</b>, <b>V. arvensis</b>.</p> <p><b>Herbal drugs preparation</b>  <i>Belladonnae folii extractum siccum normatum</i> - <b>Atropa belladonna</b>; <i>Belladonnae folii tinctura normata</i> - <b>Atropa belladonna</b>; <i>Colophonium</i> - <b>Pinus</b> sp., in Poland: <b>P. cembra</b>, <b>P. mugo</b>, <b>P. x rotundata</b>, <b>P. x rhaetica</b>, <b>P. sylvestris</b>; <i>Crataegi folii cum florae extractum quantificatum</i> - <b>Crataegus oxyacantha</b>, <b>C. monogyna</b>, hybrids of <i>C. oxyacantha</i> and <i>C. monogyna</i>, other European hawthorns including <b>C. pentagyna</b>, <b>C. nigra</b>, <b>C. azarolus</b>; <i>Crataegi folii cum florae extractum siccum</i> - <b>Crataegus oxyacantha</b>, <b>C. monogyna</b>, hybrids of <i>C. oxyacantha</i> and <i>C. monogyna</i>, other European hawthorns including <b>C. pentagyna</b>, <b>C. nigra</b>, <b>C. azarolus</b>; <i>Frangulae corticis extractum siccum normatum</i> - <b>Frangula alnus</b>; <i>Hippocastani seminis extractum siccum normatum</i> - <b>Aesculus hippocastanum</b>; <i>Hyperici herbae extractum siccum quantificatum</i> -</p>

	<p><i>Hypericum perforatum</i>; <i>Juniperi aetheroleum</i> - <b>Juniperus communis</b>; <i>Myrtilli fructus recentis extractum siccum raffinatum et normatum</i> - <b>Vaccinium myrtillus</b>; <i>Pini pumilionis aetheroleum</i> - <b>Pinus mugo</b>; <i>Pini sylvestris aetheroleum</i> - <b>Pinus silvestris</b>; <i>Salicis corticis extractum siccum</i> - <b>Salix purpurea</b>, <b>S. daphnoides</b>, <b>S. fragilis</b> and other species of the genus <i>Salix</i>; <i>Tormentillae tinctura</i> - <b>Potentilla tormentilla</b>; <i>Valerianae extractum aquosum siccum</i> - <b>Valeriana officinalis</b>; <i>Valerianae extractum hydroalcoholicum siccum</i> - <b>Valeriana officinalis</b>; <i>Valerianae tinctura</i> - <b>Valeriana officinalis</b></p>
Mid-forest clearing or forest edge	<p><b>Herbal drugs</b>  <i>Graminis rhizoma</i> - <b>Agropyron repens</b>; <i>Leonuri cardiaca herba</i> - <b>Leonurus cardiaca</b>; <i>Lythri herba</i> - <b>Lythrum salicaria</b>; <i>Marrubii herba</i> - <b>Marrubium vulgare</b>; <i>Matricariae flos</i> - <b>Matricaria chamomilla</b>; <i>Meliloti herba</i> - <b>Melilotus officinalis</b>; <i>Papaveris rhoeados flos</i> - <b>Papaver rhoeas</b>; <i>Plantaginis lanceolatae folium</i> - <b>Plantago lanceolata</b>; <i>Stramonii folium</i> - <b>Datura stramonium</b> and its cultivars; <i>Stramonii pulvis normatus</i> - <b>Datura stramonium</b> and its cultivars; <i>Trigonellae foenugraeci semen</i> - <b>Trigonella foenum-graecum</b>; <i>Verbasci flos</i> - <b>Verbascum phlomoides</b>, <b>V. thapsus</b>, <b>V. densiflorum</b></p> <p><b>Herbal drugs preparation</b>  <i>Matricariae aetheroleum</i> - <b>Matricaria chamomilla</b>; <i>Matricariae extractum fluidum</i> - <b>Matricaria chamomilla</b>; <i>Menthae arvensis aetheroleum partim mentolum depletum</i> - <b>Mentha arvensis var. piperascens</b>, <b>M. canadensis</b></p>

Explanation: *aetheroleum* – essential oils; *aquosum* – aqueous; *cortex* – bark; *extractum* – extract; *flos* – flower; *folium* – leaf; *fluidum* – liquid; *folium cum florae* – leaf and flower; *herba cum florae* – flowering aerial parts; *herba cum radice* – herb with root; *fructus*, *pseudofructus* – fruit; *galbulus* – juniper berry; *herba* – flowering aerial parts; *hydroalcoholicum* – hydroalcoholic; *minutata* – cut; *normatus*, *normata* – standardised; *partim mentolum depletum* – partly dementholised; *pulvis* – powder; *quantificatum* – quantified; *radix* – root; *raffinatum* – refined; *recens* – fresh; *rhizoma* – rhizome; *seminis* – seed; *siccum* – dry; *tinctura* – tincture.

Herbal drugs and herbal drugs preparations derived from forest species, such as those occurring on mid-forest clearings or at the edge of the forest, belong to all the most important phytochemical groups. The most numerous are flavonoids (16), essential oils (15) and tannins (12). Among the herbal drugs and herbal drugs preparations described by the monographs of "European Pharmacopoeia 9" there are also eight plants containing alkaloids and one plant containing cardenolide glycosides.

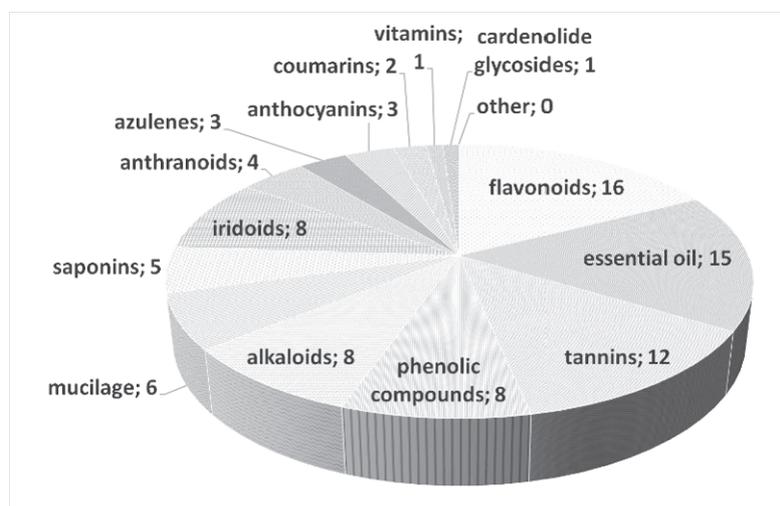


Fig. 1: Assignment of pharmacopoeial herbal drugs and herbal drugs preparations from Polish forest areas (including the mid-forest clearings and the edge of the forest) to the groups of phytochemicals

## Discussion

The quoted data indicate a very large potential of the forest environment as a place of occurrence of pharmacopoeial medicinal plants. There are as many as 74 species of medicinal plants in Polish forests, which are the source of 62 herbal drugs and 20 herbal drugs preparation listed by the latest "European Pharmacopoeia 9". It is worth noting that these herbal drugs and herbal drugs preparation constitute a permanent assortment of leading Polish and European herbal companies, however, using

materials from plantations of medicinal plants. There is therefore a very promising platform for cooperation between forest management and the pharmaceutical industry (Staniszewski 2010a). Following the promotion of the forest environment as a source of medicinal plants, however, there should be two-way educational activities, carried out by both foresters and pharmacists. Almost from the beginning of the mass exploitation of wild medicinal plants for the needs of the herbal industry Polish pharmacists draws attention to the need to protect them (Bilek 2009). In the context of the possibilities of cooperation between the pharmaceutical industry and forest management pointed above, this postulate is of special significance. 10 medicinal plants listed by the "European Pharmacopoeia 9" in Poland is subject to protection under the "Regulation of the Minister of the Environment of 9 October 2014 on the protection of plant species" (Regulation... 2014). Three species are subject to strict protection, six partial and one partial protection with the limited possibility of obtaining (Tab. 2). For this reason, the collection of medicinal plants in the forest environment should be carried out only by competent, trained and authorized persons.

Tab. 2: Species protection of medicinal plants included in the "European Pharmacopoeia IX" occurring in the Polish forest environment (Regulation... 2014)

Protection form	Latin name of the resource and latin name of plant species according to "European Pharmacopoeia 9"
Strict	<i>Arnicae flos</i> - <b><i>Arnica montana</i></b> ; <i>Colophonium</i> - <b><i>Pinus x rhaetica</i></b> ; <i>Uvae ursi folium</i> - <b><i>Arctostaphylos uva-ursi</i></b>
Partial	<i>Angelicae archangelicae radix</i> - <b><i>Archangelica officinalis</i></b> ; <i>Belladonnae folium</i> , <i>Belladonnae folii extractum siccum normatum</i> , <i>Belladonnae folii tinctura normata</i> ; <i>Belladonnae pulvis normatus</i> – <b><i>Atropa belladonna</i></b> ; <i>Colophonium</i> - <b><i>Pinus cembra</i></b> , <b><i>Pinus mugo</i></b> ; <i>Ononidis radix</i> - <b><i>Ononis spinosa</i></b> ; <i>Primulae radix</i> - <b><i>Primula elatior</i></b>
Partial with the limited possibility of obtaining	<i>Menyanthidis trifoliatae folium</i> - <i>Menyanthes trifoliata</i>

Explanation: see Tab. 1

Forest medicinal plants may be of interest not only to the pharmaceutical industry, but also to all forest visitors, who are mainly people without medical and pharmaceutical education whatsoever. Meanwhile, among the above mentioned medicinal plants (Tab. 1.) there are plants belonging to the groups of phytochemicals cardiac glycosides and alkaloids, thus directly threatening the health and human life. A number of other raw materials, for example containing anthranoids or coumarins, have serious side effects. Essential oils, iridoids and saponins, in turn, have many contraindications for use (Strzelecka and Kowalski 2000). For this reason, in promotional activities, should be disseminated information only about forest plants causing no threat and without contraindications to the use. Among the herbal drugs listed by the "European Pharmacopoeia 9" particularly two seem to be worth the attention and popularization. A wild rose fruit (*Rosae pseudo-fructus*), originating from species *Rosa canina*, *Rosa pendulina* and other species of the genus *Rosa*, is a valuable vitamin source, a source of vitamin C in a record amount of up to 6% of the mass of the raw material. This material is collected when the fruit is red, but still firm and dried in a single layer at a temperature not exceeding 35°C. According to the recommendation of "European Pharmacopoeia 9", the raw material must be free of achenes (Pharmacopoeia 2017). It can be used to prepare nutritively valuable infusions, which is a source of vitamin C, but also carotenoids, organic acids and sugars (Strzelecka and Kowalski 2000). Another herbal drugs, which can be popularized among the guests of the forest, is an anthocyanins raw material - fresh fruit of bilberries *Vaccinium myrtillus* (*Myrtilla fructus recens*). It is mostly consumed raw and like all other anthocyanin resources applied, it may be used in the prevention of cardiovascular diseases and tumors. Thanks to high antioxidant potential and consequently the capacity to free radical scavenging, it prevents inter alia damage to the walls of blood vessels and initiation of carcinogenesis (Strzelecka i Kowalski 2000, Szajdek i Borowska 2004, Wawrzyniak and others 2011, Zalega and Szostak-Węgierek 2013).

## Conclusion

The desire to spend free time in the forest is largely due to the availability of mushrooms, fruit and other useful plants. However, knowledge of the importance and proper use of these goods is not satisfactory. The foresters' education on non-wood forest products use, therefore, is met with great public interest (Staniszewski et al. 2016a, 2016b). Popularization of the collection of medicinal plants

in the forest environment, both for the needs of the pharmaceutical industry and forest visitors, will allow the implementation of a new and very attractive concept in forest education of society: "the forest that heals", which is a place to obtain valuable medicinal plants that bring relief in suffering human. However, it should be emphasized that the list of plants that can be recommended for self-collection and use should be very limited. In practice, this applies to herbal raw materials with safe prophylactic and not strictly healing effects. The key issue is the safety of amateur users, whose knowledge about the possible side effects of plant drugs, resulting from the multitude of active substances presented in them, may be insufficient. Of course, this does not exclude education in the field of plants that are or may be used by the pharmaceutical industry - but highlighting the risks associated with their improper use.

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## Souhrn

Lesní prostředí je významným zdrojem nedřevních lesních produktů, jako jsou houby a plody lesního podrostu. Relativně menší pozornost je však věnována potenciálu lesního prostředí jako zdroje léčivých rostlin. Lesní prostředí, které je v současné době považováno za okrajové z hlediska získávání léčivých rostlin pro potřeby farmaceutického zpracování, které je založeno na surovinách smlouvaných na plantážích vzhledem k tomu, že „Evropský lékopis 9.0“ (Ph.Eur) umožňuje použití surovin pro léčivé rostliny a to jak z plantáží, tak z přírodních lokalit, přičemž se současně u obou skupin vyjasní jednotné požadavky na kvalitu. Surovina získaná v lesním prostředí má oproti produktu z plantáží významnou výhodu: pochází z nejčistšího dostupného ekosystému a splňuje přísné požadavky na ochranu zdraví, aniž by byla kontaminována zbytky přípravků na ochranu rostlin nebo těžkými kovy. Vysoká kvalita lesních léčivých zdrojů se může stát důležitým propagačním prvkem lesního hospodářství, adresovaným společnosti. Nutné je však provádění vzdělávacích aktivit, zaměřených na jedné straně na prevenci devastace zdrojové základny na straně druhé - poučení o možných vedlejších účincích bylinných léčiv. Cílem této studie bylo zhodnotit užitečnost léčivých rostlin nalezených v polském lesním prostředí v kontextu rostlinných léčiv a přípravků rostlinných léčiv uvedených v nejnovějším „European Pharmacopoeia 9“ v průmyslovém kontextu i ve vztahu k

individuálnímu sběru a použití. pro vlastníky sběratelů. "European Pharmacopoeia 9" obsahuje 210 bylinných léčiv a 80 bylinných léků, monografií, nativních i exotických. Pocházejí z 249 pojmenovaných rostlinných druhů, s 50 rostlinnými léky a 17 rostlinnými přípravky z 59 druhů léčivých rostlin v polském lesním prostředí. Na středním lesním paseku nebo na okraji lesa lze nalézt 15 druhů léčivých rostlin. Lesní ekosystémy mají velký potenciál jako místo výskytu lékopisných léčivých rostlin. V polských lesích je až 74 druhů léčivých rostlin, které jsou zdrojem 62 bylinných léčiv a 20 přípravků léčivých přípravků uvedených v posledním „European Pharmacopoeia 9“. Lesní léčivé rostliny mohou být zajímavé nejen pro farmaceutický průmysl, ale i pro všechny návštěvníky lesů, kteří jsou především lidé bez lékařského a farmaceutického vzdělání. Z tohoto důvodu by se v propagačních činnostech měly šířit informace pouze o lesních rostlinách, které nevyvolávají žádné ohrožení a bez kontraindikace užívání. Mezi bylinnými léky uvedenými v „Evropském lékopisu 9“ se obzvláště hodí pozornost a popularizace: divoké růže ovoce (*Rosae pseudo-fructus*), převážně z psí růže (*Rosa canina*) a bilberry - *Vaccinium myrtillus* (*Myrtilla*) fructus recens). To samozřejmě nevyklučuje vzdělávání v oblasti rostlin, které jsou nebo mohou být používány farmaceutickým průmyslem - ale zdůrazňují rizika spojená s jejich nesprávným použitím. Popularizace sbírky léčivých rostlin v lesním prostředí umožní zavedení nového a velmi atraktivního konceptu v lesním vzdělávání společnosti: „les, který se léčí“.

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## THE HISTORICAL DEVELOPMENT OF RURAL ROADS IN THE BASILICATA REGION, SOUTHERN ITALY

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### Abstract

The rural road network is an inseparable part of the landscape and a fundamental mean for agricultural and forest management. The aim of this study was to analyze the historical development of the rural road network in relation to its density and distribution. The evaluation of the rural road network development includes an assessment of whether and how the road layout changed in time. For this study, a part of the hydrographic basin of the Bradano River (Basilicata region, Southern Italy) was selected. The basin map was created in ArcGIS environment the single map layers from the years 1829, 1875, 1955 and 2013 were imported. Vector layers of rural road network and basin boundaries were created in each of the maps for the rural road network density calculation, defined by the ratio of the length of hauling roads (in meters) to the basin area (in hectares). For the calculation of its distribution in the study area, the methodology commonly used for forest road network evaluation - based on average geometrical skidding distance and theoretical skidding distance - was applied. The analysis shows that the roads were constructed gradually, with an abrupt increase after the Second World War.

**Key words:** rural road network, historical cartography, Geographic Information System, rural landscape

### Introduction

The analysis of rural land modifications, as well as the wider environment and landscape context in which they take place, is important in order to understand the dynamics connected with human intervention and natural events (Statuto et al., 2017). The current state of the landscape and the road network are based on traditional land use, which was applied over the decades. The technology development and GIS environment are the key tools for multi-temporal and multidisciplinary analyses of landscape. One aspect that can be analyzed is, for example, terrain accessibility in a forest or poly-functions of the forest stands (Hrůza and Vyskot, 2010). As well as in many rural landscapes, this is an essential component for a quality forestry and agricultural management. This article deals with the quality and distribution of rural and forest roads in the area of the "Forenza" Municipality. The identification of best management strategies could be based on the evaluation of wide time landscape modifications (Statuto et al., 2018). Also for this reason, historical maps can be used for land cover and settlement pattern analysis (Pindoizzi et al., 2016; Olišarová et al., 2018). In this article, historical maps from 1829 to 2013 were analysed.

### Materials and methods

#### *Study area*

The study area (Fig. 1) covers one part (about 18 km<sup>2</sup>) of the Municipality of "Forenza" (Basilicata region – Southern Italy).

The altitude of the study area ranges from 450 to 920 m a.s.l.; the population density is 17.4 inhabitants per square kilometre. The soil structure has characterized the various orography of this area, which is influenced also by the socio-economic activities, mostly based on agriculture (Statuto et al., 2016). Major dominant of the forest represents oak wood, while there are some allochthonous conifer species into an artificially afforested area. There are several watersheds, which flow into the "Bradano" River.

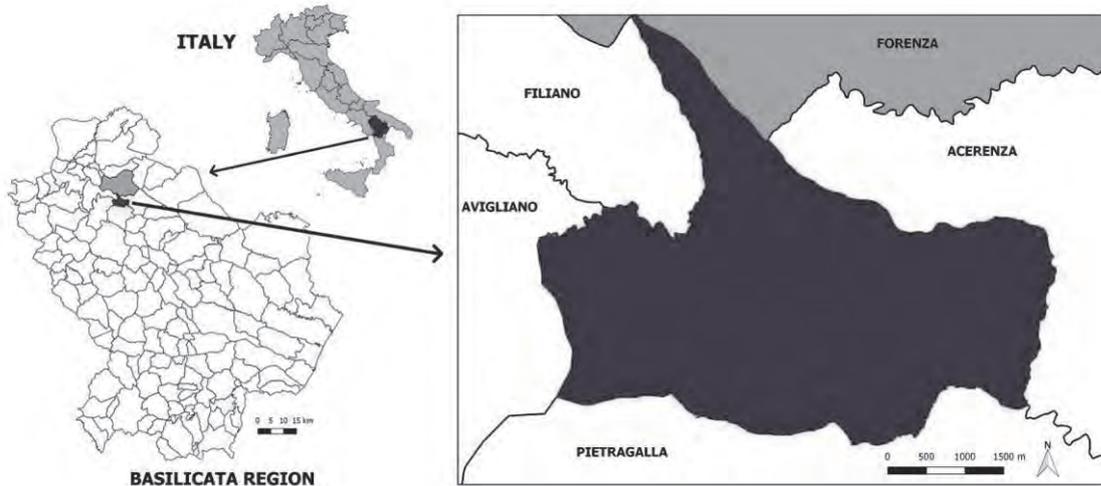


Fig. 1: Location of the study area (40° 47' 57" N, 15° 51' 39" E – WGS84)

### Cartography

Changes in road distribution through the years were analysed in four different historical maps (1829, 1876, 1955 and 2013). The map of 1829 was produced by legal experts after border disputes to solve division of ownership between municipalities private owners. The scale of this map is 1:30 000. On the contrary, other map corresponds to scale 1:50 000 (1876) and it was produced by the Italian Topographic Military Institute after national unification. For land use of 1955, two aerial photograms were taken by the Italian Aeronautics Group, on behalf of the Italian Geographic Military Institute (IGMI) and the USA Army Map Service, were used. A scale of this photos is 1:33 000. For the year 2013 (1:50 000), orthophotos in GeoTIFF format from the open geo-database of the Basilicata Region were used. Each map has been elaborated separately and with different techniques to obtain information on land use and road networks (Statuto et al. 2018).

### Rural road network evaluation

Road network was evaluated by Beneš methodology presented in 1986 (Beneš, 1986). The method was originally developed for forest haul road network evaluation. The practical application consists in the road network optimization in the various morphologic areas (flatlands, uplands and mountains). We used a part of this methodology focused on the road distribution in the access area expressed by its efficiency  $U$ . Other criterion for the road network evaluation is *the road density*. It is often considered as the main criterion to evaluate access standard. The road density  $H$  is given by equation:

$$H = \frac{D}{S} \text{ [m} \cdot \text{ha}^{-1}\text{]}$$

where  $D$  is the total road network length (in meters), and  $S$  is the accessed area (in hectares). Anyway, since this parameter does not provide for any information on the road network distribution, some additional parameters have been implemented.

The method deals with various types of skidding distances representing the traces of timber transport from the stand of harvesting to the haul road. Stands of harvesting are represented by 10 ha net area, and in the each stand they are marked in the centre of 10 ha square stand by the cross (Fig. 2).

We used the average geometric skidding distance  $x D_g$  and the theoretical skidding distance  $D_t$  due to calculation of the road distribution in the accessed area. The theoretical skidding distance  $D_t$  is an average skidding distance due to the optimal distribution of roads in the accessed area; it depends on the road density  $H$ .

The geometric skidding distance  $D_g$  represents the direct distance from the point of harvesting to the haul road. The average value of  $D_g$  depends on the road distribution and generally is higher than the theoretical skidding distance. The geometric skidding distances from grid points to roads were performed in QGIS software by vector analysis tool *Distance to nearest hub*.

Efficiency  $U$ :

$$U = \frac{D_t}{D_g} \cdot 100 \text{ [%]}$$

Average geometric skidding distance  $x D_g$

$$\overline{D_g} = \frac{D_{g1} + D_{g2} + \dots + D_{gn}}{n} \text{ [m]}$$

Theoretical skidding distance  $D_t$ :

$$D_t = \frac{10000}{4H} \text{ [m]}$$

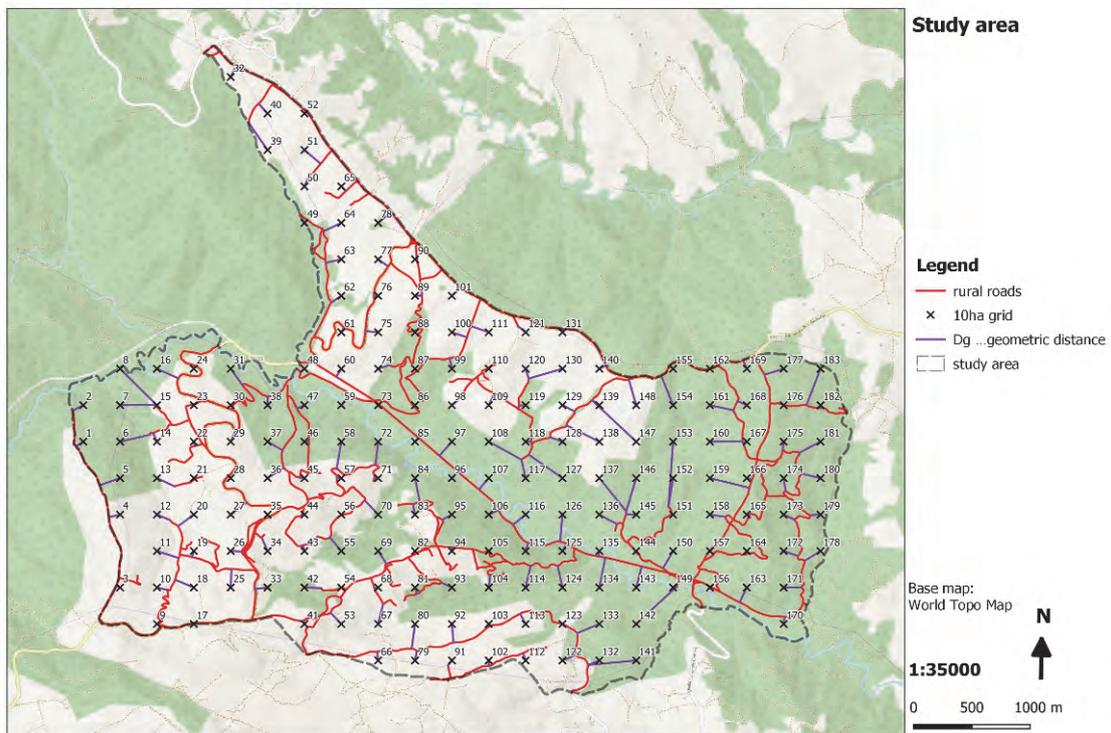


Fig. 2: An example of average geometric distance calculation of 2013 forest road network

## Results and Discussion

In Table 1 some basic characteristics found from map data in different time periods are reported.

Tab. 1: Basic characteristics of the study area

Year	Length [m]	Area [ha]	Density [m/ha]	Efficiency [%]
1829	22744	1826,73	12	49
1876	28162	1826,73	15	44
1955	63451	1826,73	35	57
2013	69213	1826,73	38	55

The density of the forest road network was 12 m/ha in 1829; it has grown to 15 m/ha in 1876. Only in the second half of the 19th century, forest roads gained in significance. After the Second World War, the density increased to 35 m/ha in 1955. Then the rural road network density has stagnated (38 m/ha in 2013). Surprisingly, the road network distribution has not changed much in time, fluctuating within a range between 43 and 57%. These are realistic values commonly achieved in practice, which means that the rural roads were constructed throughout the entire study area during time.

Not all of the original roads detected in the year 1829 are present today. From a comparison of the rural road network in the year 1876 and in 2013 (Fig. 3), it is possible to notice that most of the roads present in the past are even present in 2013, and an expansion of the same occurred especially in the areas that were previously inaccessible.

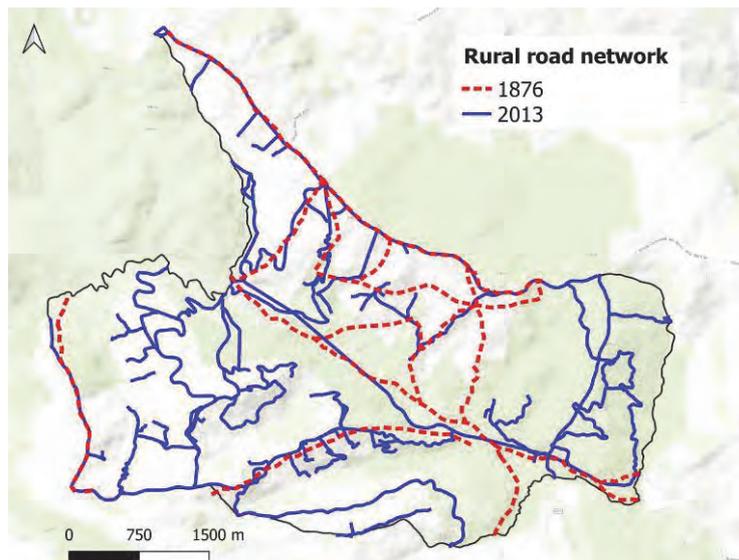


Fig. 3: Comparison of the rural roads in the year 1876 and in 2013

### Conclusion

The original use of the forest road network assessment method was generally verified on rural roads in the landscape, to assess the development of its accessibility. The results show that the expansion of road construction occurred after World War II and the situation was stable in other periods. The actual road density is reasonably high, but the efficiency reaches just 55%. The value indicates the distribution of rural roads in study area would be improved, so as to develop the fundamental function to proactively support agricultural and forest management, while contributing to a sustainable evolution and environmental protection of the rural landscape.

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### Souhrn

Účelové komunikace jsou nedílnou součástí krajiny a základní prvek pro zemědělské a lesní hospodářství. Cílem této studie bylo analyzovat historický vývoj zpřístupnění krajiny z hlediska hustoty

a rozložení cestní sítě v čase. Jako zájmové území byla vybrána část povodí řeky Bradano v oblasti Basilicata jižní Itálie. Mapové podklady území byly vytvořeny v prostředí programu ArcGIS a jednotlivé mapy pochází z roků 1829, 1875, 1955 a 2013. Následně byly z mapových podkladů vytvořeny vektorové vrstvy cestní sítě daného období.

Vektorové vrstvy byly použity pro výpočet hustoty sítě účelových komunikací, která je definovaná jako poměr celkové délky cest v m k ploše území v ha. Výpočet míry rozložení cestní sítě v řešeném území byl proveden pomocí metody běžně používané pro hodnocení lesní cestní sítě, založené na průměrné geometrické přibližovací vzdálenosti a teoretické přibližovací vzdálenosti. Analýza zkoumaného území prokázala, že účelové komunikace byly v rámci řešeného období budovány postupně, avšak s prudkým nárůstem výstavby po druhé světové válce. V roce 1829 byla hustota cestní sítě 12 m/ha a v roce 1876 15 m/ha. V druhé polovině 20. století účelové komunikace nabyly na významu. Po druhé světové válce hustota dosáhla hodnoty 35 m/ha v roce 1955. Poté hustota sítě komunikací stagnovala (38 m/ha v roce 2013).

Kupodivu účinnost zpřístupnění vyjadřující míru rovnoměrného rozložení cestní sítě se během času příliš neměnila a dosahovala hodnot 49%, 43%, 57% a 55%. Jedná se o reálné hodnoty běžně dosahované v praxi, z čehož vyplývá, že síť účelových komunikací byla postupně budována rovnoměrně v celém řešeném území. Všechny historické cesty z roku 1829 nebyly zachovány; rozložení cest vybudovaných před druhou světovou válkou se příliš neměnilo; po roce 1955 byla cestní síť pouze rozšířena v oblastech, které byly dříve nepřístupné.

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## THE ISSUE OF MARKING TOURIST TRAILS IN CONNECTION WITH THE LEGAL RESPONSIBILITY OF THE LAND OWNER

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### **Abstract**

The Czech legal order stipulates the right of free passage through the landscape as well as everybody's right to enter a forest and move within it freely. This fact contributes to the development of hiking, which is very widespread in the Czech Republic. The Czech Tourist Club is responsible for the creation of new trails as well as the maintenance and repairs of the existing ones. Because these trails often lead over lands owned by various entities, it is necessary to clarify the issue of responsibility for damage that could potentially arise on them.

**Key words:** free passage through the landscape, responsibility for damage, tourist trails

### **The Subject Matter**

The Czech legal order stipulates everybody's right to enter a forest and move within its bounds freely. This right can be referred to as a 'public use of the forest'. The regulation of this right is not simple, it is dealt with in several regulations, each of them using their own way but with common features (Procházková, Hrůza, Kliková 2018). The public use can be defined as the use of generally accessible material goods relevant to their intended use by an undefined group of users (Mácha 2015). The public use of the forest is stipulated e.g. in §19 of Act No. 289/1995 Coll., on forests, as amended, which establishes everybody's right to access a forest at their own risk. This right is also enshrined in Act No. 114/1992 Coll., on nature and landscape protection, as amended, § 63, which regulates the right of access to the countryside generally (Procházková, Hrůza, Kliková 2018). This provision guarantees everybody's right to freely pass through lands owned by municipalities, the state or legal entities provided that this will not cause damage to the property or health or breaching of the protection of person and neighbourly rights. This provision also determines the exceptions when the free passage is restricted. By contrast, the right of free passage does not apply to lands in private property of natural persons provided that they are not leased to the state, a municipality or a legal entity. It means this regulation also guarantees a free access to the landscape. However, it only includes the right to enter the lands and pass through them. Other legitimate interests of the owners or lessors must be respected as well as other generally valid regulations. As mentioned above, the passage is restricted in some properties in compliance with § 63, section 3 of Act No. 114/1992 Coll., as amended.

With an increasing concentration of urban populations, the rate of exploitation of these rights rises. The movement of the public in the forest environment is further regulated by Act No. 289/1995 Coll., on forests, as amended, which in the context of the public use of the forest stipulates various rights, but also the obligation not to damage the forest or disturb the forest environment and the obligation to obey the forest owner's or lessor's or their employees' instructions. This provision restricts the rights of the owners, who must tolerate this fact. However, §20 of the Act also provides an exhaustive list of the activities that are prohibited in the forest. If the forest user performs them, they bear full responsibility in the event of any damage or injury. The provision directs many of the activities to forest roads. If these actions take place outside the roads, they are illegal and the person performing them bears full responsibility for any damage or injury. As the forest users do everything at their own risk, damage can only be compensated in the case that it was a consequence of the violation of forest owner's obligations as opposed to force majeure, i.e., events that cannot be controlled by this person.

Although the entrance to the forest is at a user's own risk, the private law in the form of the Civil Code (Act No. 89/2010 Coll., as amended) applies here too. Provision §2900 stipulates a general prevention obligation. This requires that everyone acts so as to avoid injury to the life, health or damage to property. For owners or operators of forests this means they have to prevent damage by keeping the forest and the forest road network in a good condition. However, it is always necessary to individually examine what can be expected, which dangers can be predicted and the extent to which the danger could be prevented (§2910 stipulating that everyone is responsible for the damage caused by the violation of their legal obligations). Accordingly, a potential compensation for the damage will be governed by the Civil Code, §2958, taking into account the degree of fault on both sides. If this

obligation is breached by the owner, they bear the responsibility for the damage. The new Civil Code contains the notification obligation, which was taken over from the commercial code in a modified form. If an obligation is going to be breached or the person knows that an obligation will be breached (or if the person is responsible to know about the potential breach), they need to notify those in danger of damage or injury, without undue delay. It follows that if forest owners appropriately notify the users about a potential danger within their lands, the damaged lose any rights to compensation for injury or damage that could be prevented thanks to the notification (Procházková et al. 2018). The responsibility can be disengaged from based on §63, section 5, of the amendment of act on nature and landscape protection, if the damage is caused by natural forces or self-infliction.

Forest roads can be generally in compliance with the forest act – without exceptions granted by the owner – used exclusively for walking, cycling, riding, skiing or sledding.

A forest road is a publicly accessible road if it meets the following: a permanent road is apparent in the terrain, its progress does not change, its purpose is access to estates, and there is at least a tacit consent of the road owner and the access is necessary. However, the condition of apparent character is not used if the users cannot use the road as a result of the owner's illegal activity, especially the placement of fixed obstacles, and a consequent invisibility of the road. A road becomes public when it is dedicated to the general use (a provision allowing a relatively unrestricted group of people to use it) or if it is so "from time immemorial". This term is used for a general use of a road in the case the owner's will to ensure public accessibility of the road can be hardly proven. The consent with the use of a road then follows from its very existence and its use so far. Additional criteria have risen from the decisional practice of the courts. One of them is the consent of the road owner with its use by the public. It does not matter if the owner granted the consent expressly or tacitly, i.e. by other than oral or written expression, which however, raises no doubt as to what their will is. An important aspect is also the binding character of such consent for the legal successors. It must be noted that the legal succession applies even when the ownership is transferred from a public entity to a private person. The acquirer cannot disengage from this obligation even if they did not know about it. It is their responsibility to find out the legal and de facto status of the property, or the original owner should inform the acquirer of all facts accompanying the property transferred. In practice, this means that if the previous owner agreed with the public use of the road, their successor accepts this without the possibility to disengage from this obligation. This avoids land transfers with the purpose of being released from the obligation to tolerate this use as well as the situations when the owners of connected properties cannot use the road.

The need of access, as another specific feature, is valid when there is no other adequate way to ensure communication between properties than this kind of ownership rights restriction. If this exists, it has to be given precedence. An alternative way exists even if the property is not linked directly to a road, but there is public space between them, which is also a subject of public use.

Forest roads are also frequently used by the Czech Tourist Club (CTC), which was established in 1888, and currently associates almost 40 000 members from all over the Czech Republic (KČT 2019). One of the Club's activities, existing since its establishment, is marking the tourist trails. Valuable roads and paths in the terrain are selected and marked by standardised symbols and other information elements. Standard ČSN 01 8025 specifies the rules for tourist marking and defines it as the tourist information system providing information for the movement along specified trails in the terrain and the territory of territorial units, usually in periods without snow cover. This marking is also used in specially protected parts of the countryside. When marking the tourist trails, the CTC cooperates with the Ministry of Environment of the Czech Republic and the administrative bodies of specially protected territories. The activities of the CTC are funded by the Ministry of Regional Development of the Czech Republic. However, tourist marking is of international significance. The trails are linked to the trails of the neighbouring countries. For example, cooperation with Poland was established in 1959. Recently, the Agreement has been concluded between the Government of the Czech Republic and the Government of Germany on border traffic on tourist trails and in tourist zones and on crossing of borders in special cases, No. 237/1994 Coll.

Marking tourist trails interferes with the property rights of owners of the lands through which the planned trails lead. The people marking the trails enter the properties in order to mark new trails, which brings an increased number of users/visitors to the owners' property. The increased use is closely related to the need for maintenance, checking and security in the place.

When the CTC plans tourist trails, they find the owners of all the lands affected. They contact them – individuals as well as competent local authorities if the lands are in the property of municipalities, state, etc. – in order to obtain a written consent with the placement of a new trail or a restoration of an old one. According to the chairperson of one local CTC organization, refusal is not frequent. If they are refused, they try to negotiate with the owner or they find a different direction of the trail. In practice, it

could occur that a marked trail could have to be cancelled. Due to the fact that there is no legal regulation of the creation and subsequent marking of tourist trails, it is necessary to approach the issue based on general legislation relating to public use of lands and the civil code in relation to the responsibility of the individual stakeholders.

The hot issue is primarily the responsibility for any potential damage or injury. The act that governed the responsibilities on marked trails has been cancelled. According to the CTC, the movement along the marked tourist trails is at the users' risk. However, they admit responsibility when events (marches etc.) are held that are approved by the competent authority of the Club. In these cases, they choose specific trails for specific events and are responsible for their appropriate progress. For example, they ensure that mining activities are not performed in the vicinity of the trail on the day of the event, or that the trail avoids territories with a valid prohibition to enter the forest.

Due to the provision of public forest use, the entry and use of these places should be subject to use at the users' own risk. But even in this case, the prevention obligation must be taken into account. As has been said, the prevention obligation requires everybody to prevent damage or injury. Therefore, forest owners have an obligation to avoid possible damage or injury that could occur to users of their lands. To be able to meet this obligation to an adequate degree, they need to know the places with an increased public movement and pay more attention to their maintenance. With respect to this general obligation, the Czech Tourist Club should discuss the land owners' economic plans and the regime of the lands. The potential agreement on the placement and route of the tourist trail should provide attractive tourist environment for the CTC as well as possible maintenance for the owners.

However, there is also the responsibility towards the Czech Tourist Club as the owner of the tourist information system. It is necessary to take into account not only the general responsibility, but also the responsibility for damages caused by operations.

The CTC follows the valid legislation when creating and renovating the trails. For this purpose, the people marking the trails need to use the CTC Binding Methodology of Marking. The placement of all information elements is governed by Act No. 183/2006 Coll., on territorial planning and building code, as amended. According to §79, section 2 of the building code, and §103, section a, information and advertising equipment up to a total area of 0.6 square meters placed outside protective zones of roads does not require any permissions. When placing these elements, as well as when establishing or changing tourist trails, the Club respects protective and similar zones. Other provisions of the building code are used for other information elements, based on their character, which determine the form of a potential permission, i.e. whether it is necessary to obtain the territorial consent, a planning decision, a building permit or a notification. The Club's methodology also suggests that its representatives always deal with the land owners, as they demonstrate their right to place the information elements in the case of the above mentioned procedures.

It is worth mentioning that there have been some legislative efforts to include the issue of tourist trails and their marking in the legal order of the Czech Republic (PČR 2016). A group of representatives (Mihola et al. 2016) presented a draft of act on marked tourist trails to the House of Parliament on 5 December 2016. The Government gave a negative opinion on the draft on 20 December 2016, and further discussions of the draft were discontinued. The draft suggested tourist trails can be established so that the environment and the rights and legally protected interests of legal entities and natural persons are not disturbed. It also proposed that the placement of the elements of the tourist information system is not subject to civil legislation. In relation to the responsibility for the use of tourist trails, the draft transmitted it to individual users. *"Everybody is entitled to use marked tourist trails in accordance with their purpose to carry out tourist, hiking and recreational activities at their own risk."* *"Owners of lands are not liable for damage to property, health or life inflicted on the users of marked tourist trails by natural forces and processes, especially landslides, falling rocks, falling trees or their parts and avalanches, or by their own fault".*

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### **Souhrn**

Klub českých turistů při zřizování tras vždy jedná s vlastníky dotčených pozemků o jejich vedení a o umístění prvků turistického značení. Tyto trasy jsou primárně navrhovány esteticky či jinak hodnotnou krajinou bez ohledu na vlastnická práva k pozemkům. Tato zamýšlená trasa je následně s vlastníky konzultována. Pokud nedojde k dohodě, vedení svých tras překládá. Jelikož v současné době neexistuje žádný speciální zákon, který by činnost klubu a vztahy z něj vzniklé upravoval, řídí se značkaři KČT svojí metodikou, která je založena na platné legislativě. Zohledňuje všechny právní předpisy, které se dotýkají nebo mohou dotknout vytváření, obnovy tras nebo umístování prvků turistického informačního systému – průběh tras skrz pozemky různých vlastníků, trasování na zvláště chráněných územích, respektování ochranných pásem, umístování informačních tabulí atd. Co se týče odpovědnosti na trasách zřízených KČT, je z hlediska klubu pohyb po nich pouze na vlastní nebezpečí. Vlastníkům pozemků však obecná prevenční povinnost ani notifikační povinnost nezaniká. Vystává otázka, zda by i vzhledem k rozvíjejícímu se turismu, nebylo vhodné alespoň omezenou formou tuto problematiku zakotvit do zákona.

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## THE PROTECTION OF TREES IN RECREATIONAL AREAS AND PERCEIVED HAZARD SAFETY

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### Abstract

Trees in recreational areas provide many benefits or as they are currently referred to - ecosystem services. Numerous studies confirm the production, regulatory, supply and cultural functions of trees which translate into tangible monetary benefits. Trees do however generate costs related to planting, maintenance, removal and minimisation of risks posed by windfalls and windthrows. This last issue, especially payment of damages related to accidents, is rarely valued, and administrators of green areas lack objective data which would help plan management of tree stands in urban areas. In Poland, those risks in areas of high traffic are too often mitigated by removal of trees.

This paper aims to present pros and cons resulting from presence of trees in such areas. The authors have estimated the risk of windfall and windthrow related accidents in Poland. These results have been juxtaposed with the results of analogous research done in USA, England and Australia. In each of these countries tree management practice are well developed. This study provides chosen premises to be used for tree-related risk management based on estimated level of hazard for people and property.

**Key words:** hazard trees, ecosystem benefits, trees in recreational area, tree risk management

### Introduction

Valuation of trees done in USA based on “ecosystem services” concept has clearly shown, that trees, as compared to other types of vegetation, are most effective constituents of the ecological structure of cities in terms of services provided to the environment. Trees have the advantage of longevity and size.

Multifaceted benefits stemming from their presence, especially in cities, are confirmed by numerous studies. Review of 250 scientific papers dealing with benefits of trees in urbanized areas allowed to make the following observations. Most of the articles provide a general overview of all services provided by trees [e.g. Mc Pherson, 2010; Lorek, 2015]. The studies usually divide tree functions into five groups: health services, visual and aesthetic services, social services, natural and economic services. Figure 1. shows how often those functions have been described in the analysed 250 scientific papers [Rosłon-Szeryńska, 2019].

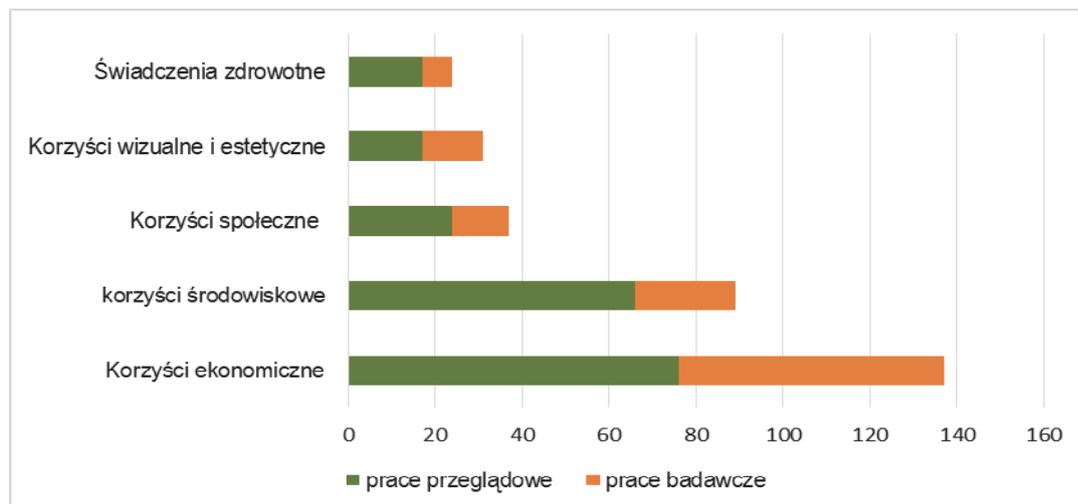


Fig. 1: Frequency of the five types of benefits provided by trees in public areas in 250 scientific papers

Natural and economic benefits are discussed most often [e.g. Farber, et al., 2002]. Some of the papers highlight how mature trees and skilfully designed and maintained tree-stands increase biodiversity [e.g. Chace and Walsh, 2006; Bovyn et al., 2019]. Many scientific papers describe results of use of particular methods of ecosystem services' valuation in chosen green areas including their advantages and limitations [e.g. Jędraszko-Macukow et al., 2018; Puzdrakiewicz, 2018]. Impact of trees on increase of real-estate value is discussed, among other by Tyrvaainen and Miettinen [2000].

Social as well as visual and aesthetic benefits of trees are mentioned in approx. 15% of analysed papers [e.g. McCollister et al., 2010; Hsieh et al., 2016]. Approximately 10% of papers evaluate influence of trees on health and psychological comfort of people [e.g. Wolf et al., 2015; van den Berg et al., 2010].

Most of described studies deal solely with benefits of trees in a cultural landscape. The cost of planting, maintenance and removal is rarely mentioned, while the issue of losses caused by natural disasters as well as risk for people and property is mentioned the least frequently. Some papers do not go beyond a general statement that benefits of tree related ecosystem services many times exceed costs of their planting and maintenance [e.g. Szczepanowska, 2015; Kronenberg, 2015]. Among the least frequently analysed topics is the problem of windfalls and windthrows which could pose risk for people and property. Falling branches break power lines or even cause fatal accidents [Rosłon-Szeryńska, 2012]. There are no studies which would comprehensively describe all potential benefits including costs of trees in urbanized areas. This has practical applications, as estimated benefits of tree are theoretical in nature. They rarely result in a tangible income. However, tree related costs are real and tree owners have to bear them. The goal of this article is to present results of studies dealing with tree-related costs and risks in recreational areas.

### **Material and methods**

This paper deals with two issues. An important argument when considering removal of a tree from a given space is the risk associated with it breaking or falling. Evaluation of the risk involves calculation of a risk factor for a region or country based on the importance of the site or accident statistics [Rosłon-Szeryńska, 2012]. In Poland losses caused by windfalls or windthrows are not monitored. General data on damages caused by natural disasters, such as gales and tempests, are however collected, and those include damages caused by falling trees. Rosłon-Szeryńska [2019] has undertaken this task. The researcher estimated risk of accidents caused by windfalls and windthrows for entire Poland based on accident statistics from years 2000-2018.

These results have been juxtaposed with the results of analogous research done in USA, England and Australia. In each of these countries tree management practice are well developed. Used data included information on gales published by IMiGW (Polish Institute of Meteorology and Water Management) and data from the Internet portal Polscy Łowcy Burz (Polish Storm Hunters), from archives of country-wide news portals (onet.pl, Wirtualna Polska, TVP Wiadomości, TV Meteo, Gazeta Wyborcza), as well as local ones (regional news). Data on strongest gales was collected. Damages caused by gales, storms and tempests have been catalogued in tables, charts and maps. The research included comparison of hazardous weather conditions in Poland and USA, Australia, England and Germany. Countries selected for risk comparison are known to employ mature and advanced tree management strategies.

The second part of the paper analyses costs of tree maintenance and care. The analysis accounts for tasks usually included in tree owner budgets as well as those which often get omitted.

### **Results and Discussion**

This paper shows a comparison of circumstances and locations of fatal accidents caused by windthrows and windfalls in chosen countries: England, Australia, Poland and USA. Collected data indicates that accidents in England (60% of incidents) and in Poland (48%) occur most often near roads, in vehicles or on parking lots. Trees hit vehicles causing injuries or even death. In Australia number of such incidents is smaller and amounts to 20%. In Australia accidents related to trees falling on a motorcycle or a bike are quite frequent (32%), while in Poland such accidents occur six times less frequently (5%). Fatal accidents caused by tree falling on pedestrians along streets or roads constitute a significant portion of all incidents. In Poland such incidents constitute 16% of all incidents, as compared to 10% in England and 8% in Australia (tab. 1.).

Share of incidents involving children: 14% in England, 24% in Australia and 16% in Poland. It should be noted that the factor for Poland does not deviate significantly from the British factor, despite the latter having a risk management system in place.

Tab. 1: Comparison of circumstances and locations of fatal accidents caused by windthrows and windfalls in chosen countries: England, Australia, Poland and USA. Data shown in percentages [own research].

chosen countries	incidents involving children	incidents involving adults	vehicles/roads, parking lots	pedestrians/roads	motorcycles/bikes	forests	parks	sheds, gazebos, gardens	beaches, rivers	school yards,	analysed period	
England	14	86	60	10	10	5.5	5.5	4	3	1	1999-2005	
Australia	24	76	20	8	32	4	13	8	7	1	7	2000-2018
Poland	16	84	48	16	5	8	9	5	3	5	1	2000-2018
USA	average age: 44		44	38 - outside				9	9	38 - outside		1995-2007

An analysis of incident risk reveals that the highest number of fatal accidents involving trees occurs in public spaces, along communication routes, in squares and parking lots. In Poland accidents involving trees happen less frequently in forests (8%), parks (9%), and least frequently on beaches (5%), in gazebos, mobile homes, tents and buildings (5%), in gardens (3%) and educational facilities and playgrounds (1%) (tab. 1).

To estimate risk of fatal accidents caused by windfalls and windthrows, the annual frequency coefficient of such incidents was calculated adjusted for total population of a given country (continent). The lowest coefficient per million of inhabitants was calculated for Germany (0.0%), Poland (0.10) and England (0.9). Low coefficient was also calculated for states of Virginia (0.15), Delaware and Hawaii (0.16) as well as Australia (0.17), states of Georgia, Kentucky and North Carolina (0.19). Relatively highest coefficient - though still within tolerable level - was calculated for states of Mississippi (0.38), New Hampshire (0.35), Washington (0.32), West Virginia and District Columbia (0.25) (fig. 2.).

The relationship was checked between the frequency of accidents and the implementation in a given country of tree management and the severity of storms systems. The use of Pearson's correlation coefficient ( $r$ ) showed in the surveyed countries and states a weak linear relationship between the accident rate per million inhabitants and the risk's level management of trees [ $0.416$ ;  $p = 0.086$ ]. Next, the relationship between accident rates and the degree of threat of storms in selected countries was examined. The use of the Pearson's linear correlation coefficient ( $r$ ) showed a stronger linear relationship between the accident rate and the hazard level of storms [ $0.633$ ,  $p = 0.005$ ]. This means that the number of accidents depends more on weather anomalies than on the possession of risk minimization systems (fig. 3 – 4.).

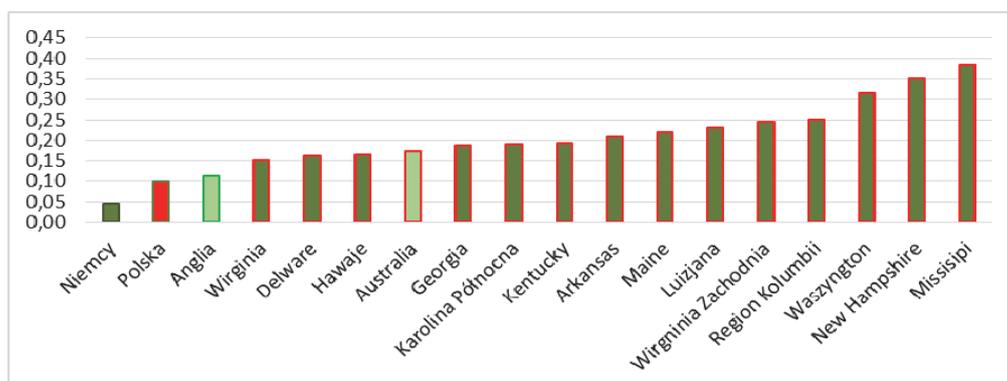


Fig. 2: Coefficient of fatal accidents caused by windthrows and windfalls in chosen countries: England, Australia, Poland and 14 US States per million of inhabitants [own research].

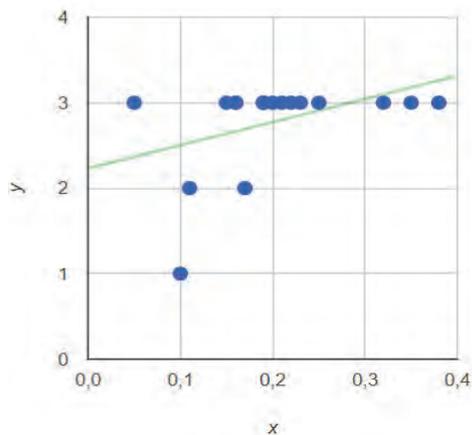


Fig. 3: The examination of the relationship between the accident rate per million inhabitants and the level of risk management related to trees in given countries and states [own elaboration]. Correlation of r-Person: 0.416, significance level: 0.086.

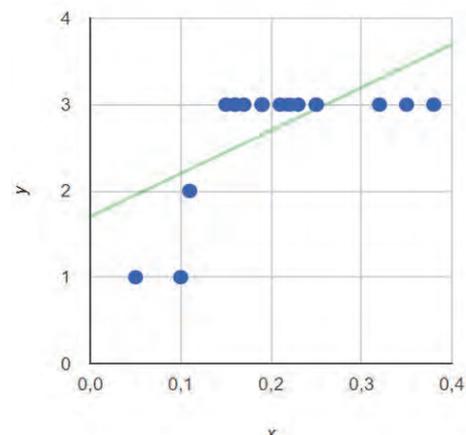


Fig. 4: The examination of the linear relationship between the accident rate and the threat level of storms in selected countries and states. Correlation of r-Person: 0.633, significance level: 0.005

The following part of the article provides an analysis of a budget for tree maintenance of urban tree-stands based on data from USA. Tasks planned in the communes of Chicago region stood out. They included tasks which are rarely, if ever, included in such budgets (fig. 5.). Among tasks omitted in other commune budgets the highest share was of tree valuation, improving soil conditions, tree-related risk management, watering, tree protection and mulching.



Fig. 5: Frequency of studied tasks related to tree maintenance in USA in relation to planned Chicago region communes' budget for urban trees' maintenance [own study based on: Vogt et al., 2015].

## Conclusion

Trees provide a number of benefits in human living space. Their impact on quality of air, climate, water and soil is undeniable. Researchers agree on high social, cultural, aesthetic and health benefits of trees. Popular awareness of tree advantages but also of hazards lies at the root of risk management system.

Risk of accidents caused by windfall or windthrows has been estimated. Gathered data suggests that the average number of fatalities in Poland coincides with data from Australia. Average annual fatality factor of incidents involving falling trees is 3.8 in both countries. In England, on an average, trees cause 6.9 fatalities while in Germany - 3.7 fatalities. The risk of death caused by trees is extremely small and within tolerable risk range.

Analysis of a survey done in USA, known as the birthplace of arboristics, reveals many similarities with Polish circumstances. American communes struggle with similar problems as Polish Local Government Units, despite having the benefit of a well-developed system of financial aid and technical expertise, and also favourable legal regulations which separate trees from other forms of vegetation into a category of "urban forest" with proper budget allocation.

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## Souhrn

Stromy v rekreačních oblastech poskytují mnoho výhod nebo jsou v současnosti označovány jako ekosystémové služby. Četné studie potvrzují produkční, regulační, zásobovací a kulturní funkce stromů, které se promítají do hmatatelných peněžních výhod. Stromy však generují náklady spojené s výsadbou, údržbou, odstraňováním a minimalizací rizik, které představují větrné a větrné větry. Tato poslední otázka, zejména výplata škod souvisejících s nehodami, je zřídka oceňována a správcům zelených ploch chybí objektivní údaje, které by pomohly plánovat řízení porostů stromů v městských oblastech. V Polsku jsou tato rizika v oblastech s vysokým provozem příliš často zmírňována odstraňováním stromů.

Cílem příspěvku je prezentovat klady a zápory vyplývající z přítomnosti stromů v těchto oblastech. Autoři odhadli riziko havárií způsobených neočekávanými a větrnými rány v Polsku. Tyto výsledky byly porovnány s výsledky analogického výzkumu provedeného v USA, Anglii a Austrálii. V každé z těchto zemí je praxe v oblasti řízení stromů dobře rozvinutá. Tato studie poskytuje vybrané prostory, které mají být použity pro řízení rizik na základě stromů na základě odhadované úrovně rizika pro osoby a majetek.

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# THE RECREATIONAL POTENTIAL IN THE VALLEY OF SVITAVA RIVER BETWEEN OBŘANY AND ADAMOV

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## Abstract

This article discusses the recreational potential in the valley of the Svitava river between the border of Brno (Obřany city district) and Adamov. The area is about 14 kilometres long and the article describes natural conditions in the valley, also lists all protected areas and other important elements in the landscape. It evaluates the current situation of the area with Bina's methodology *Evaluation of tourism potential in municipalities of the Czech Republic. Urbanism and territorial development*. It describes this area with SWOT analysis focused on suburban tourism and it proposes possible measures to increase attractiveness for suburban tourism.

**Key words:** cultural values, natural values, suburban tourism, tourism potential

## Introduction

Svitava is one of two large rivers that flow through the Brno agglomeration and is therefore often used for recreation. Unlike Svatka river, it does not offer so much space to be used for it – in urban areas, it is surrounded by industrial areas and after leaving the city it flows through a deeply cut narrow valley. Even so, Svitava valley is a popular destination for walks and sports. Its recreational potential is the subject of this article and is discussed below.

## Materials and methods

The Svitava river springs near Svitavy town in the Pardubice region. Svitava flows through Brno from north to south, enters the territory in Obřany district and flows into Svatka river in Přížfenice district. Solved section of the river is 14 km long (Czech Institute of Surveying and Cadastre, 2019) and the average flow is 4,26 m<sup>3</sup>/s (Czech Hydrometeorological Institute, 2019). The river flows through granodiorite with cambisols (Czech Geological Survey, 2019) and it creates a deep narrow meandering valley.

The geomorphology of the Svitava valley influences its use for recreation. The valley is only a few tens of meters wide and it also leads the Prague express train. Every wider place in the valley was used for development – in wider places for the permanent settlements (Bilovice nad Svitavou, Adamov), elsewhere for garden colonies or recreational buildings. The valley is also used as a link between these settlements.

Solved river section was divided into six segments as map shows. In the table below are each segment lengths and short characteristic.

Tab. 1: Segments length and characteristic

	Segment length [km]	Segment characteristics
Segment 1	2,9	Narrow valley, railway, communication, cottage area
Segment 2	1,8	Urban area
Segment 3	1,6	Narrow valley, railway, road
Segment 4	2,8	Narrow valley, road, cottage area
Segment 5	1,8	Narrow valley, railway, road
Segment 6	3,8	Urban area, railway, industrial areas

Evaluation of recreational potential is included in the tourism potential evaluation. The potential measurement is difficult especially because an intangible subjective component is included in the evaluation and these components significantly affect recreational potential (like *genius loci*). The basis of the evaluation has divided the territory into individual components and evaluate each component separately. The final potential is the sum of partial potentials. We evaluate the attractiveness potential (visitors destination) and territory potential for recreational activity. (Bina, 2010)

For the evaluation, the methodology by Bina from 2002 (methodology *Evaluation of tourism potential in municipalities of the Czech Republic. Urbanism and territorial development*.) and its update from 2010 were used. This methodology evaluates recreational potential using various indicators, including historical, cultural and natural values of the territory. A field survey is needed for evaluation. The

attractiveness is divided into localization levels (1,2,3) which determine that the attractiveness is located in the territory and her significance. These levels are further assigned a rating system. Some attractions are rated only by level (fishing, climbing). (Bína, 2002)

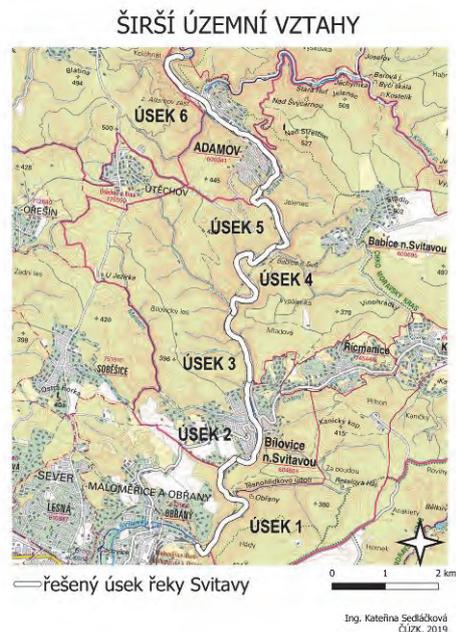


Fig. 1: The solved territory (ČÚZK, 2019)

Tab. 2: Levels and rating system (Bína, 2002)

<b>LEVELS</b>	
1	Basic level, registerable
2	Intensified level, noticeable
3	High level, dominant
<b>RATING SYSTEM</b>	
0	Without potential
1-25	Basic potential
26-50	Intensified potential
51-100	High potential
101-200	Very high potential
200 and more	Extraordinary potential

The evaluation was recorded in evaluation sheets, which are divided into two sections – attractiveness and the landscape suitability for the activity. In these sections are only items that actually exist in the territory. In the attractiveness section was evaluated natural sights, castles and chateaux, religious and technical monuments, memorials, museums and galleries, cultural, sports and religious events and other attractiveness not included in the list. In the section evaluating the landscape suitability for the activity was evaluated suitability for motorcycle use, for walking touristic, cross-country skiing, inline skating, cycling, for swimming, fishing and paddling.

### Results

The first segment begins at the railway bridge on Mlýnské nábřeží and ends at 14,2 km. It is mostly used for suburban recreation. On the right riverbank is S. K. Neumann's path, on the left is communication used by cyclists and inline skaters. There is nature trail Hády a údolí Říčky. On right riverside is natural monument Obřanská stráž, on the left is abandoned stone quarry, on both riverbanks are rock outcrops. Near the railway bridge is a miniature garden railroad, skate park and place for a workout. There is a restaurant on the right riverbank. On the right riverbank is Hamerský mlýn, blacksmith museum. We can find there a footbridge near a railroad bridge. In the same place is tourist shelter with educational signs and path for Rudolf Těsnohlídek memorial and Obřany castle ruins. Around the river is a cottage colony.

The second segment includes an urban area of Bílovice nad Svitavou. Bílovice has been a traditional destination for suburban tourism since the First republic. There are several restaurants. The locality is

connected with Brno by train and bus. Bílovice is traditionally associated with names like Rudolf Těsnohlídek or S. K. Neumann. They are tied to the tradition of the Christmas tree on náměstí Svobody. Nearby Bílovice is Josef Ressel memorial. Traditional Sokol feasts are held in September. There is also a football club.



Fig. 2: Tourist shelter and educational signs (Sedláčková, 2019)

Segment 3 ends on 17,6 km. On the left riverbank is road 374, on the right is railroad and communication. Besides the rock outcrops, we can find NM Kněžnice. There are only a few recreational buildings.

Segment 4 ends on 20,6 km. There is a dense cottage development. On the right riverbank is natural reserve Malužín with many rock outcrops and with Myší díra gorge. In the woods around there are many memorials of Lesnický Slavín.

Segment 5 ends on 22,2 km at the railway bridge. It includes a railway station in Babice nad Svitavou, where we can find a restaurant, pension and swimming pool. On the hill above the valley, we find Ronov castle ruins. There are other memorials of Lesnický Slavín and cottage colonies.

The last segment includes the urban area of Adamov city. It is connected with Brno by train and with Blansko by bus. There is a church with a rare altar, old cemetery and forest cemetery. Above the city is the lookout tower Alexandrovka. To the north of the city, the protected landscape area Moravský Kras begins, a little further away is NR Jelení skok and NR Dřínová. In area of ADAST factory is Adamov castle. The whole city is very industrial.

Tab. 3: Evaluation of recreational potential

EVALUATION			
	LEVEL		
Attractiveness	1	2	3
Natural sights	-	95	-
Castles and chateaux	60	-	-
Religious monuments	45	-	-
Memorials	-	65	-
Technical monuments	10	-	-
Museums and galleries	80	-	-
Other attractiveness	-	55	-
Cultural, sports and religious events	60	-	-
Suitability for the activity	1	2	3
motorcycles	-	-	90
walking	-	-	90
cycle-tourism	-	-	90
inline skating	80	-	-
Crossroad skiing	20	-	-
swimming	-	60	-
paddling	-	-	95
fishing	-	-	80

The territory is mostly used for various sports activities. The historical value of the territory is high (castles, memorials). The whole territory is mainly focused on suburban recreation.

Tab. 4: SWOT analysis of solved territory

<b>Strengths</b>	<b>Weakness</b>
Natural conditions	Safety
High recreational potential	Footbridges
	Mess around the rail track
	Unsuitable cycle track equipment
<b>Opportunities</b>	<b>Threats</b>
Safer path for cyclists	Threats to protected area
Improving the river navigability	Reducing recreational potential by degrading the territory
New footbridges	
Regular cleaning around the rail track	
Cover recultivation	
Equipment renovation	
<b>Strengths</b>	<b>Weakness</b>
<b>Natural conditions</b>	<b>Safety</b>
<b>High recreational potential</b>	<b>Footbridges</b>
	<b>mess around teh railtrack</b>
	<b>Unsuitable cyclotrack equipment</b>
<b>Opportunities</b>	<b>Threats</b>
<b>safer path for cyclists</b>	<b>threats to protected area</b>
<b>improving the river navigability</b>	<b>reducing recreational potential by degrading the territory</b>
<b>new footbridges</b>	
<b>regular cleaning around the railtrack</b>	
<b>cover recultivation</b>	
<b>equipment renovation</b>	

The most important is to increase safety. This is connected with the construction of safe crossing across the river and a new cycle path. Improving the potential of the territory will also help to improve covers around the railway.

### Discussion

The potential of the territory is relatively high thanks to interesting geomorphology. The territory is interesting in nature sights and provides many opportunities for various sports – the river is suitable for fishing and paddling, the roads in the valley are used by cyclists and bikers and there are many hiking trails. The problem, however, is the safety and accessibility of the territory. For lack of footbridges, tourists use railway bridges, even passing through tunnels. Cyclists on the road are also a risk. Along the railway body, there are considerably neglected vegetation and a lot of garbage. The benches around paths are mouldered and the guardrails are broken in places. In the villages the recreational potential is used quite well, there is a suitable background for tourists. The territory is mostly used by cottagers and suburban tourism.

There are many opportunities for safer and more comfortable recreation – the most important are footbridges to allow safe crossing river (they should be near railway bridges so that tourists do not

walk through them) and new cycle track. Recultivation of the railway surroundings will improve the aesthetic.



Fig. 3: A footbridge parallel to the railway bridge (Sedláčková, 2019)

### Conclusion

The recreational potential is relatively high and the territory is frequently used for recreation by cottagers, cyclists, tourists and fishermen. The territory strengths are interesting nature and the possibility of sports activities. Opportunities are to increase the safety and accessibility of the territory. Territory can be degraded by unsuitable management. The territory has a great potential that it can develop in future, providing even more opportunities for suburban recreation.

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Geological map of ČR, WMS, [online] [http://mapy.geology.cz/geocr\\_25/](http://mapy.geology.cz/geocr_25/)  
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### Souhrn

Svitavské údolí je hojně využíváné k rekreaci především sportovní. Poskytuje využití pěším turistům, cyklistům, motocyklistům a v posledních letech i inline bruslařům. Přímo řeky využívají vodáci i rybáři. V celém údolí od Obřan až po Adamov se nachází mnoho chatových oblastí. Jako degradační prvek působí těleso železniční tratě, kolem kterého jsou porosty v zuboženém stavu a nachází se zde hodně černých skládek. Oblast má díky zajímavé geomorfologii, přítomnosti řeky a mnoha kulturním a historickým zajímavostem vysoký rekreační potenciál, řeka je ale zároveň výrazným omezením. Chodci při jejím překonávání používají železničních mostů rychlíkové trati, což je pochopitelně velmi nebezpečné. Někteří dokonce prochází tunely. Cyklisté zase jezdí po silnici, což v nepřehledných zatáčkách ohrožuje je i motoristy. Bezpečnosti rekreace by pomohlo vybudování více lávek pro pěší (ideálně poblíž železničních mostů) a nové cyklotrasy, která by vedla po jiném břehu, než silnice. Úzké údolí řeky je v tomto bohužel dost limitující a neposkytuje tolik prostoru.

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## THE SPIRITUAL DIMENSION OF CHŘIBY MOUNTAINS IN THE CONTEXT OF THEIR TOURISM POTENTIAL

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### **Abstract**

This paper focuses on the spiritual dimension of the landscape in the territory of Chřiby Mts. located in south-east Moravia (mostly in the Zlín region and partly in South Moravia region). The entire territory of Chřiby Mts. in the Zlín region is declared a Natural park. This legislative cover aims to protect the preserved landscape character and a considerable amount of significant cultural and natural values, concentrated in the area. In the whole territory, altogether 77 places and buildings connected with the spiritual perception of the landscape were noted down. The registered places with a spiritual dimension in Chřiby show that some places have been seaked out across history repeatedly. These are the places with convenient natural conditions, because those have been an important criterion for humans for choosing places to settle or build castles, churches etc. Furthermore, places with unusually strong influence on human perception have also been repeatedly searched for. The strong effect of those places have compeled humans to assign them with magical abilities (springs with healing water) or associate their origin with a legend. The spiritual dimension is currently an essential component of tourism in Chřiby Mts.

The current relationship of visitors with places of the described value has been traced with help of a questionnaire survey for a selected part of the territory.

**Key words:** landscape, tourism, cultural and natural values, cultural heritage, public survey

### **Introduction**

The area of interest extents up to approximately 225 km<sup>2</sup>. People have been connected with this landscape since prehistoric times, when it initially served as a viewing point for animal herds movement, then as a strategic point of defence and subsequently as a source of raw materials for industry (Hrabec, 2013). The term "sacred" in connection with landscape invokes different feelings in us compared to our ancestors. Cílek (2004) talks about sacred landscape as of an entity, which will strike and affect us. Květ (2003) presents that people of archaic societies lived up until the Middle Ages in a sacred, mythical environment surrounded by magic (trees, groves, springs, stones, hills, valleys). Almost all natural formations had a potential and reason to be worshiped. The relationship between a human and landscape was different. People weren't separated from the nature, but considered themselves to be part of it. Today it is a fact, that people have lost contact with their homeland. It is true for the city dwellers, but unfortunately even for the people living in countryside. They don't feel and don't know the local landscape, don't know how the life rhythm of their ancestors was flowing and which places controlled their life (Květ, 2003). That is why people return to nature in an effort to find a piece of forgotten, hidden and old wisdom. Currently, Chřiby Mts. are a popular area for vacation stays, tourism and recreation.

### **Materials and methods**

The definition of borders for the interest area was based on the borderes of the Natural park and Sites of Community Importance Chřiby Mts. A buffer zone with a width of 1,5 km was set out around the entire area. The spiritual dimension of landscape in the territory of Chřiby Mts. was examined on two levels. The first level consisted of the determination of places with a spiritual dimension based on literary sources - chronicles, literature and articles. Spiritual places were classified into three categories: sacral, archaeological and natural places. Chapels, cemeteries, statues and churches were included in sacral places. Most of the sites defined as sacral are currently classified as cultural monuments and as such their notice was taken from the National Heritage Institute. The second category, archaeological places, contains secular historical buildings (palaces, castles) and sites, where archaeological exploration was implemented. The majority of these places was selected from the literature and part of them, classified as cultural heritage, was taken from the National Heritage Institute. The third category, natural places, is based on the relationship of human with nature. Some places have been fine-tuned by humans on the physical level, others have been transformed to mystical form through myths and legends.

The second view of places with a spiritual dimension was based on a current perception of visitors of a selected part of the Nature park Chřiby Mts. The respondent's relationship to local landscape was

evaluated via questionnaire. The questionnaire also included questions focused on limits and conflicts in the territory. The area of the survey focus was the opening part of the territory of Natural park Chřiby Mts. near the town of Koryčany. The attached map displays the spiritual places mentioned by respondents in the survey five or more times (see Fig. 1 Map spiritual places in the area of Natural park Chřiby Mts. near the town of Koryčany).

## Results

In the territory of Nature park Chřiby Mts. was together 77 places and structures reported to be connected with spiritual perception of landscape. This total amount is divided into 34 sacral, 30 archaeological and 13 natural places associated with spiritual perception of landscape. Almost all sacral places are in the buffer zone and located near towns in the area. Only two sacral buildings are located inside of the Nature park Chřiby Mts., both connected with Christianity. Archaeological sites connected to spirituality are located primarily inside of the forest complex of Chřiby Mts. The cairns are common in this area and the most important location with a concentration of 42 Slavic skeletal remains from the last third of the 9th and beginning of the 10th century can be found in Tabarky near the village of Nová Dědina (Hrabec, 2013). Other cairns are located near Čeložnice, Na Zvražci, Na Kostelíku, etc.

The natural places with spiritual overlay are located wholly in forests of Chřiby Mts. The variously hewn frontier stones can also be perceived as numinous, but they had a solely practical purpose in the past. Many such stones occur in the forests of Chřiby Mts. Most of them are from the 19th century (Baščan et al., 2005). Another place associated with spiritual perception of landscape is Salaš. Supposedly in this place grew a pagan linden tree, where people were coming to give various sacrifices to the gods (Baščan et al., 2005).

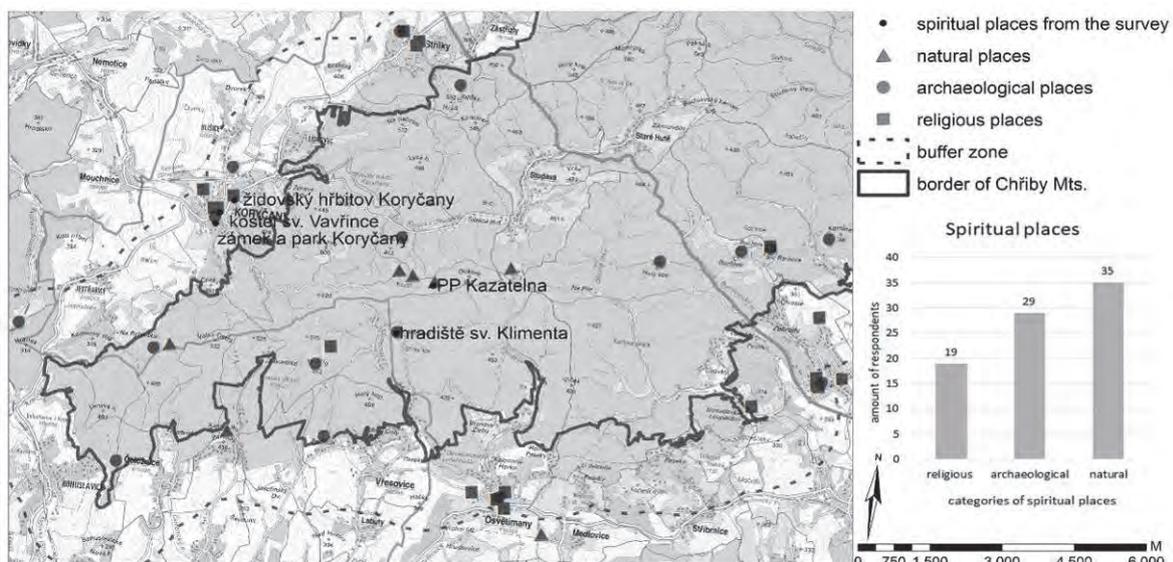


Fig. 1: The map of spiritual places in the area of Natural park Chřiby Mts. near the town of Koryčany

The questionnaire survey took place on approximately one third of the territory of Natural park Chřiby Mts. and overall involved 121 respondents. The surrounding landscape is perceived by most respondents as forest (111 respondents) and further also attributed with the adjectives tourist (79 respondents) and mushroom (63 respondents). The survey also shows that the spiritual landscape is perceived much more in the connection with the forest as a landscape type (35 respondents) compared to the meadow landscape (8 respondents). The respondents, which characterised the landscape as tourist most often also identified it as forest (72 respondents) and significantly less as a meadow landscape (15 respondents). The questionnaire was further focused on finding of the most tourist-exposed areas. Majority of the respondents perceive as the most tourist burdened place the ruins of Cimburk castle during the summer season. The whole area of Chřiby Mts. is most burdened by tourists during the summer and spring season, while autumn is perceived as a tourist burdened by only one third of the respondents. Approximately one third of the respondents also presented the rock formation named Kozel and the castle with its park in Koryčany as the most tourist burdened localities. Of the total amount of respondents of the town of Koryčany and its surrounding, 35 respondents perceive Chřiby Mts. as a spiritual landscape, thereof 20 women and 15 men. Respondents who perceive Chřiby Mts. as a spiritual landscape most often identify as places associated with spirituality

the ones classified in this paper as natural values (21 places). The sacral values were on the contrary identified by the smallest number of respondents (10 places). This phenomenon is the same for respondents who didn't indicate Chřiby Mts. as a spiritual landscape. Most places associated with spirituality belong to the category of the natural values (35 places) and places from the category of sacral values (19 places) are identified by minority of respondents. The most frequently mentioned place associated with spirituality is ruined fortified church of sv. Kliment (19 respondents) and the rock formation named Kazatelna together with the Jewish cemetery in Koryčany (12 respondents).

## Discussion

Along with defining places, which were to be described as spiritual, arose the question whether nature carries a spiritual dimension in itself or whether a person has embedded its spiritual dimension on it. The mapped places with a spiritual dimension in the area of Chřiby Mts. clearly show that some places have been searched repeatedly throughout history. This phenomenon is often caused by the convenient natural conditions of the locality (elevated locations, proximity to watercourses, etc.). Nevertheless, there are sites in the area, which have been sought by people solely for their strong energy. In the past people had a different relationship with the landscape. They identified themselves to be a part of it, and the whole landscape was considered a magical place (Trpák and Trpáková, 2007). The breakthrough point in the perception of landscape spirituality was the arrival of Christianity into this region. Květ (2003) considers this milestone to be rather more regressive in relation to the spiritual dimension of landscape. That being because the sacred has been reduced to symbols that humans have created. Despite this, the results of the questionnaire survey show that the local inhabitants have a spiritual landscape associated with forests, and consider natural sites as spiritual places. The reflection about connection between characterising the landscape as spiritual and forest unfolds the apparent association of spiritual qualities with the landscape that is at first sight unaffected by humans. On the other side stands the meadow landscape, an open land, that is more strongly shaped and maintained by humans, which is perceived as spiritual significantly less. The loss of spirituality is severe pronounced in the urban and unified agricultural „large-scale production“ landscape (Kubalíková et al. 2017).

Spiritual places in the landscape aren't always depending on human activity. Many localities are considered sacred on their own. In the survey the forests themselves were often mentioned as a sacred place, which people had a mystical relationship to, since the beginning of the human race. So it is possible that the forest is a magical substance for us, a place where we go to hide and get energy. It is important to keep in mind that the results can be only related to this territory. How Cílek (2004) presents, each landscape claims its inhabitants in a different way. And maybe that is why a person from mountain region will never feel completely at home in a flat area. The feeling of „missing something“ will haunt him until he returns to the mountains. Trpák and Trpáková (2007) state, that humans have the childhood landscape imprinted in their minds, and therefore the lowland residents are unhappy in hills and vice versa.

Humans haven't embedded the spiritual dimension on all places in the landscape, however they are still influencing them to some extent. Tourists currently have unlimited possibilities of global movement, which according to Trpák and Trpáková (2007), along with a change in basic life rhythms, brings formation of new territoriality, regardless of existing ties in the many landscapes of the world. Tourists move in landscape without consideration and connection, and in large numbers. The pressure of visitors can be so big that spirituality of place is eventually suppressed. This presumption is confirmed by the questionnaire survey. Places that have been identified as the most tourist loaded are rarely considered spiritual. Hoferek and Makýš (2006) express the opinion, that no law will protect the landscape, if in public will remain in the state of apathy and disinterest. This issue is very delicate for tourists who usually don't have a strong emotional relationship to visited landscape. The whole nature is a dynamic system that evolves and changes, so it may happen that some places lose their spirituality in surge of tourists and others will take their place. The fear that human invasive behavior destroys the spirituality of landscape can be justified in many cases. But it is certain that as long as trees will grow in forests, this one place in our landscape will still be connected with spirituality and allow us to calm our minds from everyday duties and concerns.

## Conclusion

Human relationship with the landscape is constantly evolving. In the past, this relationship was based on the mystical perception of the nature as a whole. Gradually this position has changed. Sacredness was concentrated into handful of certain places and buildings. Nowadays there is some return to the initial perception of the landscape. The respondents have associated the spirituality mostly with the nature localities and the forest itself consider to be a mystical place, where they can draw energy and

restore their strength. That might also be the reasons why the pressure of tourists grows in many places. In order to preserve the beauty of our nature and its harmony, it is essential that tourists as well as locals have in the first place in mind the nature protection.

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### Souhrn

Tento příspěvek je zaměřen na duchovní rozměr krajiny na území Chříbů, které se nachází ve Zlínském a částečně v Jihomoravském kraji. Celé území Chříbů ve Zlínském kraji je vyhlášeno přírodním parkem. Z důvodu ochrany dochovaného krajinného rázu a ochrany významných kulturních a přírodních hodnot, které se v území nacházejí. V celém území bylo zaznamenáno celkem 77 míst a staveb, které mají spojitost s duchovním vnímáním krajiny, z tohoto celkového počtu bylo 34 sakrálních, 30 archeologických a 13 přírodních. Duchovní rozměr je v současné době významnou součástí cestovního ruchu v Chříbech. Současný vztah návštěvníků k vybraným duchovním místům, byl zjišťován na základě dotazníkového šetření, pro vybranou část území a bylo do něj zapojeno celkem 121 respondentů. Respondenti vnímají jako místa spojená s duchovnem nejčastěji lokality, které byly zařazeny do přírodních hodnot. Duchovní místa v krajině nejsou vždy podmíněna člověkem. Přesto, že člověk nevtiskl duchovní rozměr všem místům v krajině, tak je všechny do jisté míry ovlivňuje. Tlak návštěvníků může být tak velký, že duchovnost místa je potlačena, a proto musí být turisté ohleduplní a jednat v souladu s přírodou.

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# THE UNIQUE VALUES OF TREES AS THE REASON FOR THEIR PROTECTION AS NATURAL MONUMENTS IN FORESTS

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## **Abstract**

Trees have played an important role in people's consciousness since time immemorial. Today, when the natural resources are at a growing risk, it is necessary to make every effort in order to protect their most valuable elements, including trees. The Nature Conservation Act in effect in Poland specifies the dimensional criteria for the selection of trees to be recognised as natural monuments, but it also lists other aspects which determine the values of old trees. The aim of the study, which is based on a review of literature, was to describe the primary values attributed to exceptional specimens of trees growing in forests. These values were identified and characterised with reference to natural and cultural aspects resulting from the ornamental features and the landscape-related role of trees, as well as the historical, social, scientific and educational, religious and symbolic, and economic background. Knowledge of these values contributes to a more comprehensive assessment of trees and to informed decisions about their protection as natural monuments in forests.

**Key words:** natural monument, environment, forest, natural and cultural values

## **Introduction**

Trees have held a special place in people's consciousness since time immemorial (Pietrzak 2009). Their protection as natural monuments also has a long tradition in Poland. The first forms of inventories date back to the Late Middle Ages, yet such activities intensified at the turn of the 19th and 20th centuries. The first legal acts stipulating conservancy of ancient trees were issued during the interwar period, more followed after World War II (Kasprzak 2011).

Nowadays, natural monuments are established based on a resolution of the local district council in compliance with the Nature Conservation Act of 2004 (Ustawa... 2004), most recently amended in 2018 (Obwieszczenie Marszałka... 2018). The resolution needs to include: the name of the given object, its location, the supervisory body, specific objectives for protection, and, if needed, also certain restrictions. The primary criteria for the selection of trees to be recognised as natural monuments were listed in the Regulation of the Minister of Environment (Rozporządzenie Ministra... 2017). They include:

- trunk circumference – no smaller than the minimum specified for individual types and species of trees, measured at the height of 130 cm, or
- distinguishing features which make the tree stand out against other trees of the same type or species across the country, region (voivodeship) or municipality on account of the trunk circumference, height, crown width, age, occurrence in clusters, including in avenues and rows, the tree form or other morphological features, as well as other exceptional natural, scientific, cultural, historical or landscape-related values.

Naturalists, nature enthusiasts, and foresters alike have played an important role in inventorying trees recognised as natural monuments (Pietrzak 2009). Many of the oldest specimens of trees, including natural monuments, still grow in forests now. According to data from the end of 2017, 8,810 single trees recognised as natural monuments, 1,484 groups of trees, and 130 historic avenues were inventoried (Lasy w Polsce 2018). Among the largest and oldest tree-monuments in the Polish forests, the common oak (*Quercus robur* L.) prevails. Examples include the Chrobry Oak from Piotrowice (recognised as the oldest coniferous tree in Poland; its age is estimated at about 760 years), the Bażyński Oak in Kadyny (named after a knight, a former owner of the land where the tree grows; the age of the specimen is estimated at about 720 years), and Bartek from Zagnańsk (the best known one – a symbol of strength and perseverance, connected with many events and legends; its age is estimated at about 690 years) (Pacyniak 1992; Zarzyński, Tomusiak 2009; Tomusiak, Zarzyński 2014). However, there are many more other unique trees with exceptional features in the Polish State Forests. A considerable part of them survived thanks to their location – they have grown in places which are not easily accessible, along roads, in particularly picturesque areas or those intended for special purposes (e.g. hunting) (Borkowski et al. 2008). Many of these trees are known only locally. They include both specimens of record sizes and those more modest ones, standing out due to their

form or related history (Tomusiak, Zarzyński 2014). On account of a number of unique values that they have, also these trees aspire to be recognised and protected as natural monuments.

## Methods

The aim of the study, based on a literature review, was to identify and characterise a number of special values attributed to trees considered as exceptional. In accordance with the provisions of the Nature Conservation Act, these values are listed among the criteria for recognising these specimens as natural monuments. They refer not only to the environmental, but also the cultural aspect resulting from the ornamental features and the landscape-related role of trees, and the historical, social, scientific and educational, economic, as well as religious and symbolic background of individual specimens occurring in forests.

## Results

Apart from meeting certain parameters, the primary objectives and motives for protecting trees as natural monuments also refer to their unique values. The natural values are of major significance. Trees are a very important element of the natural environment, particularly in the context of benefits resulting from the preservation of its natural resources. They are some of the most durable plants, greatly contributing to the production of oxygen and cleaning the air of dusts, as well as maintaining the water cycle on Earth. Larger tree clusters, which is of significance in the case of forests, prevent unfavourable climate change to a considerable extent (Będkowska 2016). The natural value of trees as sanctuaries of biodiversity increases with their age. Older trees are populated by larger numbers of various organisms, including many species of fungi, lichens, insects, birds, and other small animals (Pietrzak, Zawadka 2009; Pietrzak-Zawadka 2016). They contribute to the presence of different species and the development of habitats important to environmental protection, which is why it is crucial to leave declining and dead decaying trees in forests. The protection of trees as natural monuments is directly related to their scientific values. Old trees are used as objects of studies involving bioindication – analysing reactions to environmental changes. They are a source of dendrochronological information (Siewniak 1998) – on account of their viability (ability to regenerate and longevity) and the record sizes they can grow to, they provide a lot of information on their distinctive features specific to the given species, as well as knowledge on ecological succession. Additionally, they constitute a source of genetic resources needed to preserve the most valuable populations and obtain seeds (Program zachowania... 2011).

Their cultural significance is of considerable importance in the context of the protection of trees as natural monuments – unrecognised, it may substantially impoverish local communities and even entire nations (Michałowski 1991). As elements of nature, trees participate in the formation of the cultural landscape (Siewniak 1998). The historical background also determines their significance. On the one hand – on account of their age, but also as a result of leaving dead specimens in forests – they remind us of distant eras. On the other, many of them have an interesting history and their presence in forests documents the past – historical facts and events which took place within the given area, as well as people who lived or died there and often rendered great service to the region or to science (Kasprzak 2011). The presence of many unique trees was documented in different historical periods – in inventories and academic publications, tourist guides, but also in literature and film. Many specimens have proper names resulting from the history of the given place or referring directly to folk legends and tales. They constitute a form of commemorating special events, dates, and figures from the past – this gives trees symbolic value (Grzywacz 2011). Additionally, their strong silhouette and viability are associated with longevity. The presence of a monumental tree alone, recognisable in the forest landscape, creates a unique spirit of the place (*genius loci*). The occurrence of specimens with exceptional features makes them function as direction signs and landmarks in space (Siewniak 1998). The historical background often involves religious reasons, which are yet another argument in favour of the protection of trees as natural monuments. Certain trees have a powerful impact on the spiritual sphere – they are associated with revelations, beliefs, and religious or magical practices (Grzywacz 2011). Old specimens, respected by the local community, are often perceived as places or objects of worship – shrines are erected next to them and religious paintings and sculptures are hung on their trunks (Pietrzak, Zawadka 2009; Pietrzak-Zawadka 2016). This role is directly related to the ornamental values of trees. They have high aesthetic quality as such (Siewniak 1998), and the specimens “aspiring” to be protected as natural monuments are usually perceived as particularly beautiful – visually attractive and standing out against those typical of their species thanks to individual features. Their form is often deformed and thus unique. The ornamental values of trees are also relevant in a broader context – their perception as elements highlighting the natural landscape and

determining its attractiveness. Their exposure against the background of other elements of nature perceived as a whole determines their landscape-related values (Pietrzak-Zawadka 2016).

All of the aspects mentioned above translate into the social values of trees. The plants themselves and simply being around them positively influences human health, but they can also inspire cultural activity through powerful impact on imagination and the possibility to be used in artistic (literary, painting, music, etc.) activities (Pietrzak-Zawadka 2016). They stimulate spiritual development, experience of the beauty of nature. As objects included in tourist programmes for forested areas, they become elements of educational interest in the field of nature and history, both to individuals and groups, at various levels of school education. In the context of education, it is also important to conduct activities aimed at propagating knowledge about protected trees, raising awareness of their role and significance on account of their natural and cultural values (Pietrzak 2011). Trees contribute to the multifaceted development of society to a substantial extent – they encourage physical activity and exploration of cognitive interests. They are very frequently perceived as tourist attractions or even icons (Staniewska-Zątek 2007; Pietrzak, Zawadka 2009). Moreover, they help promote the region in which they grow, thus bringing economic benefits (Kasprzak 2011).

### Conclusions

Forests are areas densely populated by trees – including both natural monuments and those aspiring to be protected. Due to primarily natural origin, this type of space provides possibilities for the growth of trees in the most favourable conditions, where balance between their requirements and habitat is maintained. Some of the specimens occur in rather densely covered areas, others are exposed as solitary trees in forest clearings or along roads. Today, when the natural resources are at a growing risk, it is necessary to make every effort in order to protect their most valuable elements, including trees. Many of them achieve record sizes. But apart from the natural, they also have cultural values related to a number of aspects resulting from their ornamental features and their role in shaping the landscape, as well as the historical, social, scientific and educational, religious, symbolic, economic and other backgrounds. Learning about and understanding how different aspects may determine the unique value of individual trees should be the basis for their comprehensive assessment, and consequently, an argument in favour of protecting them as natural monuments in forests.

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### **Souhrn**

Stromy hrají od nepaměti důležitou roli ve vědomí lidí. Dnes, když jsou přírodní zdroje vystaveny rostoucímu riziku, je nutné vynaložit veškeré úsilí k ochraně jejich nejcennějších prvků, včetně stromů. Zákon o ochraně přírody ve skutečnosti v Polsku specifikuje rozměrová kritéria pro výběr stromů, které mají být uznány za přírodní památky, ale také uvádí další aspekty, které určují hodnoty starých stromů. Cílem studie, která je založena na přehledu literatury, bylo popsat primární hodnoty přisuzované výjimečným exemplářům stromů rostoucích v lesích. Tyto hodnoty byly identifikovány a charakterizovány s odkazem na přírodní a kulturní aspekty vyplývající z okrasných rysů a krajinných rolí stromů, jakož i historické, sociální, vědecké a vzdělávací, náboženské a symbolické a ekonomické zázemí. Znalosti o těchto hodnotách přispívají k ucelenějšímu posouzení stromů ak informovanému rozhodování o jejich ochraně jako přírodních památek v lesích.

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## THE USE OF BIOLOGICAL PROCESSES FOR WATER PURIFICATION IN THE NATURAL POOL

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### **Abstract**

The use of biological processes to remove pollutants from water is currently the subject of alternative environmental practices. Vegetation and microorganisms as natural elements of the landscape are used to reduce the anthropogenic burden of water bodies. The aim of their use is to study patterns and achieve a reliable functioning of natural processes in artificially created conditions. Biological methods of phytoremediation and biofiltration using live microorganisms are suitable for water purification, where the application of other remediation techniques is too expensive or unusable. These are primarily low-concentration sites requiring only long-term purification, possibly in combination with different methods where the flora and microorganisms are used as a finishing measure.

The paper describes the mechanism of biofiltration used for water purification in the Lackovce natural pool situated in eastern Slovakia.

**Key words:** Phytoremediation, biofiltration, water quality, legislation

### **Introduction**

The aquatic environment represents an important part of the environment. Surface waters make up the majority of the volume of EU waters and are important habitats, providing key support to society and the economy throughout Europe (EEA 2018). The human activity can adversely affect the quality of water (Zeleňáková et al. 2016), in some cases to a significant contamination of waters threatening human health or the quality of the ecosystem (Frankovská et al. 2010; Junáková & Bálintová 2013a). Clean waters are essential for human health due to their use for recreational purposes (Junáková & Bálintová 2013b) and the maximum possible benefit for population (WHO 2006). Therefore the main aim of EU water policy is to ensure a sufficient quantity of good quality water (EEA 2018).

Bathing water policy is one of the success stories in EU water policy and important to protect human health and the environment (EC 2018). The attention is paid to bathing water which is defined as any element of surface water where the competent authority expects a large number of people to bathe and has not imposed a permanent bathing prohibition, or issued permanent advice against bathing (revised Bathing Water Directive 2006/7/EC) (EC 2006). It is not applied to swimming pools and spa pools and artificially created confined waters separated from surface water and groundwater (EC 2006), where monitoring of water quality is also necessary.

### **Natural pools**

At present a natural alternative of swimming pools useful both to people and to the environment are bio-swimming pools (biopools, natural swimming pools), characterised as artificially created body of water that are sealed against groundwater and natural surface water in which water is not chemically disinfected (WHO 2006; SR Ministry of Health 2012). The first natural pool appeared in Austria in 1983. Since then, there has been a rapid increase in numbers, with over 20,000 public and private natural pools now in Europe (HCMA 2016). The constant quality of bathing water in biopool is guaranteed through a biological and/or mechanical treatment. The bathing area is separated from the water treatment and cleaning area (regeneration zone) so that there is no uncontrolled water exchange between them (SR Ministry of Health 2012). Natural swimming pools are also defined as pools that use naturally occurring biological water filtration and treatment methods to provide pure and clean bathing facilities that mirror natural bodies of water, without the use of chemical treatment (HCMA 2016).

As it is mentioned, the water treatment in biopools is carried out through mechanical techniques, biological filters and plants growing in the system (Guardia-Puebla et al. 2019). The aquatic plants enrich the water with oxygen and remove nutrients (nitrogen and phosphorus) from the water through the root system which acts as a natural biological filter and incorporate nutrients into cell mass (Harvey & Fox 1973).

Although the aim of water purification in natural swimming pools is to remove contaminants, especially nutrients, Decree no. 308/2012 Coll. determines the water quality requirements of biopool considering microbiological and biological indicators of water quality (Tab. 1).

Tab. 1: Water quality requirements for natural swimming pools (SR Ministry of Health 2012)

Indicators	Unit	Limit value
Escherichia coli	CFU/100 ml	100
Enterococci	CFU/100 ml	50
Pseudomonas aeruginosa	CFU/100 ml	10

The construction of biopool doesn't have significant environmental impacts so is not necessary to implement environmental impact assessment process before its permission (Ondrejka Harbulakova et al. 2018; Ondrejka Harbulakova et al. 2016; Zeleňáková & Junáková 2018).

### Case study - Biopool in Lackovce village

#### Study area and technical solution

The bio-swimming pool in the cadastral area of the Lackovce village is located on the flatland of eastern Slovakia in the district of Humenné city. The construction of the biopool consists of a swimming pool with a size of 33x25 m with an average depth of 1.6 m (1320 m<sup>3</sup>), children's pool with a plan size of 14x10 m with an average depth of 0.7 m (98 m<sup>3</sup>) and external biofiltration of 35.5 x 25 m with an average depth of 1.2 m (1065 m<sup>3</sup>). Biopool is supplied with water from public water supply. The inlet duct is outfallen into external biofilter section and from there water overflows into the pool section. The water level in the external biofiltration is at a level of about 0.5 m above the water level in the pool, which ensures natural overflow of purified water to the swimming pool.

From the pools, the water is continuously siphoned off and pumped into external biofiltration, at the beginning of which there is mechanically drum filter for filtering of impurities from the water. Pre-treated water flows into the external biofiltration where nutrients are removed. The water surface of the pools and its cleaning is ensured by skimming the surface with six powerful skimmers. These provide collection of floating debris and mechanical particles. The upper level meniscus together with the impurities are transported through the pumps to external biofiltration.

After water purification in external biofiltration it returns gravitationally back to the swimming pool. If necessary, the pool water is discharged into the public sewer.

#### Technological process of water treatment through biofiltration

In Lackovce biopool, the water treatment for safe bathing is proposed using biotechnology, in the form of coastal biological zones and external biofiltration. Initial water treatment takes place in coastal biological zones, with water being fed through dolomite gravel substrate of fraction 16-24 mm and CaCO<sub>3</sub> x nH<sub>2</sub>O sorber. Here the nitrification process with nitrifying bacteria takes place on the substrate surfaces. The limestone sorber ensures the sorption of phosphorus components, which should be maximum 0.5 mg/L.

External biofiltration serves for biological water purification, where phytoplankton and zooplankton filter impurities and feed on pollutants (Bhateria & Jain 2016) such as nitrogen and phosphorus (Junáková & Bálintová 2012), in a continuous process of self-healing (Khan & Ali 2018). The surface area of external biofiltration is designed so that its nutrient sorption capacity exceeds the nutrient supply arising during bathing and operation. In external biofiltration also called as regeneration zone there are basket weirs about 3500 mm wide, which are filled with a substrate of 24-36 mm. They mechanically, but also sorptively, treat the flowing water. Oligotrophic and mesotrophic plants are planted in these basket weirs, which sorb the pollutants through the roots and purify the water.

There is a place on the areas between the weirs that serves for biological adjustment during stress operation. In this place, other biological alternatives such as: *Cladophora* (phytomaterial), *Cladocera* (plankton crustaceans) and others are used. The most used of the Cladocera series are *Daphnia pulex*, *Daphnia magna*. They are used primarily for the filtration of unicellular algae, but also for organic residues, protozoa and bacteria. They play an important role in regulating the cycles of nitrates, phosphates and phytoplankton.

The regeneration zone is designed to continuously circulate water through the sorber and phytomaterial surfaces. The water flow rate is such that the hydrobiological processes of the water treatment can be reliably carried out in the individual systems, at an oxygen regime of 6-10 mg/L O<sub>2</sub> while maintaining the aerobic process.

Simple and technical maintenance is necessary for operation because it affects the compliance with safe bathing limits given in regulation (SR Ministry of Health 2012). Because the biopool is an ecological and environmental element in the landscape, it is necessary to consider the use of alternative waste materials for its construction (e.g. Junakova & Junak 2017; Številová et al. 2008; Junáková & Bálintová, 2014).

## Conclusion

The main objectives of sustainable development include, among other things, quality of life, recreation and clean water. Bathing recreation is an essential activity in the summer months.

Paper summarizes information about biopools as a natural alternative of swimming pools that are useful both to people and to the environment. The advantage of biopool is used water treatment method, which is naturally occurring, safe and sustainable alternative to mechanical and chemical treatment commonly used in the majority of swimming pools.

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### **Souhrn**

Odkryté koupací zařízení - biokoupaliště se nachází se v západní části obce Lackovce v okrese Humenné. Biokoupaliště se skládá z koupací části (dva bazény), biofiltrace v umělé vodní nádrži a samotné technologie čištění vody (potrubí, čerpadla, armatury). V biokoupališti v Lackovce je navržena úprava vody pro bezpečné koupání biotechnologií, formou externí biofiltrace a pobřežními biologickými zónami. Prvotní úprava vody probíhá v pobřežních biologických zónách. Zde dochází k nitrifikačním procesu na celých plochách nitrifikačních bakteriemi. Vápencový absorber zabezpečuje absorbování fosforových složek. Celá vodní plocha a čištění její hladiny je zajištěno skimmrovaním hladiny šesti výkonnými skimmry. Tyto zajišťují sbírání náletových biologických, ale i mechanických částic. Vrchní meniskus hladiny spolu s nečistotami je dopravován přes čerpadla do externí biofiltrace. Biokoupaliště představuje ekologický a environmentální prvek v zemi, využívané je zejména místními obyvateli, kteří tuto možnost rekreace velmi oceňují.

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## THE WEEDS OF ALFALFA AS A SOURCE OF POLLEN ALLERGENS IN THE LANDSCAPE

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### Abstract

The common alfalfa (*Medicago sativa*) is one of the few cultural plants cultivated on arable land for more than a year. However, together with the crop, weeds are also present on the land, among which highly allergenic plants can be found. Our study deals with data related to the weed infestation of the fodder crop *Medicago sativa* sampled in Kroměříž District (southeast of the Czech Republic). We found the differences in weed species composition during three years of monitoring, where annual weeds common for annual crops (e.g. *Fumaria officinalis*, *Viola arvensis*) continually disappeared at the expense of perennial weeds common mainly in second (e.g. *Arctium tomentosum*, *Rumex acetosa*) and third year of monitoring (e.g. *Lamium purpureum*, *Taraxacum* sect. *Ruderalia*). Frequency of anemophilous allergenic plants (e.g. *Plantago lanceolata*, *Rumex acetosa*) changed during weed species composition succession.

**Key words:** pollen, allergen, weed, *Medicago sativa*

### Introduction

The term “weeds” refers to undesirable plants present on cultivated land. Weed plants are frequently used in the kitchen as herbs. They also play a role as medicinal plants. Thirty-five allergenic pollens have been identified in Europe. The most important ones are ragweed pollens and plantain pollens (Gadermaier et al., 2014).

Biological diversity in urban and suburban ecosystems may depend on various non-indigenous plant species, including crops, garden plants and weeds. Weed species may contribute to preservation of biological diversity by providing sufficient pollen for pollinators. The benefit of plants in urban and agricultural areas is often underestimated in terms of biological diversity assessment (Koyama et al., 2018).

Grass and weed pollens are major producers of allergenic pollens. Pollen grains dispersing freely in the air are triggers of asthma and allergies on a large scale (Siti et al., 2015).

Pollen grains originating from weed plants are most commonly present in the air from early summer to mid September. One plant may produce millions of pollen grains per day. The amount of pollen in the air is influenced by weather. The levels of pollen in the air culminate on hot windy days (Ziska et al., 2011).

### Materials and methods

The plot in question is situated in Kroměříž District (Zlín Region, Czech Republic). The plot is managed by the agricultural business Kvasicko, a. s. The plot belongs to the sugar beet production area and lies in a warm and moderately moist climate region. The average annual temperature is in the range from 8-9°C. The plot “Novina levá” (5902.4) covers 28.64 ha, and its gradient is 0.95°. The plot altitude is 186.55 metres a.s.l. and its BPEJ code is 3.59.00. The soil types are gley fluvisol and fluvisol with gley; the topsoil thickness is deep to very deep. The topsoil structure is crumbly.

The previous crop on the plot was winter wheat (*Triticum aestivum*), which was harvested on 13 Aug 2013. Common alfalfa (*Medicago sativa*) was sown on 11 Apr 2014.

The weed rate in the cover of the common alfalfa (*Medicago sativa*) was assessed using a counting method. The covers were monitored for three years. Four iterations of four measurements were made each year. The measurements were made in a defined square sized 4x4 metres. The selected representative areas were the same throughout the three years. Measurements on the plot “Novina levá” were made on 1 Jun 2014, 10 Jun 2014, 20 Aug 2014, 20 Sep 2014, 10 Mar 2015, 1 Jun 2015, 8 Jul 2015, 19 Aug 2015, 12 Mar 2016, 4 Jun 2016, 9 Jul 2016, 18 Oct 2016.

The scientific names of each weed species were used according to Kubát Kubát et al. (2002). The data obtained on the weed rate in the alfalfa cover were processed using multidimensional analysis of ecological data. The selection of the optimum analysis was governed by the length of gradient (LG), determined by Detrended Correspondence Analysis (DCA). In addition, we applied redundancy analysis (RDA). The testing of conclusiveness using the Monte-Carlo test consisted of 999

permutations. The data were processed using the software Canoco 5.0 (Ter Braak and Šmilauer, 2012).

## Results

Eleven weed species were identified in the alfalfa cover in the course of the monitoring. The numbers of weeds in each monitoring period are shown in Table 1. The identified species include species producing strongly allergenic pollens.

The alfalfa weed rate results were processed using Detrended canonical analysis (DCA), which calculated the lengths of gradient; it was 1.2. Furthermore, the results were processed using redundancy analysis (RDA). The RDA determines the spatial layout of the individual weed species and assessment dates. The RDA results are significant at the significance level  $\alpha = 0.001$ . Thus, the results are statistically highly conclusive. According to the ordination diagram (Fig. 1), the weed species can be divided into several categories.

The first category of weeds was present mostly in the beginning of the monitoring in June 2014 (*Brassica napus* subsp. *napus*, *Viola arvensis*, Table 1). The second successional stage of weeds was present later (mostly in late summer 2014; *Fumaria officinalis*). During the second year (2015), we found typically *Capsella bursa-pastoris*, *Plantago lanceolata*, *Rumex acetosa*, *Arctium tomentosum* and *Veronica persica*. Last category (typical for last year of monitoring, 2016) consists of the species *Stellaria media*, *Lamium purpureum*, *Taraxacum* sect. *Ruderalia* (Table 1).

Tab. 1: Overview of weed species found in the alfalfa crop

Species names	Abbreviations	Frequency per assessment dates, (pcs.m <sup>-2</sup> )											
		1 Jun 2014	10 Jun 2014	20 Aug 2014	20 Sep 2014	10 Mar 2015	1 Jun 2015	8 Jul 2015	19 Aug 2015	12 Mar 2016	4 Jun 2016	9 Jul 2016	18 Oct 2016
Species with strongly allergenic pollens													
<i>Brassica napus</i> subsp. <i>napus</i>	Bra napu	6.8	6.3	0.8	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>Plantago lanceolata</i>	Pla lanc	0.0	0.5	1.5	0.8	1.3	2.0	1.0	2.8	0.0	1.0	1.3	0.5
<i>Rumex acetosa</i>	Rum acet	0.0	0.0	0.0	0.0	0.5	3.3	2.0	6/0	0.0	0.0	0.0	0.0
<i>Taraxacum</i> sect. <i>Ruderalia</i>	Tar Rude	0.0	0.0	2.8	4.3	6.5	7.5	4.8	5.0	7.3	7.0	10.3	9.3
Other pollen-producing species													
<i>Arctium tomentosum</i>	Arc tome	0.0	0.0	2.3	1.0	1.3	0.5	1.5	0.8	0.3	0.3	0.0	0.0
<i>Capsella bursa-pastoris</i>	Cap burs	1.3	4.8	6.8	1.8	9.8	2.3	2.3	8.0	3.0	9.0	1.8	1.3
<i>Fumaria officinalis</i>	Fum offi	5.5	3.0	4.5	4.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>Lamium purpureum</i>	Lam purp	0.0	0.0	0.0	0.5	3.0	12.0	6.5	4.8	10.5	8.5	7.8	11.8
<i>Stellaria media</i>	Ste medi	7.8	5.8	2.3	0.5	5.3	8.5	1.5	4.0	6.5	3.8	1.3	2.5
<i>Veronica persica</i>	Ver pers	1.0	0.3	6.0	6.0	6.5	8.5	1.5	5.8	10.5	11.3	6.0	3.0
<i>Viola arvensis</i>	Vio arve	9.5	7.3	0.5	0.3	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0

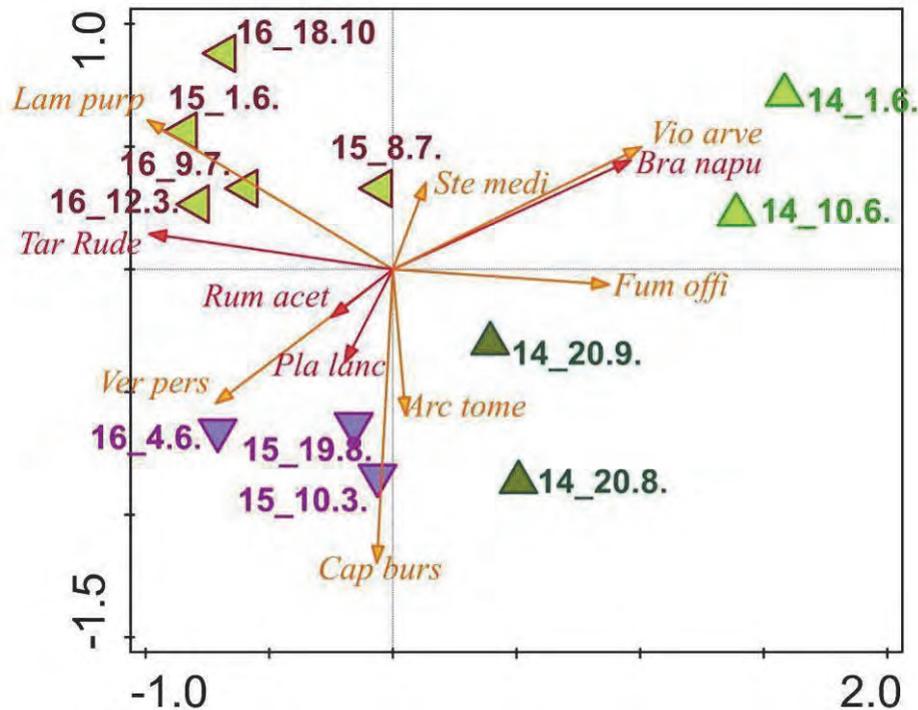


Fig. 1: Ordination diagram expressing the relationship between the assessment date and weed species found in the alfalfa culture (RDA results; pseudo F = 7.9; p = 0.001)

### Discussion

Based on the results, we can conclude that species producing strongly allergenic pollens were found in the study locality together with alfalfa crop. These species included *Brassica napus* subsp. *napus*, *Plantago lanceolata*, *Rumex acetosa* and *Taraxacum* sect. *Ruderalia*.

The species *Brassica napus* subsp. *napus* was found mostly on the initial assessment dates. The subsequent mowing of the alfalfa reduced the flowering of the species, which was then not present in the following years.

The other species producing allergenic pollens are *Plantago lanceolata*, *Rumex acetosa*. These species were present mostly in the second year of the alfalfa culture. It is the second year that is important for flowering in these species. Repeated mowing will only reduce the flowering period but will not eliminate the presence of these weed species.

The presence of *Taraxacum* sect. *Ruderalia* was observed mostly in the second and third years of the alfalfa cultivation. This species can be a source of allergenic pollen notably in spring and early summer, if the alfalfa cover is disconnected. Although alfalfa is also allergenic plant, it is not a source of allergenic pollen grains due to early harvesting prior to flowering time, in the growth period in which buds form.

### Conclusion

Alfalfa cover stands are not significant in terms of production of allergenic pollens. Each mowing of alfalfa significantly reduce the flowering plants and, thus, pollen production. The presence of weed species changes during the years in which alfalfa is cultivated. A change in the weed species composition occurs as well over a multi-year vegetation period.

Species that may be sources of allergenic pollens include *Brassica napus* subsp. *napus*, *Plantago lanceolata*, *Rumex acetosa* and *Taraxacum* sect. *Ruderalia*. Reducing the weed rates in alfalfa may also lead to reduction of allergenic pollen production.

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### **Souhrn**

Vojtěška setá (*Medicago sativa*) je jednou z mála kulturních rostlin, které se pěstují víceletým způsobem. Sledovaný pozemek se nachází v okrese Kroměříž (Zlínský kraj, ČR). V průběhu několikaleté vegetační doby dochází ke změnám i v druhovém složení plevelů. K druhům, které mohou být zdrojem alergenního pylu jsou *Brassica napus* subsp. *napus*, *Plantago lanceolata*, *Rumex acetosa* a *Taraxacum* sect. *Ruderalia*. Omezení zaplevelení vojtěšky může zajistit také snížení produkce alergenního pylu.

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## TOURISM AND RECREATIONAL POTENTIAL IN SOLOMON ISLANDS EXCEEDING THE BENEFITS OF LOGGING SECTOR

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### Abstract

Most of the area in Solomon Islands is covered by tropical forests, possessing abundant diversity of endemic animal species (Solomon eagle, Red-knobbed Imperial Pigeon) and native plants (orchids, begonias, palms). Many of these unique species are endangered due to unsustainable logging practices over the last decades. This paper emphasizes the long-term benefits of recreational and ecotourism functions of forests exceeding the current value of timber for export. Logging sector, as the main economic driver in Solomon Islands today, has very negative impacts on ecosystem and may cause irreversible loss of forests in the forthcoming future. The change can be achieved by promoting successful models of ecotourism, such as conservation projects in Tetepare Island or Kolombangara. Replacement of short-term economic benefits by long-term benefits of ecotourism is a necessary step to protect the precious forests and to attract the local and foreign tourists to Solomon Islands.

**Key words:** biodiversity, deforestation, endemic species, ecotourism, Solomon Islands

### Introduction

Solomon Islands are located in the South Pacific Ocean on the area 28 400 square kilometers. Dense rainforests cover 90% of the land. In 2014, more than 2,5 million cubic meters of wood had been logged, which exceeds sustainable rates per annum by 10 times. The Solomon Islands economy grew by 3.5 percent in 2016 driven by a peak in the forestry sector (IMF, 2018). Logging remains at a crisis level, set to exhaust the accessible resource in the very near future (Roughan, Wara, 2010). Local communities heavily depend on forests not only for water resources, traditional food and medicine, but they are culturally connected to the land and nature. Indigenous communities still live traditional way of life. Over-harvesting has negative impacts on the environment, such as disrupted microclimate, diminishing water resources, soil degradation and erosion already taking place in the country. The most threatened are many endemic species of plants and animals found nowhere else in the world. These long-standing threats to national biodiversity caused by extensive logging must be stopped and replaced by forests conservation. Every year, the scientists discover new animal, insect or plant species. In 2015, New Georgian monkey-faced bat - *Pteralopex taki* (Fig. 1), new species of megabat endemic to the Solomon Islands was discovered. As a result of over-exploitation of forests, *Pteralopex taki* belongs to the category of critically endangered animals.



Fig. 1: Endangered species of *Pteralopex taki* (Tyron Lavery Ecology, 2018)

Native people are pressured by foreign logging companies to give away their rights over own forests in return for minimum income. Indigenous groups receive 1/10 of export log prices. Rarely, the companies keep the promise to build the schools, hospitals or roads for local communities. Solomon Islands possesses massive potential to develop forests recreation services and ecotourism as an alternative source of income. However, if the high rates of deforestation continue in the future,

then development of ecotourism is threatened. Once all old rainforests are logged out, the government and society would have to pay very high price to regenerate local environment.

On the other hand, promotion of conservation projects is a long-term strategy outweighing the short-term economic benefits of destructive logging. Through ecotourism local people are kept away from cutting down precious trees, moreover they can gain other life skills and knowledge, that improve life standards of all native communities. It is important to have a vision how to develop new revenue sources from ecotourism, taking examples from already existing successful conservation projects in Solomon Islands.

### **Materials and methods**

In order to prove the value of conservation projects, we will be analyzing the aspects of ecotourism in two already successfully implemented projects. The first one is Kolombangara Island Biodiversity Conservation Association (KIBCA) established by native groups as a result of long lasting deforestation and destructive logging practices. Kolombangara forests located 400m above sea level are under constant threat from illegal extraction of timber. Kolombangara Island has extremely high rates of terrestrial biodiversity with extraordinary fauna. Recently, the scientists discovered 13 different frogs, that haven't been known before.

The mountain area forms a 20,000-ha conservation area, the largest in Solomon Islands (Kolombangara, 2019). Significant cultural heritage of indigenous people is also promoted through ecotourism. Since KIBCA begun to operate and encouraged sustainable management of local forests, the local landlords have gained a range of benefits. On one hand, ecotourism attracts increasing number of ecotourists and researchers from all over the world. Ecotourism and recreation services bring economic profits so that native islanders can enjoy higher quality of life. KIBCA has become successful model both locally and internationally, which aims to further promote sustainable development throughout the country.

Tetepare Descendants Association (TDA) is strongly supported by KIBCA. These two associations implement similar conservation practices; they share valuable experiences. The main objectives are protecting endemic species of plants and animals living in native ecosystems; encouraging sustainable management of natural resources through viable economic and social ventures for local groups (Pacific Islands Protected Area Portal, 2019)

TDA's activities also focus on widening ecotourists' knowledge about the local environment and cultural heritage. Since 2013, Tetepare Island possesses 13km-long Marine Protected Area, that preserves marine species in its natural states. The Tetepare conservation program includes research station and Eco lodge. Monitoring programs have been established for turtles, seagrass, coconut crabs, reef check, forest, fish and trochus (Tetepare, 2019).

Both places, Kolombangara and Tetepare Island have Eco lodges that can accommodate limited number of ecotourists. Places like this become more popular among people (ecotourists, scientists, ornithologists) who search for peaceful environment and have a vision to educate themselves. Therefore, many forested areas in Solomon Islands can be preserved via sustainable forest management before being completely logged out.

In 2002, a survey was conducted to find out what Solomon Islanders think, how ecotourism could benefit the country? What would it be, if the country continued with the current economic development activities? (Ell, 2003) Here are some responses from local people to the last question:

-There is currently a dangerously rapid loss of culture, without preservation of heritage, our traditions will disappear forever

-Loss of natural resources at a dangerous rate threatens village life as many people still live off the land

-There is a loss of community spirit when international developers take advantage of us and take away our rights to our own resources and land

Based on the answers, we have to address the forests exploitation as an urgent issue, negatively effecting local population. Their culture and environment is deeply threatened by unsustainable logging. There is a need to conserve all primary forests that have great potential to develop recreation services and ecotourism following the examples of KIBCA or TDA. The revenue from ecotourism and recreation activities would be shared among community, this way, the value of forests won't be lost and cultural heritage would be preserved too. Long-term sustainability is beneficial solution for majority of native communities.

## Results

The implementation of ecotourism in endangered areas such as Kolombangara has led to improvement of indigenous peoples' life. KIBCA and TDA sustainable development projects not only conserve precious ecosystems, but they reverse biodiversity loss in the country. Over-exploitation of natural resources and inappropriate land practices in Tetepare and Kolombangara island were reduced.

Recreation and ecotourism services have brought great opportunities to the people living in rural areas: new jobs, improved qualities of education, protection of unique culture and local customs. Stable income in ecotourism sector have allowed natives to afford studies, medical care and all necessities for living. Recreational activities maximized the potential of historical and cultural sites that attract tourists from all around the globe.

Only by looking at long-term benefits in preservation of old-growth forests and copying successful models of conservation projects in Solomon Islands, we can achieve that less forests will be exploited. Immediate financial gains from logging activities do not reflect the real value of forests. If unregulated forests exploitation continues to take place in Solomon Islands, it would result in decrease of ecotourism in the future, because the most precious animal and plant species will eventually become extinct.

## Discussion

Analyzing the tourism sector in Solomon Islands, commercial traveling is not very popular in the country. Apart from the capital city of Honiara, where we can find number of commercial resorts, most of the places don't have fully developed infrastructure. Current development of mass tourism is low, while ecotourism is on the rise. The country comprises of scattered Islands that have great predisposition to develop ecotourism. Many islands have already built the Eco lodges with limited tourists occupancy. Moreover, the local communities promote the tourism in eco-friendly way, which is the right direction to protect fragile natural sites. In the future, ecotourism can ensure the well-being of the population and may become the most dominant form of tourism industry.

## Conclusion

In the case of ongoing exploitation of rainforests in Solomon Islands, immediate action is needed! Local communities should be encouraged to reverse the current trend of logging sector, which deeply threatens stability of the environment and also destroys the ecotourism potential. The value of forests cannot be only measured from the economic perspective, but socio-environmental values should be also taken into account.

The long-term investment in conserving the rainforests should prevail over immediate conventional economic benefits of logging. Based on the recognition that unique biodiversity is irreplaceable and society's heavy dependence on the nature, the irreparable damage of forests can be avoided.

By doing so, the future generation can benefit from diverse natural treasures- extraordinary flora and fauna. The most successful framework suitable for Solomon Islands environment is to promote the recreation and ecotourism services.

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## **Souhrn**

Většinu území Šalamounových ostrovů pokrývají tropické pralesy, ve kterých se vyskytují bohaté druhy živočišných endemitů (Orel šalamounsky, Červenohrdlý císařský holub) a původních rostlin (orchideje, begónie, palmy). Mnoho těchto jedinečných druhů je ohrožených z důvodu neudržitelných těžebních praktik v posledních dekáдах. Tento příspěvek se soustředí na dlouhodobé benefity rekreačních služeb a ekoturistiky v lesích, daleko přesahující současnou hodnotu vyváženého dřeva. Odvětví těžby dřeva je dnes hlavní hnací síla ekonomiky na Šalamounových ostrovech, má velmi negativní dopady na ekosystém a může způsobit nevratné ztráty lesů v blízké budoucnosti. Změnu dosáhneme podporou a propagací úspěšných modelů ekoturistiky, jakými jsou projekty ochrany přírody na ostrově Tetepare nebo Kolombangara. Nezbytný krok jak ochránit vzácné lesy a přilákat místních či zahraničních turistů je náhrada krátkodobých ekonomických benefitů za dlouhodobé přínosy ekoturistiky.

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## TOURISM DEVELOPMENT IN THE AREA OF THE BOHEMIAN FOREST – THE NEXT ŠUMAVA OR A COMPLETELY DIFFERENT CONCEPT?

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### Abstract

The main goal of the cross-border project is to link nature preservation with the requirements of the strategic planning for sustainable tourism development in the Czech Republic. In addition, the project focuses on the valuable areas that are not sufficiently protected by legislation (landscape, resting areas, abandoned villages). Another objective of the project is to create a Czech-Bavarian methodology for nature and landscape evaluation regardless of the different legislation. The demands of all the involved parties were taken into consideration. Furthermore, we do not only focus on the partial studies that have been conducted in the area, but also on the international project the European Green Belt. In order to conduct a successful project, we recognize that it is vital to communicate effectively with all the parties concerned. For example, to create a territorial plan, it is important to coordinate the project with the Pilsen region. The analytic part of the project includes a detailed overview of visitors to the Bohemian Forest. The data was collected via questionnaires, visitor recountings and the STRAVA.com website. The main outcome of the analytic part is a list of recommended landmarks that could lead to tourist development and nature preservation in the area.

**Key words:** Pilsen region, Czech- Bavarian methodology, visitors, communicate

### Introduction

The Bohemian Forest, with the exception of the Chodsko Region, has been only a marginally attractive destination for tourism for a long time. One of the main contribution to the current state, was the existence of the Iron Curtain on the border with the German Democratic Republic in the second half of the 20<sup>th</sup> century. In 2005 the Protected Landscape Area (PLA) the Bohemian Forest was created in the Pilsen Region in order to preserve the unique natural area with a number of abandoned settlements. This area is valuable, not only for its high number of natural biotopes, but also for the vast woodland and marshland flora and its unique cultural landscape with remnants and traces of historical use and settlements. Especially the combination of abandoned crafts with the return of nature in these locations make the Bohemian Forest special. The creation of the Protected Landscape Area was supported by the local administration to increase the potential of tourist development. A concept study called "Tourism and Recreation" was created prior to the PLA as a basis for future care via the support of sustainable tourist development in accordance with the needs of natural preservation (Beneš, 2003).

Unfortunately, the mere existence of the PLA didn't really increase tourism in the area. The marketing strategies of the Tachov and Domažlice regions aren't helping either. At the moment, there is no unified destination strategy for the Czech Republic. In an effort to boost the visiting rate of the area, there is a number of isolated and non-conceptual potential plans with possible negative impacts on nature.

In order to prevent negative impacts on nature preservation with the execution of non-conceptual plans to increase tourism and to remain predictable for potential investors, "The Cross-border Concept for Nature Preservation and Exploration in the Area of the Bohemian Forest and Horní Falc, number 194" was created. Lead by the Regional Development Agency of the Pilsen Region, the Pilsen Region, Nature Conservation Agency of the Czech Republic (AOPK ČR), Hochschule Weihenstephan Triesdorf and the local administration of Horní Falc.

The Main Goals of the Project Are:

- to define the priorities of nature preservation
- to identify natural and cultural-historical monuments suitable for tourism
- to create a plan for transportation and visitor infrastructure with consideration for nature preservation and area interpretation
- to create communication strategies for the whole area

The cross-border approach of all the goals is a great contribution of the project.

## Materials and Methods

The Protected Landscape Area the Bohemian Forest is the core of the area in question. However, since most towns, i.e. Places that could provide jobs, are located outside of the PLA, the area in question has been expanded to the whole executive town area of Domažlice, Horšovský Týn and Tachov. The analogue area demarcation has been set to the common border of Horní Falc (Fig. 1).

The basis of nature preservation stems from the legislation and preservation plan of the Bohemian Forest PLA. The shared methodology used by the Bavarian side has been based on this as well, despite the differences in legislation. Data from the partners of the Pilsen Region project (Digital map of the administration of the Pilsen Region portal) and of AOPK ČR (Nature Preservation portal) were used in the process.

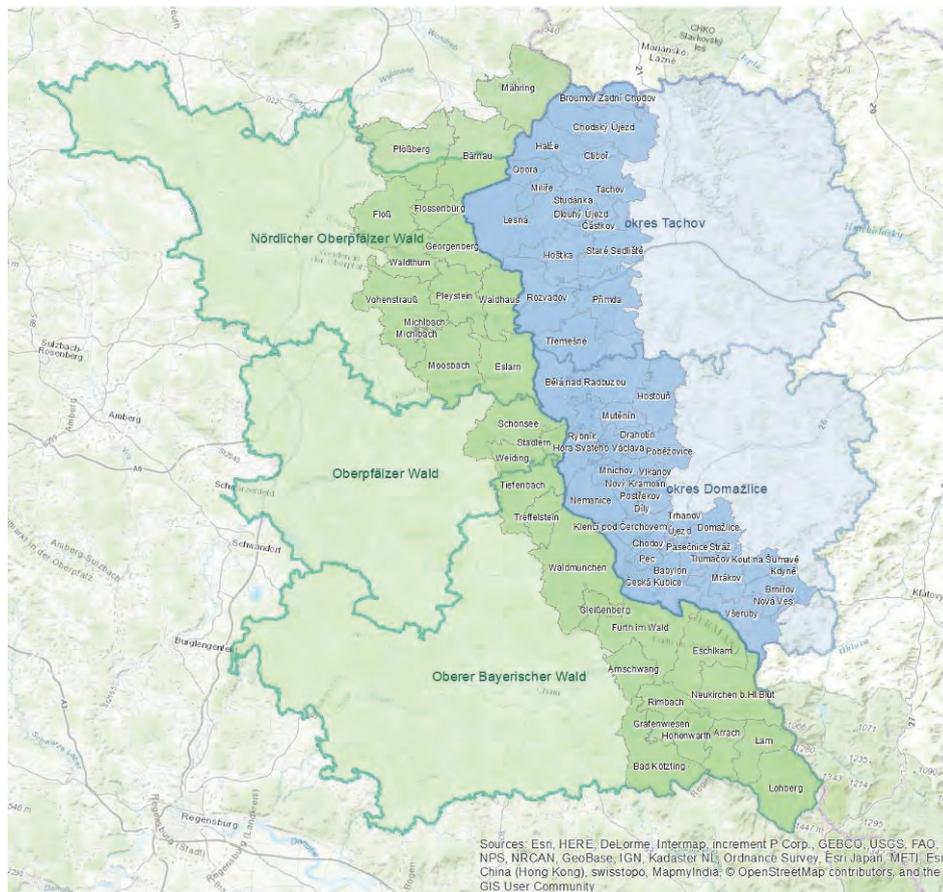


Fig. 1: Map of borders

In addition, basic data about the visitors were collected via questionnaires, tourist counters, and via information provided by the local phone companies. The collected data has been supplemented with information from service providers (hostels, restaurants, information centres, public transportation provided the number of travellers) and with the help of the [www.strava.com](http://www.strava.com) portal. The questionnaires were carried out through interviews and distribution of free questionnaires. Tourist counters were set up in ten selected trail crossroads in the core area. The phone companies provide the use of their data as a regular offer. However, their use is very dependant on thorough and specific instructions. The general disadvantage of this method is the partial data anonymity, area coverage (including the state border), and high financial cost. The advantage is then the collection of a great amount of data with partial visitor identification (age, movement, origin).

Next, the territorial town plans were used for the evaluation of potential conflicts that may arise with nature preservation in the area (most of these were approved before the creation of the PLA). The basic transportation database of the Pilsen region was used to process the transportation options, including data about personal car and truck travel on the selected roads. Furthermore, a socio-economic study with regards to the human element in the area has been conducted.

The entry data were analysed via the ArcGIS program. The mapping data are done via S-JTSK system on the Czech side and by Gauss-Krüger on the Bavarian side.

A group spanning multiple fields with representatives from important nature preservation, tourism, and regional development subjects was created in order to interpret the data and process the planned study.

A similar methodical approach was used on the Bavarian side.

## Results

An analytical map that differentiates the importance of the area according to the quality of nature was created based on the entry data on the value of natural phenomena and area limits. The analytical map is accompanied by a table of attributes that evaluates individual locations based on the limits and use of the natural phenomena in tourism (Tab. 1). The project also follows the new principle of protecting the resting areas of big mammals with consideration for, for example, hunter needs. Despite the low tourist use of the area of the Bohemian Forest, the visitor study has shown that the situation near the highest peak Čerchov is approaching critical levels.

Tab. 1: Nature limits

Location	Movement											Informatio		Food and Lodging					Sport		Entertainment			Transportation				
	Hiking	Hiking	Winter Trekking	Winter Sports	Cycling	Equestrian Tourism	Facilities	Facilities	Facilities																			
Number																												
Location Name																												
Protected Subject																												
1	Čerchov vrchol	Protected Landscape Area (PLA) 2 <sup>nd</sup> area Sites of Community Importance (SCI) Landscape	P1	P2	P3	P4	P5	P7	P8	P9	P10	P11	I1	I2	US1	US2	US3	US4	US5	S1	S2	Z1	Z3	Z4	D1	D2	D3	
			2	2	0	0	2	0	2	3	0	2	3	3	0	0	1	3	3	0	1	3	0	0	0	1	1	1
2	Čerchovské hvozdy	Large-sized Expecially Protected Areas (LEPA) PLA 1 <sup>st</sup> area SCI Landscape Big Mammal Biotope (BMB) 1 - KZ	0	0	0	0	0	0	1	0	1	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	Bystřice	LEPA PLA 1 <sup>st</sup> area SCI Landscape BMB 1 - KZ	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	Údolí Chladné Bystřice	PLA 2nd area SCI Landscape BMB 1 - KZ	1	1	1	1	1	1	1	0	1	3	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1

Area priorities were created from the study according to the visit rate and they were ranked based on their attractivity in the natural, cultural-historical, or mixed category. The result of the study is the designation of priority areas and monuments in the area. The natural priority areas are places with the highest amount of important natural locations (Herštejn, Nemanická Niva). The cultural-historical areas were designated as areas with a higher concentration of cultural-historical monuments, including immaterial cultural heritage (folklore and abandoned villages and crafts). A base study of their location

and importance was conducted based on their specific value (Procházka 2018). Next, a mixed priority area which includes both natural and cultural-historical locations with information about the tourism and recreation infrastructure was determined (Fig. 2).

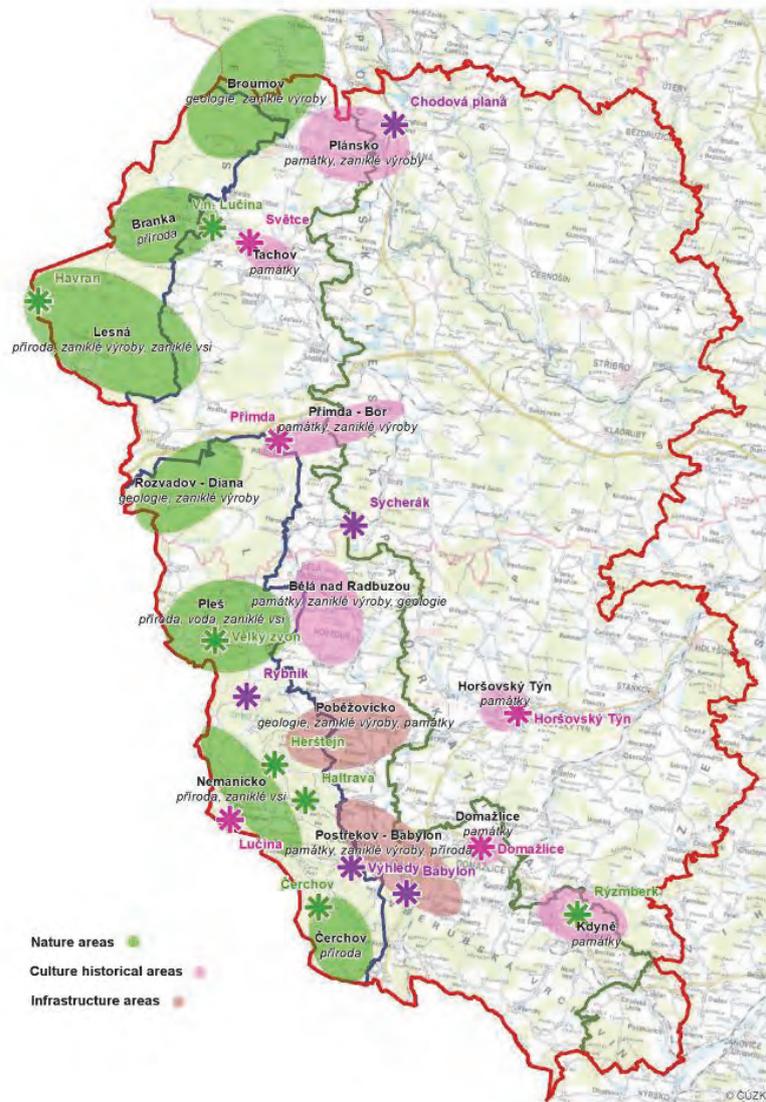


Fig. 2: Recreational infrastructure

Accessibility and public transportation options were analysed on the Czech side of the area in question. This analysis showed the issues in the use of the area in tourism. The main problem is the low, nearly non-existent public transportation frequency during weekends and holidays, great time consumption and bad accessibility of the core area. The cyclo-bus use in the area was analysed separately. It should partially balance out the lack of public transportation. Due to the wrong timetable graphic setting, this mode of transportation is barely used by the public. Therefore, car transportation is the prevalent type in the area.

One of the important results of the project is the establishment of a visit rate model of the area based on the data which took into consideration all the qualitative and quantitative information about the visitors. Discussions during the ITEP tourism expo, events like the Bohemian Forest Day and others (Fig. 3) were used to verify the model. The analysis suggests that about 500 000 visitors, including cabin owners and "cross-border gastronomy visitors", are moving in the area.

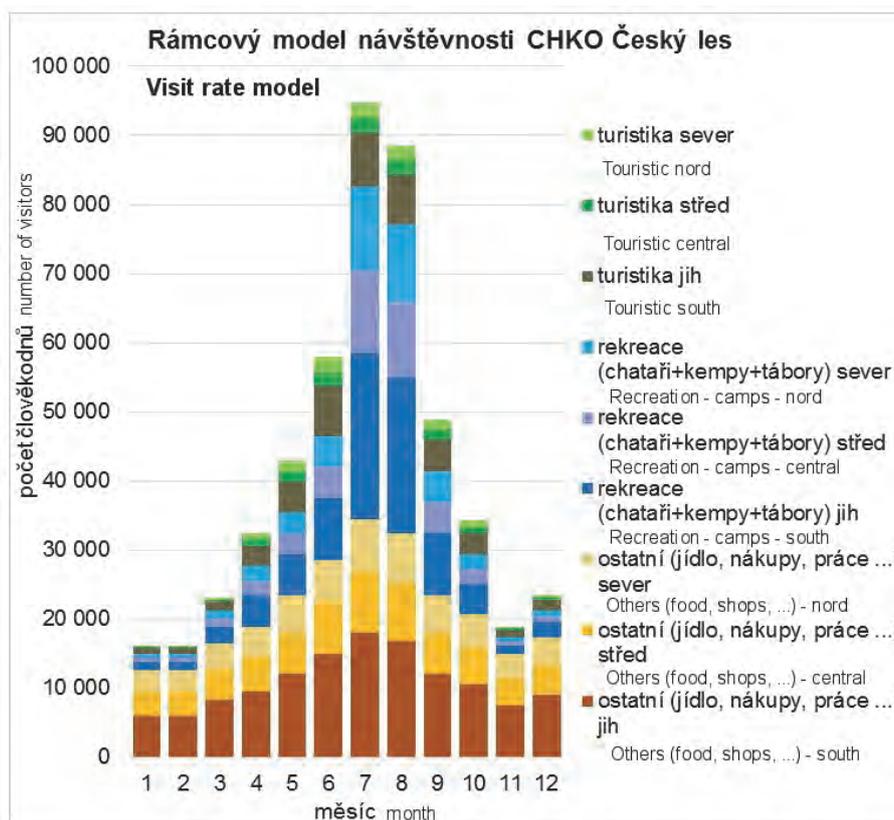


Fig. 3: The general model of visitors – PLA Český les

## Discussion

The analytical part of the presented project has been finished and the plans for processing the proposals are currently in progress. This discussion is focused on themes with the potential for the use of these proposals.

The limits of naturally valued locations for tourism were defined in the analytical part. These limits were set with consideration for the real value and preservation of objects in specific locations. The following debates were focused on creating proper ways of visitor regulation in sensitive locations, the supplementing and networking of infrastructure, and appropriate interpretation of attractive nature in tourism.

To make use of the unique potential of abandoned villages and crafts seems like an appropriate way to support tourism and cross-border cooperation. Similar to making the natural phenomena accessible and interpreting them, this too can lead to damage of the preserved value, for example, with the wrong kind of restoration. A good example of abandoned village interpretation in cross-border context is the restoration of the foundation of village Lučina (Grafenried), which combines a number of related activities and is an example of successful execution of a cross-border project from a tourist point of view.

The area is valuable for its core unburdened by individual car transportation which provides great potential for the development of various movement activities (tourism, cycling, including electromobility and the travel of visitors with handicaps, for example, the wheelchair-bound). In this area we want to consider the plans for entry points of infrastructure and possible transportation and accessibility in the core of the area in detail, using alternative transportation other than individual car travel.

A key disadvantage for the development of tourism is the insufficient infrastructure of the whole area. For the planning section of the study, it is vital to propose appropriate location and networking of hard infrastructure in relation to soft infrastructure in the significant core area.

The issues of practical sustainability and execution of the study have been considered since the beginning of the project. Its execution is happening in close cooperation with the Department of Regional Development in the Pilsen Region so that its results can be used in the regional analytical territorial materials. All the relevant subjects are communicating intensively for the entire duration of the project. This communication has resulted in the creation of a group of professionals with representatives from different regions and fields (forest rangers, local administration, museums, businesses). We are planning to cooperate with them intensively on the execution of the proposal.

## Conclusion

In the years 2018 – 2020 a cross-border study is being created for the area of the PLA the Bohemian Forest which is attempting to intertwine the needs of nature preservation and developmental activities for tourism enhancement so that the conflicts would be minimal. Defining the nature preservation priorities, defining natural and cultural values important for the boost of tourism, and suggesting appropriate ways of tourism marketing and development are all part of the study. An important part of the project execution is intensive communication with the broad executive team and with the external subjects in the area. Standard processes and tools (mapping, text, GIS applications) including a SWOT analysis are included in the processing of the results. The main expected result of the project is making a deal between the main subjects of nature preservation and tourism about mutual communication about the project and the fulfilment of its goals.

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The Cross-border Concept for Nature Preservation and Exploration in the Area of the Bohemian Forest and Horní Falc, number 194.

## Souhrn

Chráněná krajinná oblast vznikla na území bývalé železné opony nejen za účelem ochrany cenných přírodních biotopů, ale i jedinečné krajiny s četnými pozůstatky zaniklých sídel. Vznik CHKO byl podpořen i ze strany samospráv, které za vznikem CHKO viděli marketingovou podporu pro rozvoj cestovního ruchu. Stále častěji se ukazuje, že pro dlouhodobě udržitelnou koexistenci ochrany přírody a rozvoje cestovního ruchu je nezbytná jasně definovaná strategie, která určí priority a možnosti obou zájmových oblastí. Z tohoto důvodu je aktuálně zpracováván projekt „Přeshraniční koncepce pro ochranu a poznávání přírody Českého lesa a Horní Falce, číslo 194“. Jeho cílem je definovat priority ochrany přírody, navrhnout možnosti využití přírodních i kulturně historických atraktivit v cestovním ruchu, definovat základní principy rozvoje infrastruktury v jádrovém území a navrhnout koncepci marketingu pro cestovní ruch v přeshraničním kontextu. Nedílnou součástí realizace projektu je intenzivní komunikace s relevantními subjekty v území. Předpokládaným výstupem je obecně akceptovaná studie, která bude do budoucna základním vodítkem při plánování rozvojových aktivit v území.

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## TRADITIONAL COPPICE MANAGEMENT AS A WAY TO MAINTAIN A VARIED LANDSCAPE MOSAIC

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### Abstract

The contribution is focused on traditional ways of coppice management – grazing and litter raking. In general, livestock grazing has created many precious landscapes and many important wildlife habitats. Grazing preserves the biological diversity, recreational value, natural and cultural assets. Grazing plays a central role in fulfilling these objectives. Litter raking means that dead biomass was shrugged (the fall from the trees and an undergrowth) and served as litter for livestock.

The aim of the project was to investigate how grazing and litter raking influence the coppice forest stands. In order to determine the effect of the mentioned management on the coppice with standards – research plots were established. The standards were chosen and inventoried. In 2017 clear cut was done (standards were left) and new generation of sprouts was created, the circumferences of standards were measured. After one year of the experiment can be already seen negative effect of combination of grazing together with litter raking. When litter raking was compared with grazing – results showed that litter raking has bigger negative effect on the relative growth ratio of the standards.

**Key words:** litter raking, grazing, sheep, standards, sessile oak

### Introduction

In the past grazing and litter raking in coppice was very common but through 19<sup>th</sup> and 20<sup>th</sup> century became abandonment due to conversion to high forest. This phenomenon was very common throughout the Mediterranean region (Debussche et al. 2001; Ainalis et al. 2010) but also in other regions all over in Europe. Especially the deciduous oak (*Quercus* spp.) forests, have been intensively influenced by man for thousands of years with cuttings, fire and animal grazing (Barbero et al. 1990).

Nowadays new interests were created, and coppice forests are again under interest. It is known that species richness (mainly therophytes and hemicryptophytes) decreases with time in the undisturbed management (no coppice and no grazing), but therophytes and hemicryptophytes remain stable in the areas which were in the past was applied active traditional coppice management (Debussche et al. 2001). For some of these abandoned coppice forests grazing could be integrated in their management scheme, it will serve as a silvicultural tool, which may control the undesirable vegetation (e.g. herbaceous and non-oak woody vegetation) and finally to favour the oak tree growth (Liacos 1980).

Litter raking was used as a rich source of material for animal bedding. The effect of autumn raking on species composition was stronger than the effect of spring raking. No changes in soil conditions were detected (Vild et al. 2015). In the past litter raking was considered as very negative management which was nowadays refuted.

In general, little information exists on how grazing animals select their diets and habitat in deciduous oak ecosystems (Papachristou et al., 2005). There are not many studies which are focused on the effect of traditional coppice management in *Quercus petraea* agg. coppice forests and that's why the experimental site was created in the south eastern part of the Czech Republic.

The aim of the article is to evaluate the effect of grazing and litter raking on coppice forest stands with standards. The question is are there any significant differences after the first year of the experiment? This contribution will be mainly focused on the standards of the coppice. Also, whether these management methods could possibly be a suitable management to maintain a varied landscape mosaic with elements of grassland and forest.

### Materials and methods

Six permanent experimental plots (60×40 m) and three control plots (40×30 m) were established within Training Forest Enterprise Masaryk Forest Křtiny in winter/spring time in 2017. Each experimental plot was fenced and has a 20 m wide buffer belt. The forest stands from 26–66 years old were clear cut in 2017. Potentially standards 92 pieces/ha of *Quercus petraea* (Matt.) Liebl. were left on the plots (11 pcs/plot). The circumferences of 163 standards were measured before intervention (spring 2017) and after the intervention (spring and autumn 2018). The circumference increments were transferred to relative growth ratio (RGR). The RGR was calculated according to the formula (Cotillas et al. 2009):

$$RGR = \frac{x_i - x_{i-1}}{x_{i-1}} * 100 \quad (1)$$

$x_i$  – circumference of the standard in the end of the vegetation season,  $x_{i-1}$  – circumference of the standard at the beginning of the vegetation season. For the comparison of relative growth ratio between variants of the experimental plots one-way analysis of variance (ANOVA) with subsequent Tukey HSD multiple comparison test were used. All statistical tests were performed at  $p < 0.05$  and carried out using the software STATISTICA 12.

The aspects of free-grazing of sheep in oak forest stands during period from June to September 2018 in three cycles were evaluated. Three out of six experimental plots were grazed.

Litter raking was done in spring time in 2018. Mull-moder humus forms were raked away from the experimental site. Six experimental plots were divided into two parts (30×40 m), one part was litter raked and another part was without raking.

In conclusion, there were five variants of the experiment, each represented in three replicates: a) control plot (no intervention, no grazing, no litter raking), b) coppice with standards, c) coppice with standards with grazing, d) coppice with standards with litter raking, and e) coppice with standards with grazing and with litter raking.

### Results and Discussion

In 2017 relative growth ratio of the standards circumferences was statistically identical for all investigated variants of the experimental plots ( $F(4, 158) = 1.889, p = 0.115$ ). In comparison to 2018 were observed statistically significant differences of relative growth ratio of the standards circumferences ( $F(4, 158) = 11.3, p < 0.0001$ ). Oak standards had higher relative growth ratio of the circumferences in traditional coppice management in comparison to the control plots (with no management). This can be caused by so-called "light increment", which occurs on each tree after releasing its crown and root space. It is supposed that the remaining trees will better use the minerals, water, light and heat reserves and create more biomass and higher increment.

In the case of the variant of the experiment coppice with standards with grazing and with litter raking the relative growth ratio of the circumferences was the smallest (Fig. 1). After one year of the experiment can be already seen negative effect of combination of grazing together with litter raking. When litter raking was compared with grazing – results showed that litter raking has bigger negative effect on the relative growth ratio of the standards. For more detailed information – the average quantity of litter which was raked was 30,5 t/ha. More measurements are needed to confirm these results from the beginning of the experiment. But it can be expected that the effect of litter raking on the growth of the oak standards will be more visible. Litter raking, forest grazing and coppicing have historically led to a large reduction in the C stocks of the organic layer (Leuschner and Ellenberg 2017). Litter raking decreases tree growth and carbon dioxide efflux from the soil may change significantly (Grigal 2000). On the other hand, litter-raking treatment effectively increases the richness and cover of both forest and dry grassland species (Douda et al. 2017).

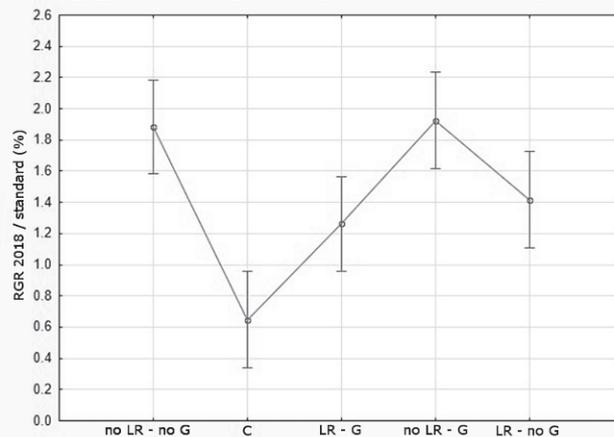


Fig. 1: Comparison of mean values of relative growth ratio of circumference increments (with 95% confidence interval) of sessile oak standards in all variants of the experimental plots (no LR - no G: plot with no litter raking and no grazing, C: control plot, LR – G: plot with litter raking and grazing, no LR – G: plot with no litter raking and grazing, LR – no G: plot with litter raking and no grazing).



Fig. 2: View of the plot with grazing and litter raking – in the background is visible closed stand, in the front are visible diverse communities such as: oak standards, sprouts in stools, grass and herb layer (photo by B. Uherková)

### Conclusion

In summary, experimental plot of coppice with standards was established where were studied the effects of grazing and litter raking. Already the first year was visible negative effect of combination of grazing together with litter raking on the growth of the coppice.

Although the results come from the first year of monitoring of the growth of coppice with standards, visible diverse communities were created such as: oak standards, sprouts in stools, grass and herb layers. More studies concerning the standards, sprouts, herbs and grasses will be done in the next years of the project. We believe that traditional forest management practices may be a suitable management to maintain a colourful landscape mosaic with grassland and forest elements.

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## **Souhrn**

Tradiční způsoby hospodaření v pařezinách (lese nízkém) v průběhu 19. a 20. století postupně zanikly, a to v důsledku rozšíření pěstování vysokého lesa a jejich zákazu (jak pastva, tak hrabání opadu jsou dnes zákonem činnosti zakázané). Nyní je návrat tradičních forem hospodaření diskutovaným tématem, prosazovaným řadou lesníků v Evropě a zejména přírodovědnou a ochranářskou odbornou veřejností.

Výzkumná plocha na Školním lesním podniku Masarykův les Křtiny v jihovýchodní části České republiky je ukázkou tradičního způsobu obhospodařování pařezin. Jedná se o jeden z unikátních projektů, kde se zkoumá vliv pařezení, lesní pastvy a hrabání opadu na vývoj pařeziny s výstavky.

Cílem příspěvku je zhodnotit vliv zmíněných faktorů na stromové patro (výstavky). A také, zda by tyto způsoby managementu mohly případně být vhodným managementem k udržování pestré krajinné mozaiky s prvky travních porostů a lesa.

Ač výsledky pocházejí z prvního roku sledování růstu pařeziny s výstavky, zdá se, že sledované tradiční způsoby obhospodařování lesů mohou být (vzhledem k diferencovaným výsledným biotopům pařezin s výstavky) vhodným managementem k udržování pestré krajinné mozaiky s prvky travních porostů a lesa.

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## TRENDS AND EXTREMES IN LOCAL CLIMATIC CONDITIONS AS PREREQUISITES FOR TOURISM IN THE ŠTIAVNICKÉ VRCHY MTS

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### **Abstract**

One of the most important factors limiting the growth of tourist and holiday activities in a selected area is the climate conditions determining the tourism potential of this area in a long-term prospect. This paper deals with the history of climatic conditions, especially climatic characteristics (heat waves, the number of summer days, hot and freezing days, frequency of rainless periods), in the Banská Štiavnica region (Central Slovakia). An additional drought-related research was also carried out with using the climate water-balance data. Meteorological variables were measured at Banská Štiavnica (48°26' N, 18°55' E, 575 m a.s.l.) during the period 2000–2017. The Štiavnické vrchy Mts have a relatively mild climate allowing to perform all-year-round activities. Our results have confirmed the significant increase in air temperature and in the number of drought periods along with the occurrence of abnormal or extreme weather fluctuations in the Štiavnické vrchy Mts, continually observed over the recent years.

**Key words:** heat waves, summer and tropical days, frost and arctic days, water balance

### **Introduction**

One of the most important factors limiting the growth of tourist and holiday activities in a selected area is the climate conditions determining the tourism potential of this area in a long-term prospect. The climate change can induce considerable changes in the natural and socio-economic conditions determining the tourism potential for particular regions or even entire lands. The tourism potential of a given destination can be notably reduced due to bad water accessibility, occurrence of extreme weather events (heat waves, drought periods, floods, intensive storms and hurricanes), loss of biodiversity, loss of the land's aesthetic value, poor quality of traditional agricultural products (wine tourism), increased occurrence risk of harmful diseases. On the other hand, some environmental changes may mean a profit enhancing the tourism potential of the area concerned (Simpson et al. 2008).

The temperature regimen of the atmosphere, precipitation regimen and upper soil moisture regimen are parameters determining the overall appearance of the land and its vegetation. The climatic change-related scenarios indicate increasing frequency and duration of extreme climatic events (IPCC 2014), at the global and also the regional level (Středová et al. 2015). In general, we may declare that, at present, the climate change issue does not mean a possible threat in the future, any more. Contrarily, this issue has been unveiled as an actual major environmental problem (Mindřáš et al. 2011). Particular regions exhibit conspicuous temperature increase accompanied by significant changes in other climatic characteristics, primarily the extremal precipitation. Despite the moderate increase in the precipitation amount over the central Europe, the conditions may seem drier - due to enhanced evaporation and saturation deficit caused by higher temperatures (Will et al. 2013, Jungo and Beniston 2001). Consequently, the total precipitation amount should be substituted with climatic water balance as a more explanatory variable. Climatic water balance is the difference between the total precipitation amount and the water loss due to evaporation (Škvarenina et al. 2009). The climate change mediated in this way can be obvious through the changes in the hydrological regimen, soil regimen, soil erosion and similar. This may cause changes in the composition of forest assemblages, plant cover, cultivated crops, which is followed by losses in biodiversity, productivity and by disturbances in ecosystem services (Škvarenina et al. 2018). All the ecosystem modifications have indirect impacts on tourism, especially in the case of destinations putting forward their flourishing nature as the tourist-attractant No 1.

The indirect impacts of the environmental changes driven by the global climate change can have significant consequences for the tourist activities from the local to the regional levels. For assessment of the climate change impacts on the tourism potential in Slovakia, the tourist traffic needs urgent regionalisation. The Banská Štiavnica region may be classified as a dominant one, thanks to the continually increasing number of visitors to this region. This paper summarises an evaluation of the

climate change indicators for the developmental trends in the climatic system in the Štiavnické vrchy Mts observed over the last 20 years.

### The area description

The Štiavnické vrchy Mts (Slovenské stredohorie) is the biggest volcanic massive in the Western Carpathians. Štiavnické vrchy are situated at the boundary between two different climatic types, which is reflected in the horizontal and vertical diffusion of thermophile floristic and faunistic elements with the Carpathian mountain species. The species composition of the forests in the central part of this region is mostly unoriginal, modified by anthropogenic activities. Beside the modified land patches, however, there have been preserved little-disturbed forest complexes. The area attractiveness is exaggerated with *taichs* - artificial water reservoirs built for mining purposes.

The centre of the Protected Landscape Area is the town of Banská Štiavnica (48°26' N, 18°55' E). "The historical town of Banská Štiavnica with the technical monuments in its surroundings" have been registered in the UNESCO World Heritage List. Banská Štiavnica with surrounding has a smooth continental climate. The town is situated in the moderately warm climatic area (moderately warm, wet hilly district), with a mean annual temperature of 7.6°C and mean annual precipitation sum of 745 mm (long term means for 1961–1990). The forest vegetation represents the 3-th and 4-th vegetation tier (ca 600 m a.s.l.). The town is protected against prevailing north winds, but also exposed to inversions resulting from the topography.

### Materials and Methods

For evaluation of the developmental trends in the climatic and hydrological system over the studied area, there were monitored selected climatic characteristics and their extremes. The meteorological variables were measured at the meteorological station of the Slovak hydrometeorological Institute in Banská Štiavnica (48°26' N, 18°55' E, 575 m a.s.l.) during the period 2000–2017.

The month average temperature values and precipitation totals were compared with the long term mean values covering the period 1961–1990.

There was calculated the variation in the number of tropical days (with maximum day air temperature of 30 °C and more), number of summer days (with maximum day value 25 °C and more), number of frost days (minimum day temperature below 0.0 °C) and number of arctic days (maximum day temperature lower than 0.0 °C). The precipitation-free periods were analysed using the methods proposed by Šútor et al. (2011). The precipitation-free periods were considered as the days without rainfall (snow) and the days with precipitation less than 3 mm. The precipitation-free periods were categorised in the following way: 5–9 days, 15–19 days and more than 20 days without precipitation. Drought was also evaluated through climatic water balance. The climatic water balance for the growing season (April–September) was calculated according to Škvarenina et al. (2009). Climatic water balance (CWB) is defined as the difference between precipitation (P) and potential evaporation (PE). The potential evaporation was calculated according to Tomlain (1979).

### Results and Discussion

Temperature and precipitation conditions over the study period are evident from the graphical representation in Fig. 1 illustrating the absolute deviations from the month air temperature values and precipitation sums from the long term mean value covering the years 1961–1990. The month and annual values display a considerable variability with prevailing positive deviations in air temperature.

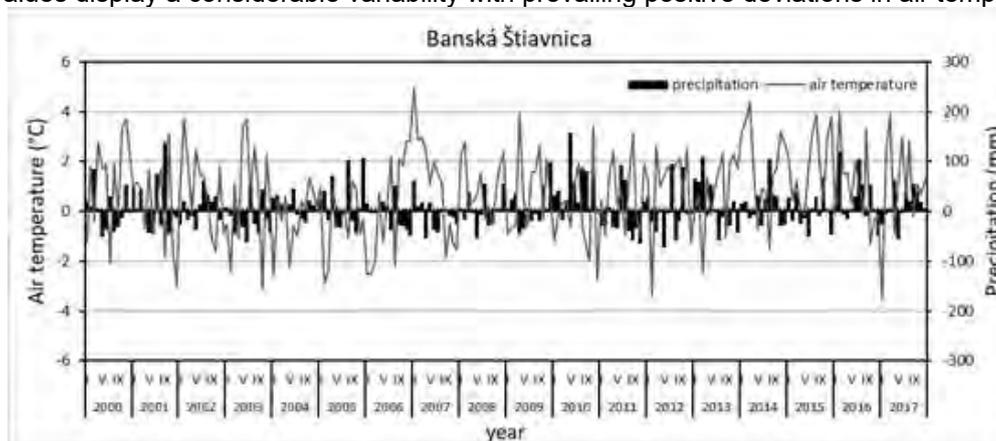


Fig. 1: Deviations of average day temperature and precipitation sum from long term mean values calculated for years 1961–1990 at the meteorological station Banská Štiavnica

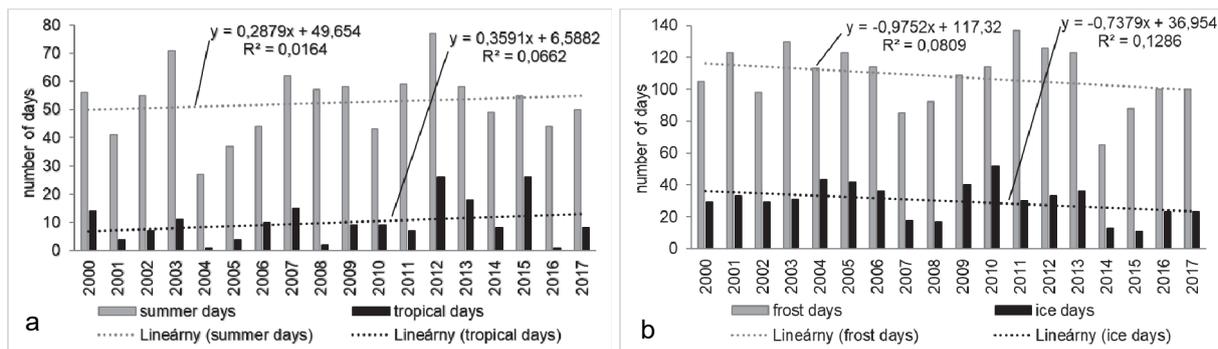


Fig. 2: Trends in number of summer, tropical, frost and arctic days in years 2000–2017

The developmental trends in the number of summer, tropical, frost and arctic days in the individual years at the station Banská Štiavnica are evident in Fig. 2 a, b. The analyses of the number of summer and tropical days in the years 2000–2017 revealed an increasing trend, with three heatwaves (years 2003, 2012 and 2015). The highest number of summer and tropical days was recorded in year 2012, the lowest in 2004. On the other hand, the developmental trend in the number of frost and arctic days observed for the study period was decreasing (Fig. 2 a, b). The highest number of frost days was recorded in 2011, the lowest in 2014.

Fig. 3 illustrates the number of precipitation-free periods in years 2000–2017. The highest number of short-lasting 5-day rainless period was recorded in 2009, with, however, the lowest number of 10- and 20-day periods. Related to the negative drought impact, longer 10- and 20- day periods exert more impacts on forest ecosystems. The highest numbers of 10- and 20-day long drought periods were recorded in years 2003 and 2011. Fig. 4 demonstrates a big year-dependent variance in the water balance. This variance explicitly reflects the temperature and precipitation conditions of the area concerned. The climate warming means more evapotranspiration demands, and this also means more serious threat of disturbance to physiological processes by drought stress during the whole study period. The climate change scenarios demonstrate that the potential evaporation will show an accelerated increase due to increasing air temperature enhancing the water absorbance capacity of the atmosphere (IPCC 2014, King et al. 2015). In most study years, the climatic water balance values were recorded negative, except years 2010, 2014 and 2017 in which positive values were obtained. The lowest value was recorded in year 2003 with an extreme dry and hot summer discussed in a number of related papers (Fischer et al. 2007, Beniston 2004).

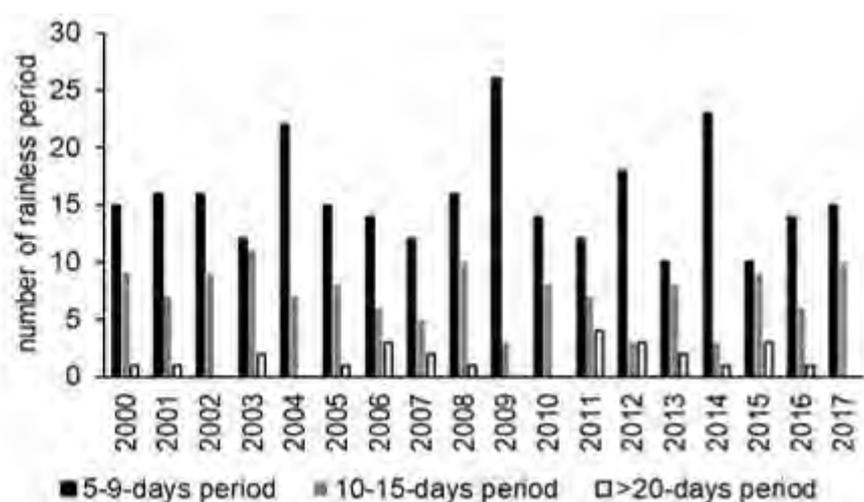


Fig. 3: Precipitation-free periods at Banská Štiavnica in years 2000–2017

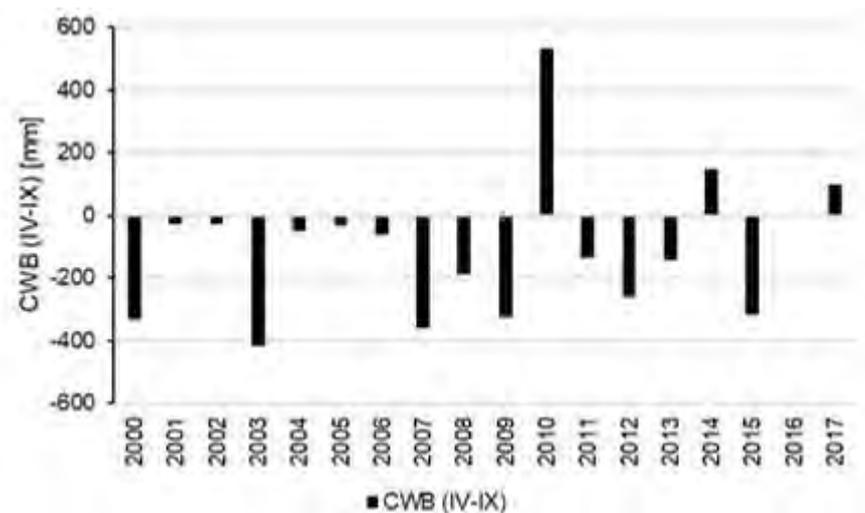


Fig. 4: Climatic water balance for the station Banská Štiavnica in the growing season (April–September), years 2000–2017

## Conclusion

The conspicuous increase in air temperature associated with abnormal, almost extreme weather events and fluctuations observed over the recent years have also been confirmed for the region of the Štiavnické vrchy Mts. The analysis of the number of days with conditions favourable for summer mountain tourist activities has revealed that this indicator exhibited a positive trend in increase of these days. Consequently, in accordance with the climate change scenarios, we may suppose a rising (climatic) potential for summer tourist activities also in sub-mountain areas in Slovakia. Contrarily, the conditions for winter tourism during winters will worsen, both in terms of snow conditions (lower numbers of frost and arctic days, reduced snowfall and snow cover) and in terms of performing winter mountain tourist and sport activities.

The discussed climate change indicators illustrate the current developmental trends in the climate system in Slovakia as well as the developmental trends in climate-driven characteristics documenting unequivocally the changes obvious over the recent 20 years. The indicators demonstrate that the time-dependent variations comprise a discernible trend component related to the changing climatic conditions throughout the Slovak republic territory

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### **Souhrn**

Jedním z důležitých limitujících faktorů rozvoje turistických volnočasových aktivit jsou klimatické podmínky, které v dlouhodobém rámci determinují turistický potenciál dané lokality. Změny klimatu mohou výrazným způsobem změnit přírodní a socioekonomické podmínky pro turistický potenciál jednotlivých regionů či dokonce zemí. Příspěvek je zaměřen na vývoj klimatických podmínek, zejména klimatických charakteristik a extrémů (horka, počet letních, tropických, mrazivých a ledových dní, frekvence bezzrážkových období) v regionu Banská Štiavnica (střední Slovensko). Výzkum sucha se navíc provádí prostřednictvím údajů o klimatické vodní bilanci. Výrazný nárůst teploty vzduchu spolu s výskytem abnormálního až extrémního počasí a fluktuací pozorovaných v posledních letech byly potvrzeny i na území regionu Štiavnických vrchů.

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## UPPER PART OF THE TOPLA RIVER – EVALUATION OF THE DENSITY OF THE RIVER NETWORK

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### Abstract

This paper presents the evaluation of the density of the river network with the aim to predict the risk of flash floods in the upper Topla river basin. It also presents the classification of the river network because of its significant impact on the river basin behind the flood. A similar solution was also chosen by the State of Egypt in the larger Nuweiba area in 2008, where they collected field survey data, enhanced thematic mappers, found morphological characteristics and soil types, soil coverage. These morphological parameters have been used by them and will be also used in next our research to evaluate the most sensitive sub-basins for flooding and to create territorial sensitivity maps for flash floods. River density and stream ordering are the basic evaluated parameters considered in selected catchment and all other characteristics will be assessed in relation to every single sub-basin of the upper part of the Topla river.

**Key words:** hydromorphometric parameters, potential of rivers (recreation, energetic, irrigation, flood protection), river network

### Introduction

Rivers are a dynamic combination of water, sediment, aquatic organisms, and riparian vegetation, all participating in a complex dance from the point of origin, or headwaters, toward the ocean or basin where the journey ends (Wampler 2012, Junakova 2012). The shape of rivers and streams changes through time as erosion, deposition, and transport of sediment occurs. Rivers and streams maintain a dynamic equilibrium between discharge, slope, sediment load, and sediment size (Lane 1955). Rivers are classified on the basis of different factors, including by their physical attributes, speed and shape (Carlston 1966). Among the most common morphometric parameters stream order, drainage density, stream number, stream length, mean stream length, stream length ratio, bifurcation ratio, mean bifurcation ratio, drainage texture, stream frequency, relief ratio, form factor, elongation ratio, circularity ratio, length of overland flow belong (Rai et al, 2017; Chandrashekar et al 2015; Carlston 1963). A method of classifying the hierarchy of natural channels according to their position in the drainage system, referred to as stream order, permits comparison of the behavior of a river with others similarly situated (Bilewu 2015). The shape of rivers and streams changes through time as erosion, deposition, and transport of sediment occurs (Lane 1955, Junakova 2013, Zelenakova 2016). It is useful for developing and testing generalizations and predictions about river processes. The morphometric analysis of watershed aids to know the aspects of linear, areal, and relief parameters (Abboud and Nofal 2017). Several modifications exist of the original stream-order system developed by Horton in 1945 ([www.shorelandmanagement.org](http://www.shorelandmanagement.org)). There are more methods how to ordering the streams for example according to Strahler (Strahler 1964), Horton or Shreve (Fig. 1).

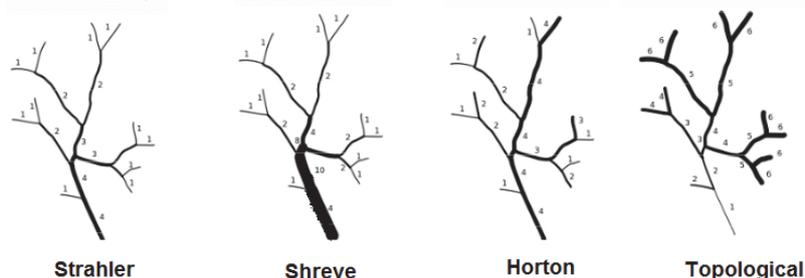


Fig. 1: Stream ordering according to the some authors

The classification is useful when making comparisons both between rivers and along sections of the same river ([www.lifeinfreshwater.uk](http://www.lifeinfreshwater.uk))

River network classification defines the order of flows according to several authors (classical, Strahler, Horton classification). The flow order is a number (Roman or Arabic) indicating the hierarchical marking of flows according to the type of classification used.

The surface water outflow occurs in the chain. The SR consists of 4 groups (Fig. 2): Creeks – Brooks – Rivers – Mainstream and Sea.

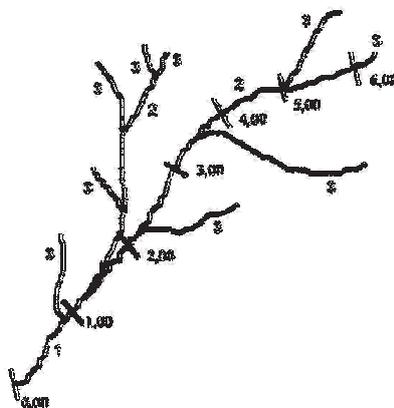


Fig. 2: Classification used in condition of Slovak Republic

The most significant stream, often referred to as the mainstream, and its tributaries, has different configurations. Typical river stream configurations include a tree-like arrangement. In this type, almost the same tributaries from both sides alternate regularly and we talk about a symmetrical system, eventually the tributaries predominate on one side and it is an asymmetric system. Another system is a fan-shaped arrangement, which is formed by a flow of flows of the same degree. In the uplands the feather-like system is the most common, where the river valleys are oriented parallel at approximately the same distances.

The impact of the river network layout on the river basin is significantly behind the flood. It is adverse when the time of the flood wave on the main stream and on the tributaries is approximately the same. After the confluence, the two flood waves will meet and result in a significantly higher the flood wave. The encounters of the flood wave are first of all in fan-shaped river networks. On the other hand there is no danger of such situation in an elongated tree-like river networks (Jandora 2011). Rivers, although potentially dangerous, also possess great power that can be harnessed for many beneficial uses including commerce, hydroelectric power generation, and irrigation of farmland (Wampler 2012). In European Union the Environmental impact assessment is considered to be one of main instruments of international environmental policy of sustainable development considering also the impact of selected structures on catchment area (Bhakar et al 2015; Ondrejka Harbulakova 2018).

### Materials and methods

The area of the study comprises the eastern Slovakia upper part of the Topla river basin (Fig. 3). This area was chosen because it has been affected by floods often (svp.sk).

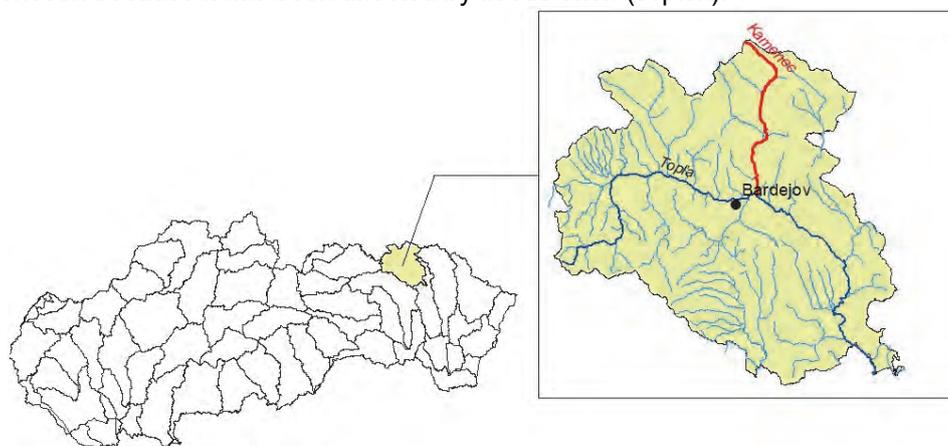


Fig. 3: Studied area (created by Lechman M.)

The river structure is directly linked to the relief and geological structure of the basin. The parts of the river system differ from each other by the so-called river network density. The density of the river

network is changed according to situations that influence the outflow of the drain or directly condition it. It is assumed that the density expresses the effects of some major runoff factors, namely an average slope of stream, a precipitation in the catchment, a permeability of the soil and an extent of the vegetation cover in the catchment area (Dub 1957).

Consequently, river network density is determined as the ratio of flow lengths of the surveyed area in kilometres and the catchment area of this area in square kilometres (Starý 2007). The mathematical formulation is given by Eq (1) (Stary 2005):

$$\rho = \frac{L + L_1}{A} \quad (1)$$

where:

- $\rho$  - density of river network, [-]
- $L$  - length of the stream, [m]
- $L_1$  - length of the tributaries, [m]
- $A$  - catchment area [m<sup>2</sup>]

As it is clear from the Equation 1, the result is dependent on the kind of used maps and on the method of evaluation. An example is the distribution of a territory map of interest by a square mesh and where the density is determined in each of these squares. The areas of equal values are defined and graphically marked.

The simplest form of the river network is in the watercourses drained by one stream, which river bed is the river basin's axis. A more complex system of rivers, as the Topla river and its tributaries, forms an environment that is divided into basic types of arrangement (tree-like, fan-shaped, feather-shaped).

### Results and Discussion

River density is assessed as a whole of the Upper Topla basin and not individually in all sub-basins separately. The reason for this is that only one water source is most likely to be present in the individual micro-conduits, and this often passes through several basins at the same time as can be seen in Figure 4.

The total area of the upper Tople basin is 998.9 km<sup>2</sup>. The value is obtained by the sum of all areas of the microprophages related to this area (district of Bardejov).

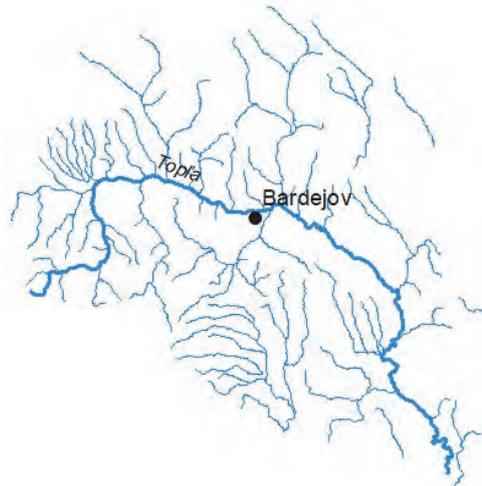


Fig. 4: Streams and tributaries of upper Topla basin

Another necessary data is the sum of flow lengths across the territory from all micro-plants. This value is 629,086 km of watercourses, including Topla river from its source to Radomek stream. According to the Equation (1) the density of Topla river network  $\rho$  was calculated (Tab.1).

Tab. 1: Selected morphometric parameters of studied basin

Catchment area [km <sup>2</sup> ]	Total length of the streams and tributaries [km]	Density of river network [km <sup>-1</sup> ]
998.9	629.09	0.6298

The Bodrog Basin (where Topla river upper part belong), according to Dub (1957), belongs to a system of fan-shaped arrangements in areas where it is a confluence of rivers of the same degree. However, when only a part of the Upper Tople basin are considered, a tree-like arrangement is also possible. This is a river system of approximately the same streams flowing to Topla from both sides, but with the predominant tributaries on the northern part of the river. This type of arrangement tells us about the basin where the main flow is of higher order (Topla) and the tributaries regularly connect to it, either with the prevailing inflow connection side or with their regular connection.

There is a clear basin asymmetry of the basin within the studied upper Topla basin. There are twice as many tributaries on the right side of the selected area. Under this fact, the location of the river Topla in the given by territory from its spring to the end of the studied part, i.e. from the west to the east with a slight meandering to the south. Almost all right-hand sub-basins belong to the surroundings of Topla catchment, while the left-hand river basins contribute to the watery of the Upper Topla are form tributaries of other rivers.

### Conclusion

The relation among the values of morphometric parameters can assist in a watershed analysis even though it is not supported by a good understanding of morphology in a study area.

There is an asymmetry among the tributaries and brooks drained upper part of Topla river. The right side is more watery compare to the left side of the river. It need to be pointed that the left-hand river basins which contribute to the watery of the Upper Topla are form tributaries of other catchments. Anyway these tributaries participate on watery of upper part of the Topla river too.

It need to be emphases that the drainage density cannot be analysed on the basis of climate alone and that it is necessary to take into account the response characteristics of the basin in any spatial or climatic study of drainage densities as it has been analysed by Rodrigues-Iturbe and Escobar (1964).

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### **Souhrn**

Povodně představují významné ohrožení socioekonomického rozvoje nejen na území České republiky, ale i v celosvětovém měřítku. Nebezpečí zranitelnosti území se měří pomocí environmentálních faktorů, které v nesprávné kombinaci dělají místa zranitelné. Tento příspěvek charakterizuje povodí Topla z hlediska hustoty říční sítě a systému číslování vodních toků v podmínkách České Republiky. Hustota říční sítě je charakteristikou hodnocenou pro cele povodí horní Topla, přičemž další vyšetřovány parametry už budou klasifikovány s ohledem na jednotlivé dílčí povodí řešené oblasti.

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## URBAN TERRITORIAL SYSTEM OF ECOLOGICAL STABILITY – REGENERATION OF GREEN SPINE

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### Abstract

The contribution deals with the regeneration of the areas defined in the city plan as segments of the territorial system of ecological stability (green spine of the city Zlín). The vegetative cover is there represented mostly by ruderal and pioneer vegetation. The site is characterized by strong anthropogenic influence owing to localisation in the centre of regional city Zlín. The proposal was preceded by detailed inventory surveys (flora, fauna, dendrology, territory limits).

The aim of the project are: substantially increase biodiversity, support of habitat native species and creating longterm management of locality. The areas of interest are divided into the core area (own area of the territorial system of ecological stability), which is surrounded by composite areas, enabling the locality to be included in the urban settlement.

The revitalising project is realised via Operational Programme Environment, Priority Axis 4 Protection and care for nature and landscape.

**Key words:** Multifunctional locality, city, biodiversity, OPE

### Introduction

The project deals the reconstruction of territorial system of ecological stability – the green spine of city Zlín that is implemented within the Operational Program Environment. The aim of the project is to integrate long-term unmanaged areas of airborne and pioneer greenery into the urban environment. Priority is given to ensuring ecostabilization functions, complementary and other green functions in the city.

### Materials and methods

The territorial system of ecological stability (TSES) is according to §3 of Act No. 114/1992 Coll. defined as an interconnected set of natural and altered but equilibrium ecosystems that maintain balance. Current Methodology of Defining the Territorial System of Ecological Stability from 2017 also touches on the solution of TSES in the urban environment. It accepts, to a certain extent, the spatial discontinuity and utilization of the elements of settlement greenery such as parks, public and reserved greenery in the composition parts of TSES.

The basic source is there master plan of the city of Zlín, which defines the area of settlement greenery and segments of the territorial system of ecological stability in the area of interest located just on the slope below the housing estate Jižní svahy, in the centre of regional town Zlín. Areas of urban TSES are an organic part of residential greenery in the spirit of traditional functionalist architecture of the city of Zlín. Functionalism, which has a prominent position in Zlín, is based on the assumption that: „sun, air, nature and free space are the basic human needs as well - like food“ (Pokluda, 1999).

Due to the complexity of the territory, a revitalization study was first prepared (2015), followed by very detailed surveys focused on very detailed inventory of trees, plant and animal species (2016). The following project included the long-term concept of territorial development and the actual implementation measure (2017). Implementation of the project started with the use of subsidies from the Operational Program Environment (2018) and the implementation part is currently completed.

### Results

The area of interest is there situated under the housing estate Jižní Svahy in the central part of the city of Zlín (fig. 1). The intentions are located on the slopes with a predominantly southern exposition. Mostly forest stands and skeletal trees are represented (fig. 2). Forest stands, old orchards, grassland, air raids and skeletal areas are also represented. Also cultivars of shrubs are growing by the paths. During implementation the area was divided into 7 basic segments and smaller units as needed. Technical infrastructure was set up, such as water mains, sewerage, gas pipelines, electricity lines, public lighting and other space limits. (fig. 3, 4, 5). The following measures were implemented:

- eradication of invasive tree species
- supplementation of habitat of original tree species not represented in the territory
- restoration of multi-species grassland
- regeneration of species-poor areas of greenery and selection promising trees
- restoration and completion of areas with old varieties of fruit trees

- foundation of biota support elements (stone walls, beetle)
- preservation and creation of torsos from dead strains
- measures for the safe movement of persons in the territory and at the same time the creation of resting inaccessible places
- reducing the possibilities of wild landfills and shelters for possible crim
- partial access to routes and protective zones of technical infrastructure (conversion of raid areas to meadow vegetation)
- leaving selected areas of self-seeding woodland spontaneous development (as an example of spontaneous conversion of vegetation while preserving refugia for biota during regeneration of neighboring stands)

**Overall scope of measures implemented:**

Area of interest	11,4 ha
Foundation of flowery meadow stands	2 ha
Planting of fruit trees	60 pcs
Planting of forest trees	286 pcs
Planting solitary shrubs nad creepers	50 pcs
Airfieds – natural development	0,8 ha
Stone walls	5 pcs
Loggers	12 pcs

The aim is to achieve greater diversification of the area and the renewal of grassland segments. The measures will create new open spaces with species-rich lawn with solitary greenery (growing of existing individuals from air raids and planting of new missing trees). These open spaces create conditions for a large portion of biota, including the specially protected species identified. To support species, elements such as dry stone walls and beetles are realized. Urban specifics of the space and other functions of greenery such as insulation, hygienic, recreational, aesthetic are taken into account.



Fig. 1: Greenery – areas of interest in the urban structure of Zlín



Fig. 2: Areas of airborne with basic skeletal trees for preservation.



Fig. 3: Identical area after the air raid removal.

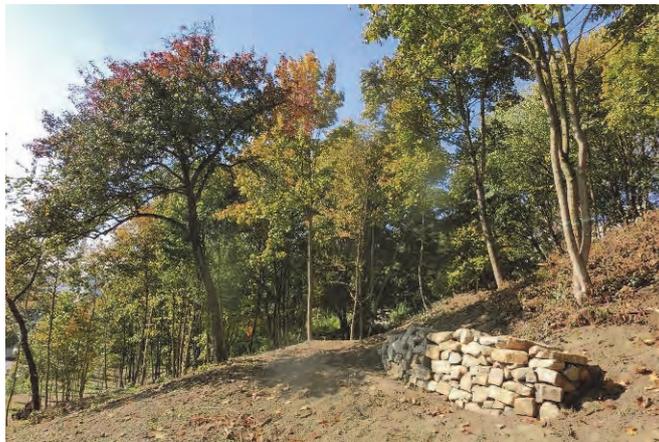


Fig. 4: Stone wall at the location after intervention.



Fig. 5: Rescue of old fruit trees released from woody air raids.

### Discussion

The proposed measures have the character of so-called controlled succession, when existing biotopes are directed to the desired target form. It is a tool for increasing the stability and biodiversity of the territory, which can help to trigger the succession process and its desirable direction. The specific management then depends on the type of site and intent to which the newly established areas are to serve. It is a deliberate influence on the natural succession process with the aim of supporting it, accelerating it and moving towards the formation of communities close to the desired target state. This will create communities that exhibit different but for this purpose more favorable parameters than communities developing completely spontaneous succession. Therefore, the long-term management of the area and the ongoing monitoring of the interventions were proposed.

## **Conclusion**

The project proposes the regeneration of TSES areas and related green areas in an extremely exposed position of the built-up area of the city of Zlín. The proposed measures located on the grounds of the Statutory City of Zlín by "controlled succession" direct existing functional areas, renew the ingrown areas and create new areas for biota and space for the knowledge and inspiration of the city's citizens. The project reflects diverse interests in the area often with contradictory requirements (nature conservation interests, administrative rule for technical infrastructure, citizens' needs, security, necessary passage, trails and others). The result is the creation of a revitalized plain, that is consistently built on the needs of nature conservation. Other societal interests in the territory are also accepted.

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Project is implemented using the OPE 2014 -2020 subsidies, its investor is the City of Zlín Municipality.

## **Souhrn**

Projekt navrhuje regeneraci ploch ÚSES a navazujících ploch zeleně v mimořádně exponované poloze zastavěného území města Zlína. Navrhovaná opatření lokalizována na pozemcích Statutárního města Zlína „řízenou sukcesí“ usměrní fungující stávající plochy, obnovují zarůstající plochy a vytváří nové plochy pro biotu i prostor pro poznání a inspiraci občanů města. Projekt reflektuje různorodé zájmy v řešeném území často s protichůdnými požadavky (zájmy ochrany přírody, požadavky správců sítí, potřeby občanů, nezbytné zprůchodnění, krytové možnosti pro drobnou kriminalitu a další). Výsledkem je vytvoření revitalizovaného prostoru, který je důsledně postaven na potřebách ochrany přírody a kompromisně akceptuje i další celospolečenské zájmy v území. Pro zájmové území je zpracován dlouhodobý management lokality včetně navazujícího monitoring provedených zásahů.

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## VEGETATION OF SELECTED VINEYARDS AND THEIR AESTHETIC VALUE IN THE LANDSCAPE

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### Abstract

The aim of this work was evaluation of vegetation of vineyards around Mikulov region. During the botanical monitoring of vineyards, altogether 216 plant species were found. Species diversity of vineyard vegetation is very variable. The most variable plant species diversity in vine line Turoid were observed. On the other hand, the least variable plant species diversity in vine line Pod Sv. kopečkem I. were observed. Some found plant species can provide an interesting tourist and aesthetic experience. Some found plant species can provide an interesting tourist and aesthetic experience. These plant species can be also used as medicinal plants use. Information about the occurrence of rare plant species in vineyards can contribute to the education of the public. The rich flora can contribute to the high tourist attractiveness of the region.

**Key words:** vineyards, flora, landscape, tourism

### Introduction

Biodiversity of plants is closely related to the preservation of landscape segmentation and its diversity (Thomson, Hoffmann 2009). Plant species that support natural enemies of harmful organisms can reduce the cost of plant protection products (Landis et al., 2000). The varied variety of vegetation can also support the natural enemies of crop pests grown around the vineyards (Gurr et al., 2004). For example, vegetation, which provides a source of nectar can increase the activity of predators and parasitoids (Winkler et al., 2006). Novák et al. (2014) says, that the Tokaj Nagy-Hill abandoned vineyards have become a refuge for many rare and endangered plant species and are rich in endemic and sub-Mediterranean species. Traditional vineyard care contributes significantly to protecting native and rare species of plant species (Von Hase et al., 2010).

The aim of this work is evaluation of vegetation of vineyards in an attractive tourist area. Also evaluate the importance and possible use of found species of plants from the perspective of man - tourist.

### Materials and methods

The wine region Moravia consists of 4 wine sub-region. The vegetation monitoring of vineyards and vineyards was carried out in the Mikulov sub-region. Chosen wine village for evaluation was Mikulov (South Moravia Region, Czech Republic) which consist 11 vine lines.

Evaluation of vegetation was made using a floristic list of the found species. Evaluation was made during June to September in 2016 and 2017. Scientific names of individual plant species were used according to Kubát et al. (2002). The found plant species were registered during the monitoring. Occurrence of each recorded species was evaluated using a simple three-point scale after completion of the inspections.

Scale of species frequency:

3 – very frequent (dominant) species

2 – scattered species or frequent species on some parts of the vineyard

1 – species with rare occurrence

The found species were divided into several groups, depending on their membership of the family, according to their life form and also their importance from the point of view of the use of plant species by humans.

### Results

A total of 216 plant species during the monitoring were found. The number of found plant species are shown in Table 1. Species were further divided according to selected criteria.

The following taxa belong to frequently occurring species: *Lolium perenne*, *Amaranthus retroflexus*, *Chenopodium album*, *Achillea millefolium*, *Convolvulus arvensis*, *Setaria pumila*, *Arrhenatherum elatius*, *Polygonum aviculare*, *Setaria viridis*, *Elytrigia repens*, *Amaranthus powelli*, *Taraxacum sect. Ruderalia*, *Cirsium arvense*, *Plantago lanceolata* and next.

Following species can have the potential to increase the aesthetic value of the landscape, for example: *Astragalus glycyphyllos*, *Ballota nigra*, *Carduus acanthoides*, *Centaurea scabiosa*, *Clematis vitalba*

*Crepis biennis* *Daucus carota* *Echium vulgare* *Epilobium montanum* *Galium verum* *Hippocrepis comosa* *Lathyrus tuberosus* *Linaria vulgaris* *Lotus corniculatus* *Onobrychis viciifolia* *Onopordum acanthium* *Securigera varia* *Solidago canadensis* *Tragopogon dubius* *Trifolium incarnatum* *Tripleurospermum inodorum* *Veronica persica* and next.

Other species are used as medicinal plants and can be collected by tourists and subsequently used for therapeutic purposes (*Agrimonia eupatoria*, *Achillea millefolium*, *Cichorium intybus*, *Glechoma hederacea*, *Humulus lupulus*, *Hypericum perforatum*, *Lamium album*, *Malva sylvestris*, *Melilotus officinalis*, *Plantago lanceolata*, *Rosa canina*, *Saponaria officinalis*, *Symphytum officinale*, *Taraxacum sect. Ruderalia*, *Urtica dioica*, *Verbascum blattaria*, *Verbascum densiflorum* and more).

There are also rare and protected species in the vineyards. These species should to be protected and therefore it is necessary to contribute to the awareness of tourists. Information on these plant species should be placed on the information boards near the hiking trails.

Tab. 1: The number of found plant species in vine lines in wine village Mikulov

		Vine line in wine village Mikulov											
		Mariánský kopec	Pod Sv. kopečkem I.	Pod Sv. kopečkem II.	Valtická	Pod Valtickou	Milovická	Za cihelnou	Šibeniční vrch	Pod Mušovem	Turold	Brněnská	Za Turoldem
Sum of found plant species		55	43	78	59	72	80	77	71	73	103	68	75
Family	<i>Fabaceae</i>	7	4	4	6	5	6	7	11	2	13	2	7
	<i>Boraginaceae</i>	2	0	1	0	1	0	1	1	2	1	1	0
	<i>Lamiaceae</i>	1	3	2	0	2	1	2	1	2	3	1	3
	<i>Asteraceae</i>	15	11	16	17	15	14	17	13	17	21	17	17
	<i>Poaceae</i>	5	6	12	11	13	11	10	13	13	11	12	9
	<i>Apiaceae</i>	3	5	7	3	5	6	5	3	5	8	3	7
	other	22	14	36	22	31	42	35	29	32	46	32	32
Live form	annual species	19	20	29	24	27	35	34	27	26	38	21	25
	perennial herbs	35	22	42	32	41	41	41	41	43	62	40	45
	woody plant	1	1	7	3	4	4	2	3	4	3	7	5
Importance from human point of view	aesthetically interesting species	22	17	29	23	27	32	33	28	31	47	29	35
	medicinal plants	11	5	12	8	10	10	10	13	10	14	9	12
	Rare and endangered species	0	3	1	1	2	2	3	3	2	4	1	3
	dangerous to human health	2	1	3	1	2	4	2	2	3	3	0	2
	other	20	17	33	26	31	32	29	25	27	35	29	23

The following types of rare and protected plant species were found in the monitoring: *Adonis aestivalis* (C3), *Allium flavum* (C3), *Anagallis foemina* (C3), *Bromus arvensis* (C1t), *Filago vulgaris* (C3), *Linaria genistifolia* (C3), *Melampyrum arvense* (C3), *Melica transsilvanica* (C4a) *Peucedanum alsaticum* (C3), *Stachys annua* (C2t), *Stipa capillata* (C4a).

However, some of found species can be dangerous to human health. Among these species belongs following the found species: *Conium maculatum*, *Datura stramonium*, *Solanum nigrum*, *Euphorbia helioscopia* and next.

### Discussion

The species diversity of vineyard vegetation in the wine village of Mikulov is very variable. The most variable plant species diversity in vine line Turoid were observed. On the other hand, the least variable plant species diversity in vine line Pod Sv. kopečkem I. were observed. For example, Maxianová et al. (2016) found altogether 104 plant species in vineyards in wine village Popice. Similar numbers of plant species are recorded by Lišková et al. (2016) in the vineyards of the village Pouzdřany and 102 species of plants. Conversely, a lower number of species in monitoring was recorded by Šťastný et al. (2017) in the vineyards of the wine village of Syrovice - 40 species of plants.

The number of plant species in the vineyards is associated with a number of factors. An important indicator is the acreage and intensity of vineyard management. On lines with a larger area and more extensive regulation of vegetation, the number of plant species is higher. On lines with intensive vegetation regulation, the number of species decreases. Also important is the nearness of protected areas with high biodiversity.

### Conclusion

Vineyard vegetation can provide tourists with an interesting aesthetic experience and can be used as a source of medicinal plants. Information about rare plant species growing in vineyards can help to educate society. The vegetation of the vineyards around Mikulov is an integral part of the whole landscape. The rich flora contributes to the region's tourist attractiveness. Protecting plant biodiversity is a necessary step to preserve the value of the entire region.

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### Souhrn

Cílem práce bylo zhodnotit druhovou pestrost vinic v okolí Mikulova. V průběhu monitoringu vegetace vinic bylo nalezeno 216 druhů rostlin. Druhová pestrost vegetace vinic je značně proměnlivá. Druhově nejbohatší je viniční trať Turoid, naopak nejchudší je vinařská trati Pod Sv. kopečkem I. Byly nalezeny

druhy rostlin, které mohou turistům poskytnout zajímavý estetický zážitek, dále mohou být využity jako léčivé rostliny. Informace o výskytu vzácných druhů rostlin ve vinicích mohou přispět k osvětě ve společnosti. Bohatá flóra může přispívat k vysoké turistické atraktivitě tohoto regionu.

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# VEGETATION STRUCTURES OF THE CITY AND THEIR USE FOR RECREATION ACTIVITIES

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## Abstract

The vegetation structures of urban settlements form a spectrum of natural, semi-natural and cultural-composed formations that serve a lot of ecosystem services. The contribution presents the vegetation structure of Nitra and its outskirts, as potential for the city inhabitants in the process of recreation and education land use. The dominant of the vegetation structure in the city of Nitra includes the following semi-natural formations: Castle hill, Calvary hill and Pine grove. Culturally composed park like formations include: Sihoť city park, Birch grove, Agrocomplex exhibition areal, Campus areal and Botanical Garden of the Slovak University of Agriculture. Additional areas for short time recreational activities include small parks and playgrounds in housing estate zones and house residential areas, school, cultural and social facilities, pedestrian city zones. In the outskirts zone the valuable and important for both recreational and nature conservation is: Zobor hills and their forest park segment, fragments of forest-steppe, thermophilic oak-hornbeam forests, and fragments of floodplain forests. Supporting mobility systems for recreation in the city and outskirts also includes a rational network of cycle paths and a city network of shared bikes.

**Key words:** city, green spaces, recreational potential

## Introduction

Recreation is a logical part of human life cycles. It has a psychological, social and health rehabilitation context. Recreation represents a wide range of activities that have substantive content for reaching defined goals (Flekalová, 2015, Supuka, Bihuňová, 2018). The highest quality values for recreation performance are provided by natural undisturbed environment, mainly forest and water complexes (Sievänen et al., 2008, Schneider, Fialová, Vyskot, 2009, Pröbst et al., 2010). The urbanized environment and the large urban agglomerations have a strongly changed and man-made environment with a wide range of partial artifacts, including supplying elements for recreational activities, experiences and education (Štěpánková, Bihuňová, Kabai, 2012, Terkenli et al., 2017, Krnacova, Barancok, Pavlickova, 2018).

The transitional type between the natural, dominantly forested and hemerobic urbanized landscape is formed by an agricultural landscape with the penetration of value features by both. Even this type of country has a relatively high recreational potential, forms the background for adjacent urban agglomerations and supply a wide range of activities and services within agro-tourism and rural tourism (Habán, Otepka, 2004). Relatively strong phenomenon of rural landscape in terms of recreation and perception of social values are historical landscape structures (Špulerovalá et al., 2017), cultural vineyard landscape (Verešová, 2011), historical parks at residential old manor (Fornal-Pienak, 2017). Many remains of natural formations, as well as composed landscape parks are available for recreation in forest, agricultural, and in urban landscape also, they often are subject to nature conservation and specific land use regimes (Tóth et al. 2014). The urban environment supply a wide range of recreational uses in the cultural, spiritual and sport spheres, as well as the use of vegetation elements and open spaces in the city and in its contact zone. In the concept of the master plan of the Bratislava self-governing region, the following categories of recreational areas were described for recreation and tourism purposes in the wider area of Bratislava municipality: a) natural elements of urban and suburban forests, b) cultural vegetation of parks and gardens, c) fragments of agriculture, especially vineyards, d) artifacts of spiritual, artistic and architectural culture (Krnáčová, 2015). The classification scheme of the vegetation structure in urban settlement for recreation purpose evaluates three fundamental categories according to the degree of transformation: natural, semi-natural and cultural-anthropogenic (Supuka, 2001, 2011). A significant, recreational and culturally attractive category of vegetation formation in the urban structure is often formed by historical parks and gardens, as a product of man's creative architectural activity in the field of garden art (Reháčková, 2012). Nowadays, objects and areas of urban agriculture are progressive areas with a wider potential of ecosystem services. The dominant ones include recreational, productive, educational, but also the phenomenon of social inclusion of interest groups and leisure-time programming. Today, this process

has acquired a minimum of pan-European dimensions and is included in many EU scientific and educational projects, e.g. COST, H2020 and others (Bell et al., 2016, Timpe et al., 2016).

### Material and methods

Urban and spatial structure of Nitra city and the outskirts was processed from the current orthophotomap from 2017 (Co: GKU, NLC; r. 2017). A map matrix was processed in GIS environment, using ESRI program. This document was used for spatial interpretation of vegetation elements of green complexes, attractive and used for recreation purposes in the city. Their areas were calculated from the orthophotomap or obtained from the database of the Municipal Office Nitra ([www.nitra.sk](http://www.nitra.sk)). Spatial analysis and composition of vegetation elements are processed according to the results of own field research and supplemented with data from the main published sources (Jahn, Košťál, 2002, Hreško et al., 2006, Supuka, 2011).

### Results

At the beginning of the results we will present the main geographical characteristics of Nitra, which amplify its recreational potential. The city has an area of 100.45 km<sup>2</sup> and 79 482 inhabitants as of 2018. From the north it is bounded by the Zobor Hills, in the south it passes freely into the Danube Basin. The climate is warm to moderately warm with average annual temperatures of 7.5-10.0 ° C, annual rainfall is 560-630 mm. Phyto-geographically, the area contain elements of pre-Carpathian flora, with species of thermophilous oak and oak forests. These communities today represent many protected sites and habitats. They are not only in the contact zone, but also in the city. Floristic richness is also represented by the cultural park vegetation of the town (Hreško et al., 2006). The embossed conditions of the city are represented by seven symbolic hills: Castle hill, Calvary, Martin hill, Vršok, Borina, Drážovský hill, Zobor. These create a dynamic image of the city, its visual interconnection and high spatial perception. According to the degree of transformation and anthropogenic influences, on the territory of the city and in its contact zone, we present three categories of the vegetation formations with recreational, cultural, but also urban forming and ecological functional significance.

#### Natural elements of vegetation

a) *Zobor Forest massif*- is part of the Protected Landscape Area (PLA) Ponitrie. The Zobor-Pyramida Geographic Group is a recreational and naturally valuable area in the northern contact zone of the city. There are also dominant nature reserves, e.g. Lupka (9.81 ha), Zobor Forest Steppe with Svorada Cave (23.08 ha), in the eastern part also Žibrica (68.6 ha). A thermophilous flora and fauna composition was formed in the area, where almost 1 300 vascular plants were identified, many of which are protected. Attractive woody plant species include *Caluna vulgaris*, *Cornus mas*, *Fraxinus ornus*, *Prunus mahaleb*, *P. fruticosa*, *Quercus pubescens*, *Q. virgiliana*, *Rosa pimpinellifolia*; the herb group represents mainly *Adonis vernalis*, *Iris pumila*, *Pulsatilla grandis*, *Stipa capillata*. Location Zobor is recreationally attractive and intensively used. Zobor Forest Park was set aside for Zobor in 1978 at area of 814 ha for the purpose of daily suburban recreation. In 2000 was considerably reduced to 201.78 ha and only 74.22 ha in 2017.

b) *Dvorčian Forest* - a relatively extensive fragment of a floodplain forest (138.74 ha) on the floodplain of the Nitra River, which is a valuable biotope on the southern outskirts of the city. We can find representative woody plants there (e.g. *Acer*, *Carpinus*, *Euonymus*, *Frangula*, *Fraxinus*, *Populus*, *Prunus*, *Quercus* and *Salix* genera), as well as rare herbs, for example *Galanthus nivalis*, *Physalis alkegengii*. This forest is not modified, but it is accessible for recreation through cycling routes built along the Nitra River.

c) *Turkey Oak Grove* - a relatively large forest stand (262.1 hectares) on the southwestern edge of the city, linked to the neighboring Parovsky Grove. The dominant tree species include: *Quercus cerris*, *Q. petraea*, *Crpinus betulus*, *Acer campestre*, *A. platanoides*. Both groves are located near the residential complexes of Klokočina, Čermáň and are used by the inhabitants as cycling, walking and mushroom collecting.

d) *Triassic dolomite quarry, resp. The Rolfes Mine (1.6 ha)* - also has the name of the Ramsar Dolomite quarry- where stone was mined at the turn of the 19th-20th century for building purposes. Located in Párovce housing estate near Štúrova street. The site was declared a natural monument in 1982 and has the character of a specific habitat. The plant composition is a product of the natural succession process with the occurrence of the genera *Betula*, *Crataegus*, *Populus*, *Prunus*, *Robinia*, *Salix*, *Typha* and others. In terms of recreation, the area has a visual perception and study character.

e) *Zobor Lake – resp. Granite Quarry* opened in 1860, the stone was used for the footpath and road pavements in Nitra city. The quarry is abandoned today, flooded with natural slope waters; the depth

of the lake is 10 m. The surroundings of the lake are natural ingrowths of trees, shrubs and synatropic herbs; it has the character of a natural habitat (all area of 0.60 ha). The lake has recreational visual and study character, but despite the ban is also used for swimming.

### **Semi-natural vegetation formations**

Within this category we include vegetation formations of originally natural character that have been partially or significantly changed by human activity. These include the Castle hill, Calvary, Borina (Pine grove).

a) *The Castle hill* - the site together with the castle and the church and green spaces (all area of 11.83 ha) form a significant visual dominant of the town with an elevation of approximately 80 m from level of the Nitra river. It is an object of permanent daily recreation and cultural tourism. The hill geologically consists of granitoid, limestone and quartz with the occurrence of a 30 m underground cave in long. The southern slopes make up the built-up church and aristocratic houses with representative historic gardens as part of the Upper Town landmark. The green ring in the east-north-west direction (area of 3.35 ha) is a forest park with a sidewalk network and terraces. The dominant tree species include *Acer campestre*, *A. platanoides*, *Fraxinus excelsior*, *Ulmus carpinifolia*, *Tilia cordata*, *Cornus mas*, *Euonymus europaeus*; from herb groups *Alium montanum*, *Campanula moravica*, *Reseda lutea*, *Sedum album*. There is also a high proportion of alien species dominated by *Robinia pseudoacacia*, *Thuja orientalis*, *Lycium barbarum*, *Syringa vulgaris*; the synanthropisation index is 0.45. Castle hill was in r. 1995 declared a natural monument.

b) *Calvary* - represents a raised relief formation (area of 22.42 ha), geologically formed by tertiary period limestone. The original hill relief is disturbed by a quarry on its western edge. There are several cave cavities under the hill, the longest has 50 m long, all unavailable to the public. On the hill there is a cross road with chapels, originally from 1774, reconstructed in 1885. Calvary with a monastery church nowadays forms an important pilgrimage site. The vegetation cover consists of xerothermic plant communities with nearly 50 species of plants, of which 21 are protected. More important herbs include *Adonis vernalis*, *Alyssum montanum*, *Campanula sibirica*, *Iris pumila*, *Gagea bohemica*, *Pulsatilla nigricans*. There are rare *Cornus mas*, *Cerasus mahaleb*, woody species of genera *Acer*, *Crataegus*, *Fraxinus*, *Ligustrum*, *Rosa*. Non-native species such as *Pinus nigra*, *P. sylvestris*, *Aesculus hippocastanum*, *Robinia pseudoacacia* are also planted there. The Castle hill and Calvary both is an important city landmark, accompanied by religious architectural artifacts. It is a sought-after and intensively visited complex not only for church events, but also for daily recreation, study and learning. Calvary forms an excellent point of view for the visual perception of the city and the wide surroundings and an emotional experience.

c) *Borina (Pine grove)* - also known as the Gallows hill (area of 19.29 ha) is similar in height to Calvary, geologically formed by triangular quartzite and dolomite. The vegetation cover consists of fragments of steppe communities and thermophilic oaks. Extensive plantings of black pine from 1890 also indicate the current name of the hill. The floristic composition is varied, from rare herb species (*Adonis vernalis*, *Bupleurum affine*, *Festuca valesiaca*, *Stipa capillata*), across scrubs (*Cerasus mahaleb*, *Euonymus verrucosa*), to trees (*Quercus cerris*, *Q. robur*, *Tilia cordata*, *Robinia pseudoacacia*, *Pinus nigra*, *P. sylvestris*). The current state of Borina has undergone a compositional reconstruction, a communication and information network has been built, and a lookout tower has been modified. Borina has the character of a forest park for daily recreation for the inhabitants of the closest and largest city housing estates, namely Klokočina, Diely and Čermáň, where 33 139 inhabitants live.

### **The cultural vegetation formations**

It consists of landscape architecturally composed elements, especially the Sihot' city park (current area of 25.45 ha, plus 11.5 ha hockey and football arenas) and Birch grove (area of 14.68 ha), park arrangements of the Slovak University of Agriculture campus including the Botanical Garden (area of 48.14 ha together) and UKF (area of 4.06 ha), the exhibition area of Agrokomplex, a double-sided green belt of embankment of the Nitra river. Relatively large green areas are among block houses of the largest housing estates, Chrenová, Klokočina, Diely, Čermáň and Párovce, where a total almost of 140 ha of public greenery was surveyed. Compositional, environmental, as well as recreational significant are park adjustments of school campuses (many open to school pupils during weekend days), hospital complexes, main street alleys and pedestrian zone of the city (Štúrova Street, Štefánikova Street), urban parter in front of important cultural buildings, services, state administration, but also residential gardens as part of family houses. According to statistical data, there are 250 hectares of public greenery under the administration and maintenance of Nitra city authority. With

regard to the size and fragmentation of the areas, we present a more detailed evaluation on four more complex green spaces.

a) *The Sihot city park* - was built in the middle of the 19th century on the former floodplain forest of the Nitra river. It consists of an old park built up at beginning on area of 20 hectares, where the dominant feature is a classicist café from 1831, which was built by Bishop Jozef Wurum. A new part of the park on an area of 15 hectares was founded in 1951 (by J. Kvapil) after the previous regulation of the riverbed of the river Nitra from 1928. The park has a natural landscape composition also enhanced by the water bodies Malá a Velká Hangócka. Dendrologically, the park is very rich with a high proportion of alien species; the synanthropisation index is up to 0.84. There are 47 species of trees and more than 500 tree individuals in the old park, 84 woody species in the new part, including 1520 trees. Attractive species include e.g. *Ginkgo biloba*, *Liquidambar styraciflua*, *Quercus x turneri* 'Pseudoturneri'. The park currently has a high level of facilities such as playgrounds, cafes, theatric culture objects, fountains, zoo parks. In the contact area of the park is a summer swimming pool, football and ice hockey stadium. The park is very attractive and intensively used in the form of daily and mainly weekend recreation.

b) *Birch grove* - it forms the left part of the regulated stream of the river Nitra, originally a floodplain forest with an area of 14.68 ha. It creates a contact recreation zone of the Chrenová housing estate and is intensively used. Dendrologically quite rich, with the dominance of *Betula verrucosa* birch, where the name of the park; the synanthropisation index is 0.56. Other notable woody species include *Acer pseudoplatanus*, *Populus alba* 'Boleana', *Quercus robur*, *Q. rubra*, *Pseudotsuga menziesii*, *Taxus baccata*.

c) *The Chrenová I., II., III and IV*- housing estates area consists of an extensive residential complex on an area of 179.79 ha, with 15 512 inhabitants. It has a spectacular urban solution with about 30% of the green area cover, which represents a total of 68.8 ha; 25-30 m<sup>2</sup> per capita. Green areas are well equipped with playgrounds and a small architecture for daily recreation. The applied wood species are relatively rich represent by 85 ones; the synanthropisation index is 0.42.

d) *The Klokočina, Čermán and Diely housing estates* - have a total area of more than 180 ha of which inter-block green spaces represents up 87.18 ha; 15-17 m<sup>2</sup> per capita. The biodiversity of applied trees account 120 species, of which up to 56% are exotic (alien); synanthropisation index 0.57. The dominant wood species include e.g. genera *Acer*, *Fraxinus*, *Salix*, *Prunus*, *Quercus*, *Tilia*, *Picea*, *Pinus*. To the most attractive belong *Gleditsia triacanthos*, *Salix matsudana* 'Tortuosa'. The green spaces are well equipped with playgrounds, an adequate level of maintenance and quality, and are frequently used by residents.

The most important green, culture historical and recreation spaces are shown on Nitra city map; Figure 1.

## Discussion

A vegetation structure and partial green spaces in the Nitra city territory have a relatively satisfy share in the area, but also in composition and biological quality. Recreation in the municipal area of the city is based on particular value features, such as the dynamic aesthetics of green spaces (Lieskovský et al., 2017), but also the natural biodiversity and cultural richness of the city (Hreško et al., 2006). The urban historical, architectural and archaeological values of the city have had a strong background since Great Moravia (Fusek, Zemene et al., 1998). Cyrilo-Methodius's religious and cultural layer is also strong and dominant for Nitra, whose artifacts still form a historical tradition today (Judák, 2012). Calvary in the city is not only a Christian presentation of the bible event, but it also forms an important relief landmark with rare forest steppe vegetation. It also has orientation and visual perception as part of recreation and visual experience (Biňušová, Halajová, Lančarič, 2016). The green spaces, open spaces as well as objects of cultural and historical values in the city also have a social and relationship character (Kazmierczak, 2013), which is a logical part for creative public communication. Interesting is the knowledge from England, where many private gardens near family houses are accessible to public, as objects of short-term recreation, education, historical cognition, aesthetic experience and social contact with the owners of historically traditional and internationally recognized English gardens (Čakovská, 2017). This phenomenon is not used in Slovakia conditions. In the vicinity of Nitra city there is a sufficient supply to visit attractive castle parks, e.g. Mojmirovce, Oponice, Horné Lefantovce, Beladice, but also Arboretum Mlyňany representing rich collection of evergreen trees. Outskirts of the city are mapped together 23 water areas, which have biotope, irrigation, fish farming, but also recreational character (Gerhátová, 1998). In Nitra, there is the well-known Agrokomplex exhibition center with a wide range of recreational, educational and experiential activities, including high-quality park architectural exterior and exhibition areas. Among the interest locality belongs several allotment

garden sites, as well as the newly conceived Hidepark community garden with a strong social context; established in 2010.



Fig. 1: Spatial contribution of dominant recreation and cultural areas on the Nitra city territory  
Explanation

- 1) Castle hill, 2) Rolfes mine; 3) Pine grove; 4) Calvary; 5) Birch grove; 6) Sihot city park; 7) Agrocomplex area;
- 8) University campus SPU + UKF; 9) Pakr like arrangement Chrenova I-IV housing estates; 10) Park like arrangement Klokočina and Diely housing estates; 11) Granite quarry Zobor

### Conclusion

The city of Nitra and the surroundings has a phyto-geographically diverse, cultural and historical very valuable background. It provides a wide range of ecosystem services. In the contribution we pay attention to recreational potential, recreational value and supply for residents and tourists. All categories of vegetation elements and formations have great potential in cultural services. They are principally divided into natural fragments, semi-natural and cultural parks and green spaces. Floristically they are very rich; many objects are protected by law. The city's territory covers more than 30% of all green spaces, which is a criterion of responsible ecological quality of the city and the life quality of its inhabitants. The city has a balanced supply for recreation, culture, learning and social experience. These features are also enhanced by the rich supply of recreational areas and historic buildings and monuments in the nearby city center.

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### **Souhrn**

Vegetační struktury městských sídel tvoří spektrum formací přírodního, polo přírodního a kulturního komponovaná charakteru, které plní celou řadu ekosystémových služeb.

Příspěvek prezentuje vegetační strukturu města Nitra a jeho kontaktního zázemí, jejich biocenologickou a funkčně prostorovou charakteristiku, potenciál pro využití obyvateli města pro účely různých forem rekreace a vzdělávání. V širším kontextu je položen důraz na vegetační formace jako elementy komplexního systému zelené infrastruktury města ale i v širším krajinném zázemí. Rekreace v přírodním prostředí je sociálním fenoménem a standardní složkou životních cyklů člověka. Prvky vegetačních struktur tvoří významný potenciál a nabídku pro výkon rekreace. Mají různý stupeň původnosti, nebo kulturní přeměny s vybavením malou architekturou a technickou infrastrukturou. Mnohé z nich představují fragmenty původních lesů, vzácných a chráněných stanovišť a společenství, nebo jsou produktem tvůrčí činnosti v oblasti zahradního a parkového umění, jako historické a současné parky. Tyto mají vysoký potenciál rekreačního a vzdělávacího využívání, ale i jako fenomén kompozice města, jeho estetické a kulturní hodnoty. K stěžejním areálům vegetační struktury v intravilánu města Nitry patří následující polo přírodní formace: Hradní návrší, Kalvárie, Borina. Kulturní komponovány formace parkového charakteru reprezentují: Městský park Sihoť, Březový háj, Areál Agrokomplex, Areál nitrianskych univerzít SPU a UKF, Botanická zahrada SPU. Doplňkovými plochami pro denní formy rekreačních aktivit jsou parkově upravené plochy a hřiště mezi bloky obytných sídlišť, zahrady v zónách individuální bytové zástavby, parkové úpravy v areálech škol, zdravotnických, kulturních a sociálních zařízení, pěší zóny v historickém jádru města. V kontaktní zóně města k hodnotným a významným územím tak z hlediska rekreačního využívání, jakož i z hlediska ochrany přírody patří: zoberského vrchy a jejich segment lesopark, fragmenty lesostepních travních porostů, fragmenty teplomilných Dubin a dubovo Hrabovo lesů, fragmenty a lokality lužních lesů. Vysoký kulturní a vzdělávací potenciál ve městě Nitra poskytují památky a objekty votivní a religiózní architektury a historie. V přilehlé krajině města je početné zastoupení venkovských zámeckých historických parků, malé vodní plochy a rybníky s vysokým potenciálem rekreačního využití. K podpůrným mobilním systémem rekreačního využívání vegetačních formací na území města a v kontaktním zázemí, patří i racionální síť cyklostezek a městská síť sdílených kol.

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## VISITOR MANAGEMENT AT THE NATURE CONSERVATION AGENCY OF THE CZECH REPUBLIC

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### **Abstract**

The Nature Conservation Agency of the Czech Republic (NCA) manages 24 Protected Landscape Areas (PLA) and several hundreds of National Nature Reserves and Monuments. NCA runs visitor monitoring to obtain data mainly for decision making, and for interpretation and visitor infrastructure planning. Most of the data comes from automated counting, some from visitor surveys, too.

NCA develops a network of visitor centres in PLAs. They are known as „Houses of Nature“. There are already 8 visitor centres and several info centres running within the project. Several more Houses of Nature are under preparation.

Together with regional partners, NCA secures development of Visitor Management Policies for PLAs. These documents contain interpretation as well as management plans for visitor infrastructure. Proposed activities are fulfilled by NCA and its partners.

Implementation of interpretation through nature guides in protected areas is currently under development. Together with partners in interpretation, NCA prepared courses for those who want to offer guided tours, especially for volunteer rangers. Successfully certified trainees will be promoted through Houses of Nature and at NCA webpages.

All the activities lead to more effective nature conservation of protected areas and higher satisfaction of their visitors obtaining proper natural experience.

**Key words:** visitor monitoring, visitor centre, interpretation, nature guide

### **Introduction**

The Nature Conservation Agency of the Czech Republic is a state organisation that administrates some protected areas and secures monitoring of nature and other activities around the whole country. NCA directly manages 24 Protected Landscape Areas (PLA – out of total 26 in Czechia), 103 National Nature Reserves, 120 National Nature Monuments and more than 550 Nature Reserves and Monuments. In densely populated Central Europe with highly developed domestic and international tourism there is high demand for nature conservation, landscape protection and sustainable tourism. NCA takes active role in visitor management within its competencies.

### **Materials and methods**

This article focuses on the 24 Czech PLAs managed by NCA. They vary in many factors from area through present habitats to tourism intensity. Presented data on protected areas come from the Nature Conservation Central Digital Registry (Anonymus, 2019a) and is valid to April, 2019.

All presented information, mainly the protected areas system, is described according to the Czech Nature and Landscape Conservation Act No. 114/1992 Gaz. in actual definition of law.

Visitor monitoring is based on methods compiled by Braun-Kohlová et al. (2017) and further developed in contracts. Visitor monitoring data is currently stored in Eco-Visio online database (Anonymus, 2019b). Counter sensors usually detect all passing objects, but in some cases they measure only a specific visitor type (bicycles, canoes, motorised vehicles).

Interpretive guiding is based on principles presented by Interpret Europe association.

### **Results**

Data from visitor monitoring is the mandatory background for visitor management. The basic knowledge of protected area managers comes from their fieldwork, observations and experience. NCA runs visitor monitoring using automated counters since 2009. Some counters measure visitor numbers continuously, but most of the profiles are monitored for only limited timespan (usually 2-3 years) to reduce costs. Interesting example of results is visitation intensity at one trail leading to the top of Lysá hora in Beskydy Mts. PLA. Since 2010 the number of passes has tripled from 60 thousand per year to 180 thousand. On a contrary a path to the top of Kněhyně in the same PLA is closed for public use and decreasing number of passes clearly show the fruitfulness of different measures applied by NCA to keep the area calm and wild (see Fig. 1). Visitor surveys are another method to obtain valuable data. Some questions are always the same to secure overall evaluation, while other questions reflect specific situation in the region.

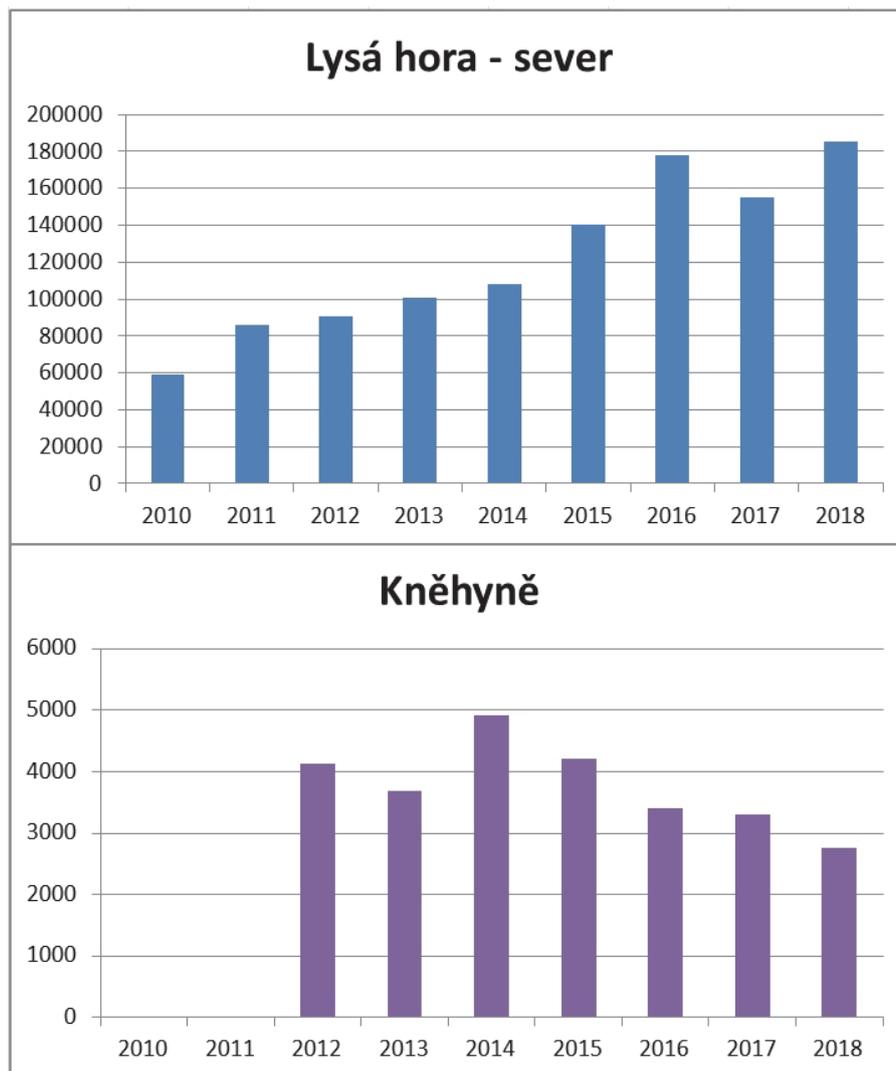


Fig. 1: Number of passes on a trail at Lysá hora has tripled during 9 years, while it decreases at Kněžyně due to several measures to keep the area closed for visitors.

NCA started to develop a network of visitor centres in PLAs in 2006. They are known as „Houses of Nature“. The aim is to establish one visitor centre in each PLA, while in larger PLAs there can be several more smaller infocentres. There are already 8 visitor centres and several infocentres running within the project nowadays. Each one has its original mascot as a guide through the exposition. Several more Houses of Nature are under preparation in different stages from an idea to a construction. The House of nature program is built on principles of Public Private Partnership. Typically a local NGO runs the centre while NCA supports the desired activities with an annual budget. Visitor Management Policies for PLAs (VMP) is the youngest instrument to manage visitors. The policies are being developed together with regional partners. Their content is based on interpretive planning, but includes non-interpretive visitor infrastructure, too. VMPs are compiled by external experts closely cooperating with NCA regional employees. The compilation consists of three phases: analysis, planning and application. It is discussed with the partners individually or at round tables, usually twice. At the end it is discussed with the ministry of the Environment and approved by NCA director. Proposed activities are fulfilled by NCA and its partners. Nowadays, four VMPs are finished and several more are in different phases of compilation.

Last but not least is the nature guide service. There is a demand for nature guides from protected area visitors. Personal capacities of NCA are limited and cannot fulfil the demand. Possibly the best way in modern world is interpretive guiding. Establishing of interpretive nature guide service in PLAs is under development. Together with partners in interpretation (especially with SIMID – Czech Association for Local Heritage Interpretation), NCA prepared courses for those who want to offer guided tours, especially for volunteer rangers. The courses may start already in 2019. Successfully certified trainees

will be promoted through Houses of Nature and at NCA webpages. We assume the service will be available from 2020 and hopefully soon expanded to all PLAs.

### **Discussion**

Visitor management is a complex approach based on many activities. Visitor monitoring provides necessary data, but is limited with available budget. It is always questionable if it is better to invest money into monitoring or into measures. To achieve success in visitor management it is important to cooperate closely with partners in the region. The best way is not only to discuss with them, but really work on some activities together while sharing responsibilities. In some regions there is a lack of active partners, but NCA competencies are limited by the law. Therefore destination agencies are needed in all protected areas or at least in those where higher visitor numbers occur.

### **Conclusion**

The Nature Conservation Agency performs several different activities in Protected Landscape Areas to secure nature while offering interesting outdoor experience to visitors. All the above mentioned (visitor monitoring, visitor centres, visitor management planning and interpretive nature guide service) and also other activities of NCA may lead to more effective nature conservation of protected areas and higher satisfaction of their visitors obtaining proper natural experience.

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### **Souhrn**

Agentura ochrany přírody a krajiny ČR spravuje 14 chráněných krajinných oblastí a několik set přírodních rezervací a památek včetně národních. Některá z těchto území jsou velmi oblíbená u návštěvníků a proto i velmi navštěvovaná, což často negativně ovlivňuje přírodu chráněných území. AOPK ČR zajišťuje řadu aktivit, které mají za cíl zajistit udržitelnost návštěvnosti svěřených chráněných území. Základem je monitoring návštěvnosti. Ten spočívá především ve zjišťování počtu návštěvníků na vybraných místech pomocí automatických sčítačů. V menší míře se využívají také návštěvnické ankety. Od roku 2006 AOPK ČR rozvíjí projekt Dům přírody, v rámci něhož vznikají návštěvnická a informační střediska v CHKO. První čtyři CHKO už také mají schválené koncepce práce s návštěvnickou veřejností a od příštího roku by měla být dostupná služba průvodců přírodou v CHKO. Kde to jde, měly by být aktivity nejen plánovány, ale i realizovány v úzké spolupráci s partnery v regionu, což se AOPK ČR v posledních letech celkem daří. Výsledkem by pak měla být efektivní ochrana přírody v chráněných územích a její návštěvníci odcházející spokojeni s tím, co v přírodě měli možnost zažít.

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# VISUAL QUALITY INDICATORS FOR ASSESSING LANDSCAPE CHARACTERISTICS AND MANAGING ITS PROTECTION

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## **Abstract**

The study of a landscape can be considered as a multidisciplinary topic that should include all its different characteristics and their relationships in space and time. The international scientific literature currently proposes several methodologies for the assessment of landscape visual quality, jointly with the analyses of natural, agricultural and human component dynamics, which are at the basis for land planning and management. In this paper, suitable landscape visual characteristics have been identified through the elaboration of some relevant indicators, able to take into account different land components and based on the concepts of six landscape visual characters, *i.e.*: coherence, disturbance, historicity, complexity, naturalness and ephemera. After a methodological framework description, an analysis in an *open-source* GIS environment has been applied. This approach is based on the integration of landscape metrics and land use data, which are the starting point for implementing these indicators. The methodology allows to analyze large land portions, for which the study area of a whole Italian region – the Basilicata Region - has been considered. The final result is represented by a series of different map-based indicators, that can be individually analyzed, or even combined, so as to formulate a general index for the landscape visual quality.

**Key words:** landscape protection, visual characters, landscape metrics, Geographic Information System, Map-based indicators

## **Introduction**

Landscape transformations are constantly increasing and, especially in the last century, their frequency and intensity are irreversibly redesigning patterns and structure (Antrop, 2000) often with negative impacts on nature conservation, quality of life and recreation for people (Kienast et al., 2015). These landscape transformations frequently have common features, even in areas with different territorial characteristics (Olišarová et al., 2018, Statuto et al., 2018/b). After the European Landscape Convention of 2000, the awareness importance of monitoring, planning and regulating all landscape components has increased, with the aim to preserve and enhance the landscape heritage (Statuto and Picuno, 2017). Several investigation methods have been proposed, such as the concept of *Landscape Character Assessment* (Swanwick, 2002). In the present study we applied an innovative approach to assess landscape visual quality, with the aim to evaluate some fundamental characteristics for the management and protection of the landscape. This approach is based on different techniques that mainly consider land cover datasets and landscape metrics (Statuto et al. 2018/a), which allows to implement a replicable and modifiable methodology, based on different objectives and landscape characteristics.

## **Material and methods**

The study area (Fig. 1), consisting of the whole Basilicata region (Southern Italy), covers a surface of 10,073 km<sup>2</sup>. From a landscape point of view, Basilicata is characterized by different protected areas of particular interest from a naturalistic and historical-cultural point of view. Many areas require continuous monitoring and planning actions, due to the fragility of the natural heritage and the increase in tourist pressure (Cillis and Statuto, 2018). The Basilicata's landscape presents varied morphological aspects thanks to the geological differences, that determine a considerable vegetational and faunistic richness.



Fig. 1: The Basilicata Region (Italy)

The methodology is based on six visual quality landscape indicators as suggested by Ode et al. (2008): *coherence*, *complexity*, *historicity*, *naturalness*, *disturbance* and *ephemera*, that measure some of the key concepts proposed by Tveit et al. (2006). Each indicator has been calculated thanks to some specific tools (Martín et al., 2018) and related plugins within a Geographical Information System (QGIS 3.4). The information needed to calculate these indicators refer to land use cover of 1960 (Land Use map of Italy), Basilicata region official dataset (2013), Land Copernicus dataset (land cover 2018) and Digital Elevation Model (DEM). These indicators have been evaluated as (Statuto et al. 2018/a):

- *Coherence*: it is related with landscape fragmentation. It has been calculated with “Effective Mesh Size” landscape metrics, based on land cover 2018;
- *Complexity*: it has been calculated as a landscape diversity index, using the Shannon's Diversity Index;
- *Historicity*: the degree of landscape historical continuity has been calculated in the period 1960-2018 for each area with land cover continuity and expressed in percentage;
- *Naturalness*: It describes the perceived closeness to a natural state. Starting from the use of the 2018, the naturalness has been calculated with the Hemeroby index (Walz and Stein, 2014) and inverting the values to be able to compare the indicator with others ;
- *Disturbance*: the presence of disturbing elements has been calculated as the percentage of anthropized area, obtained from the official Basilicata Region dataset;
- *Ephemera*: It refers to landscape modifications during the year, related to season succession or weather change. Recovering detailed information on Basilicata Nature Map, the percentage of vegetation that changes with the season (orchards, vineyards, pastures, arable lands, forests and meadows) has been assessed.

The first two indicators - *i.e.*: complexity and coherence - have been calculated, considering the whole study area, by Fragstats 4.2.1 software, applying a moving window approach. Historicity, naturalness, disturbance and ephemera have been expressed in a regular 1 km<sup>2</sup> square-mesh grid. The value of each indicator has been normalized within a scale ranging from 0 (lower value) to 1 (higher value), to make them mutually comparable and usable for further processing.

## Results and Discussion

In figure 2, the map-based values of the six indicators are reported.

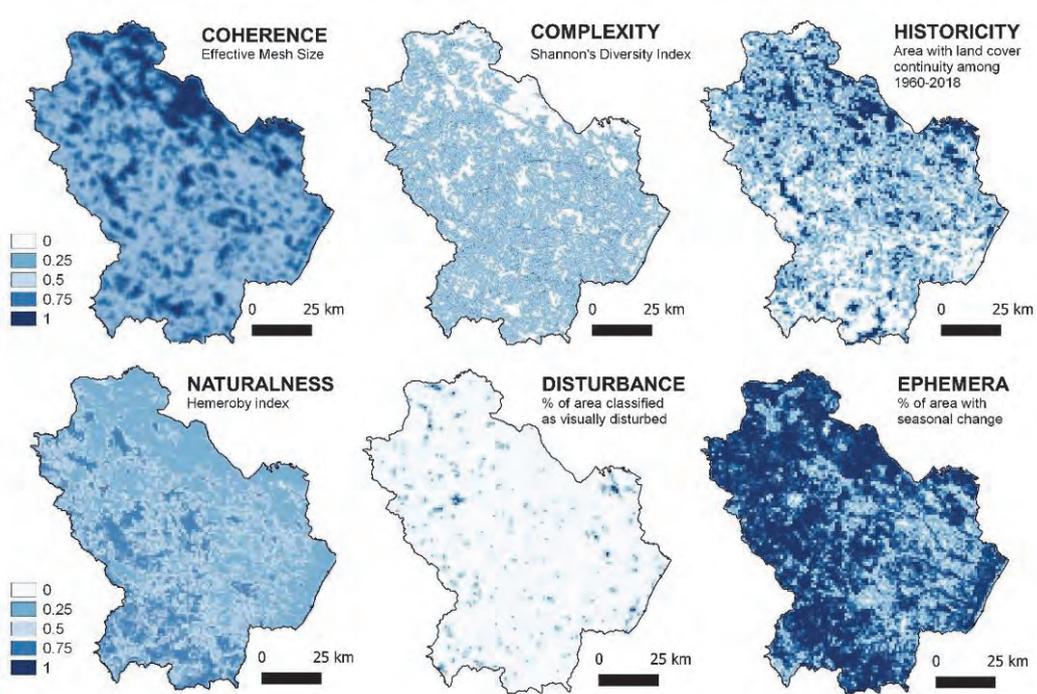


Fig. 2: Map-based values of the six indicators.

In the first step of calculation, the Index for Landscape Character Assessment (ILCA) has been obtained from the algebraic sum of the values calculated for each one of the six above-mentioned indicators, except for *Disturbance*, which has been subtracted to the total, since it determines a reduction of the landscape quality. Giving equal importance to each indicator for landscape purposes, the same weight has been assigned. Then, the Index of Visual Landscape Character Assessment (IVLCA) has been calculated with reference to an observation point, which has been extrapolated as the centroid of each 1 km<sup>2</sup> square grid. Finally, on the basis of a 5-m resolution Digital Elevation Model (DEM), a viewshed analysis (Čučković, 2016) has been carried out, allowing the realization of a binary cumulative raster map, that represents the visible (value=1) and not-visible (value=0) areas by each observation point (Fig. 3).

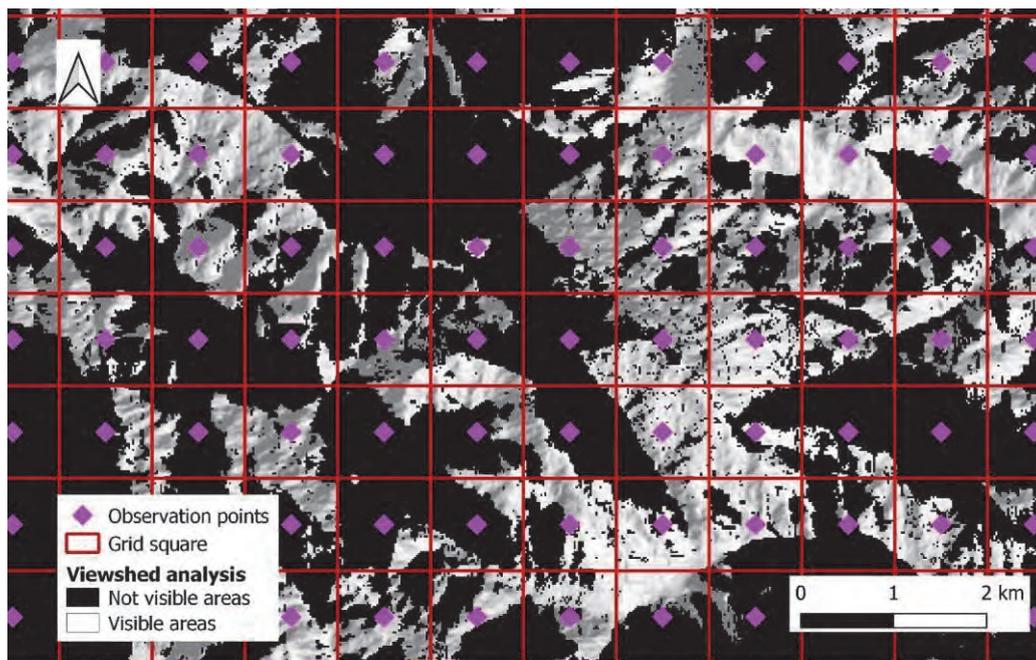


Fig. 3: Viewshed analysis: 1 km<sup>2</sup> square-grid, observation points, visible and non-visible areas

In a second step, the ILCA index has been then multiplied by the viewshed analysis raster value, resulting in the IVLCA map (Fig. 4 - right), in which the landscape quality is shown for visible areas only, since non-visible areas have zero value. The maximum value recorded of IVLCA is equal to 3.94 (on a theoretical maximum of 5).

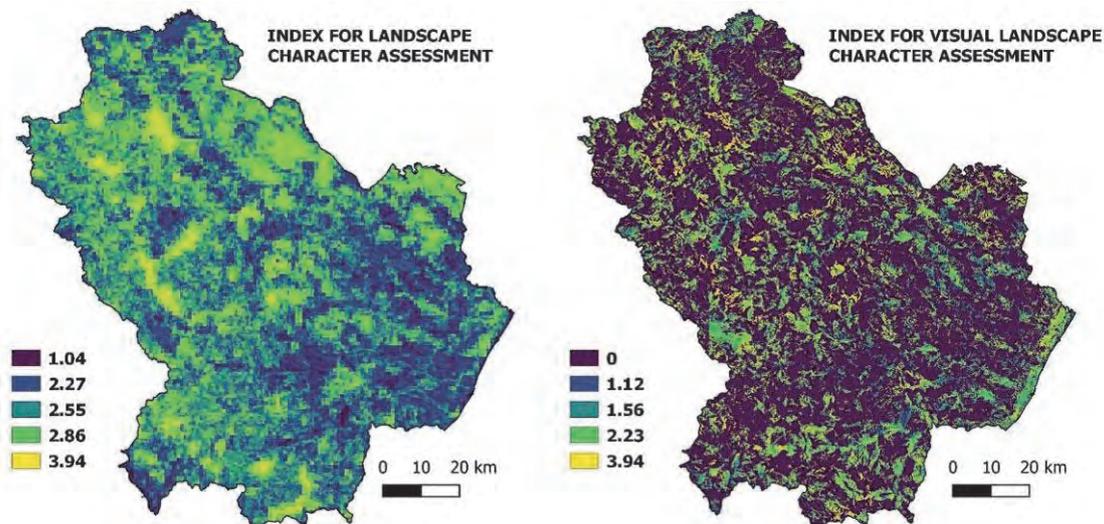


Fig. 4: ILCA (left) and IVLCA (right) maps

Finally, a more detailed statistical analysis was carried out considering the ILCA classes. 73.7% of the territory has indeed a value in the interval 2~3, while 16.6% in the interval 3~4. However, if we consider the IVLCA, it emerges that 67.2% of the territory is not visible from observation points, so the most representative class is still that with a value between 2~3, even if it covers a much lower land percentage (24.4%), due to a limited visibility. The same happens for the class 3~4, where the coverage percentage is greatly reduced (5.2%). The final result is that wide areas of the territory, even if characterized by an intrinsically high value of visual quality, are anyway roughly appreciable from an aesthetic point of view.

## Conclusions

The methodology which has been implemented allows the evaluation of the indicators which have been considered, individually or as a whole. For example, the elaboration of the *Disturbance* indicator shows how low is the anthropic pressure on this study area and therefore, with the exclusion of some core zones, it has a limited influence on the decrease of the final index. In this case study, only some key indicators have been selected but, for a more detailed analysis, others characteristics may be considered. In addition, based on the different needs of the public decision maker, each indicator can be assigned by a different weight, depending on the specific objectives of analysis. This methodology, implemented into a GIS and processing land use and land cover data, constitutes an useful tool for planning activities, in the perspective of rural landscape protection and valorisation.

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### **Souhrn**

V této studii byla navržena metodika pro vypracování indexu vizuálního hodnocení charakteru krajiny. Prvním krokem byl výpočet šesti specifických ukazatelů: soudržnosti, složitosti, historicity, přirozenosti, rušení a efeméry. V prostředí GIS byly vypočteny všechny jednotlivé mapové ukazatele, pak se spojily vizuálně. Nakonec byl první obecný index zkombinován s analýzou pohledu, aby se vypracoval konečný index pro hodnocení charakteru vizuální kvality.

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## WARSAW PARKS AS RECREATIONAL PLACES: NEEDS AND PREFERENCES OF THE ELDERLY USERS

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### **Abstract**

The elderly population continues to grow, becoming a bigger and bigger segment of the modern cities' society. The quality of life of the elderly, as well as their health, social relations or everyday activities are influenced by the access to green areas. As researchers point out, parks near housing estates are particularly important to people. 15 elderly users of three selected Warsaw parks participated in a qualitative study and revealed their attitudes and opinions on park features. In-depth interviews were used as a research method. Results proved parks proximity to be crucial for the elderly presence. Contact with nature and social relations were main reasons the elderly were spending time in parks. Accessibility of park features (i.e. stairs, landform) determined the perceived safety level. The results indicated parks to be places determining the quality of life of the elderly city citizens.

**Key words:** green areas, urban parks, recreation, accessibility, needs of the elderly

### **Introduction**

Modern population undergoes festinated ageing process, which affects most of the developing countries in Europe, including Poland. Due to GUS' (Central Statistical Office) statistics ( GUS 2014) the number of elderly people in Poland has increased almost eightfold in the last fifty years, and is still growing, what leads to prolong the old age up to 20-30 years. Forecasts shows that in 30 years there might be a situation in which one in ten citizens of our country will be 80 years old or older. Elderly people face many age-related problems. These are above all movement and sensory disorders, including the associated problems with memory, speech, vision and hearing, as well as cardiac problems associated with improper work of the respiratory and circulatory system (Podgórska 2012). 12% of elderly people fights with depression which is caused usually by loneliness (GUS 2015).

One of the most serious problems of older people is social exclusion, as well as the related phenomenon of spontaneous withdrawal from social life as a reaction to the fear of failure in the face of challenges that exceed the physical and mental capabilities of seniors (Leońska 2000, Saniewska-Kilim et al. 2008). This phenomenon particularly affects urban public spaces, including parks, where technical solutions, both at the program and detailed level, do not take into account the requirements of older people (Celik and Seyidoglu 2010). For this reason, older people prefer to spend more and more time in their home and closest surroundings. The physical environment is thus the leading tool for discrimination against older people and their exclusion from social life (Baris and Uslu 2009, Celik and Seyidoglu 2010). Meanwhile, for many elderly lonely people it is the public space: parks and squares are the place of the only social contacts that determine a better quality of life for seniors, improvement of health and well-being (Heikkinen 1989).

Research shows that contact with greenery has a positive effect on the physical and mental condition of man (Ulrich 1984, Li 2010, Li et al. 2010). Green areas are for many people a regenerative environment that allows them to keep the body in a state of equilibrium (Said 2007). In the opinion of many authors, the particular beneficiaries of green areas are the elderly. The results obtained by Maas et al. (2006) showed that the perceived health condition is in close relation to the amount of greenery in the vicinity of the place of residence. This relation occurs regardless of the level of urbanization, and in large cities it is particularly visible in three social groups: the elderly, children and people with secondary education. According to de Vries 2003, older people use green areas as they spend a lot of time in the green surroundings of their homes (estate parks, squares).

Parks visitation contributes to physical activities (Stewart et al. 2016). According to Takano (2002), walking availability of green areas (including parks and streets planted with trees) affects the increase of physical activity, and thus the extension of life of older people (regardless of their age, sex, marital status, socio-economic status). It has also been proven that mental health is to a large extent related to the distance from the parks (Sturm and Cohen 2014). The proximity of the park is directly related to the park's time of use among older adults (Mowen et al., 2007).

According to researchers, the space available to users should be characterized by the right location (Kwan 2004). People with limited physical fitness need much more time to reach the object and, importantly, stay longer in it than other users (Seeland and Nicole 2004). According to research by

Sugiyama et al. (2015) areas available for seniors should be located 5-10 minutes from the house. Burthorn and Mitchell (2010) indicate 500 m for an acceptable distance for seniors. Stoneham (2005) also draws attention to the need for car parks for people with disabilities in close proximity to the entrance. For the comfort of moving around the space, its characteristic elements are important, facilitating orientation (Furgeson 2004). The priority of providing access to public areas to the needs of seniors is first of all to provide them with a sense of security (Herman 2015). This mainly concerns the lack of barriers (including architectural ones), such as stairs. The features of a good space are numerous places to sit, wide and even surfaces, access to toilets (Trakul-Masłowska 2012, 2015, Barlow 2003, Bujacz et al., 2012). The attractiveness of space is also associated with the functional program and proposed activities (Trakul-Masłowska 2012). In the face of the above facts, the aim of the study presented in the article was to assess the availability of selected Warsaw parks in terms of adaptation to the needs of older people.

### Material and methods

A qualitative study was conducted: in-depth interviews with seniors residing in three selected parks. The aim of the study was to analyze the preferences and expectations of users (older people) towards parks. For the purposes of this study, an original interview form was created whose design was based on a PPS (Project for Public Spaces) place diagram (Table 1). The study also identified the characteristics of a friendly park (respondents gave positions in the ranking to individual features). The study was conducted in April-July 2017.

Tab. 1: The interview questionnaire used in the study

<b>Access and linkages</b>
Do you live nearby? How far is your place of residence? How long does it take you to get to the park? Do you commute to the park by public transport? What do you think about the access to the park?
<b>Comfort nad image</b>
Is the entrance to the park clearly marked? How do you assess your own ability to orientate yourself in space? Do you think the noise level in the park is acceptable or too high? Is it easy to orientate yourself / find yourself in the space of this park? Is its layout, paths clear? How do you judge the ways we move? Is the surface adequate? Do you have difficulty getting around the stairs? Are the stairs too steep? How do you assess the location of the equipment on the route you are traveling? How safe do you feel here? Have you encountered any unpleasant events / experiences in the park? Is this park attractive for you? If yes / no, why? What attracts you to this place? Do you like to rest near water? Is the presence of toilets in the park important to you? What barriers did you encounter in the park?
<b>Uses and activities</b>
How often do you go here? How much time do you spend here? How do you spend time in the park? What activities do you perform? Do you enjoy the entertainment offered by the park (eg outdoor gyms)? Do you move around the entire park or do you have your favorite places? What events / attractions would make you appear more often in the park?
<b>Sociability</b>
Do you like / prefer to rest alone? Do you usually spend time alone or in a group? What do you think about the initiative of organizing events (such as concerts, exhibitions, happenings)? Would you participate in them? Did you meet with the situation that a younger person from your staying in the park helped you overcome some obstacle? Do you feel part of this place? Do you consider this park as a park "friendly to seniors"? Do you think that older people in this park can easily interact with their peers?

The research was carried out in 3 Warsaw estate parks: Zasław Malicki Park, covering an area of 6 ha, John Paul II Park, covering 4.3 ha, Park at Bażantarnia, with an area of 9 ha. The research was conducted in April-July 2017 on a group of 15 people (Table 2).

Tabl. 2: Characteristics of 15 respondents participating in the survey

<b>Sex / Age / Motorics</b>
Male 73 years old, not using any motor assistance.
Male 69 years old, not using any motor assistance.
Male 82 years old, moving in a wheelchair.
Female 75 years old, leaning on a cane.
Male 65 years old, not using any motor assistance.
Female 79 years old, with significant visual impairment supporting a white cane.
Male 85 years old, leaning on a cane.
Female 67 years old, does not use any motor aids.
Female 85 years old, moving in a wheelchair.
Female 72 years old, leaning on a cane.
Male 74 years old, leaning on a cane.
Male 86 years old, moving in a wheelchair.
Female 71 years old, does not use any motor aids.
Female 89 years old, leaning on a cane.
Male 66 years old, does not use any motor aids.

## Results

### 2. In-depth interviews

The results of in-depth interviews are presented in Table 3.

Tab. 3: Selected conclusions from in-depth interviews with the senior users of 3 Warsaw parks. All content of interviews is available from the authors of the article.

<b>Access and linkage</b>
<p>About half of the respondents were residents of neighboring housing estates, which was the reason for their presence in the park. Thanks to this, they could visit the park every day without using means of public transport, and at the time of going out to do other private matters. When assessing the access to the object, the respondents indicated limited accessibility of pedestrian routes, the most frequent reasons being poorly parked cars on the sidewalks, preventing free passage (Park Malickiego and Park near Bażantarnia). For some of them, there were also obstacles to pedestrian crossings and stairs. Due to limited mobility, the respondents also emphasized that it takes them much more time to reach the park than at the time when a healthy person comes. A small part of the interlocutors reached the objects using means of public transport. They pointed out, however, that the distance between the public transport stop and the designated entrance, as in the case of the Bażantarnia Park and the John Paul II Park, is too far away for them.</p>
<b>Comfort nad image</b>
<p>Respondents rated parks as friendly but difficult to use. They perceived the vegetation mass as a "monolith" in which it is difficult to identify individual elements, eg entrances (Park at Bażantarnia). The factor limiting the orientation in the park was its complex spatial arrangement and lack of characteristic places and points that would increase perceptual abilities. A large number of roads intersecting at different angles was assessed as complicated (Park Malickiego and Park at Bażantarnia). Respondents indicated that in the process of orientation in the park, they would help them with signs indicating the direction, along with information on the type and distance of reaching the given place.</p> <p>Another element of the park's assumptions affecting the use by the elderly was the technical condition of the surface (uneven surface, tree roots bulging surfaces, cracks, material consumption). Respondents preferred smooth surfaces (asphalt, concrete slabs), negatively assessing those built of small elements (difficulties for people moving with a cane and a wheelchair). The subjects from Malicki Park also complained about too narrow paths. They rated the gravel surface poorly in the Park near Bażantarnia (uncomfortable for people using a walking stick and a wheelchair).</p> <p>Respondents showed preference on homogeneous surfaces. Patterns were often perceived as depressions, and shiny surfaces as potentially slippery (Park at Bażantarnia). As a threat, they assessed the height differences between surfaces of different types (Park at Bażantarnia: plate and gravel surface with a few centimeters difference in levels).</p> <p>The benches were rated as the most frequently used element of the park. Seniors showed a preference for benches with backrests and armrests, with a seat at a height of about 45 cm. They preferred benches in the bays, off the paths.</p> <p>As dangerous, they determined the elements at head height (information signs) and knees (low posts). The stairs in the parks were rated as an obstacle to movement (uneven grades and risers), the lack of handrails was also negatively assessed, as well as too narrow ramps. Respondents only respond positively to the stairs in the Park near Bażantarnia, with extensive gradations and touch marks.</p> <p>The presence of toilets, especially those adapted for the disabled, was positively evaluated. The seniors admitted that the lack of access to toilets is for them a limitation in accessibility to the space.</p> <p>The possibility of contact with nature was mentioned among the respondents as the most important feature that makes the park attractive for them. The second place was the opportunity to interact with other people. A small part of respondents also referred to the park as a place where physical activity is possible.</p> <p>The respondents, especially users of the Malicki Park, considered water and water elements to be particularly</p>

attractive. They described resting near water as an additional source of aesthetic and sound experience. None of the respondents made negative comments about urban noise. For all audiences noise in the park emitted by driving cars was acceptable. Due to numerous barriers, opinions of seniors indicated that their sense of security in the park is moderate. Nevertheless, none of the respondents encountered an unpleasant situation in the park, which would be persecutory.

#### **Uses and activities**

Studies have shown that the main activity of older people in parks is walking and resting on benches and observing the surroundings.

Analyzing the respondents' opinions, the opinions about outdoor gyms located in the Park of John Paul II and Malicki Park were surprising. As it turns out, the possibility of developing physical activities in the park, other than walking is very valuable for seniors and is its additional advantage. When asked if they use the local gyms, they usually answered in the affirmative. Similarly, positive observations were noted for chess tables located in the Park near Bażantarnia.

Most respondents admitted that they often stay in parks, and the length of time they spend here depends on the degree of enrichment of the program offer.

#### **Sociability**

Respondents acknowledged that conditioning is one of the main factors determining the presence in parks. The possibility of contact with another person influenced their level of optimism and satisfaction with life, and the park as a place influences the establishment of social bonds. The presence in the park was focused on looking for contacts with peers, although contact with other age groups (eg children) also triggered positive reactions. The seniors in a negative way referred to the issue of organizing events in the park, eg concerts, exhibitions, happenings, etc. They recognized that these events are mainly dedicated to younger users, and they themselves did not show willingness to participate in them.

Tab. 4: Medium ranking of the characteristics of a friendly park for seniors. The respondents ranked the park's features on a scale of 1-5, where I- this feature is best reflected by a friendly park in the opinion of seniors, and V- the least.

No.	Feature	Position in the ranking	Average ranking
1.	Possibility of walking and resting.	I	1,3
2.	The opportunity to enjoy nature.	II	2,0
3.	Possibility of social interaction, meetings, conversations with other people, making new contacts.	III	3,4
4.	Possibilities of using any entertainment offered to me by the park, eg outdoor gyms, chess tables.	IV	3,5
5.	Showing the history of the place.	V	4,8

### **Discussion**

The results of the research confirmed the conclusions of other researchers that the presence of seniors in the park is key to its close location and the appropriate distance of stops and pedestrian crossings, as well as pavements leading to the park and no impediments in the form of parked cars (Kwan 2004, Rebstock et al. 2009). Seniors are more likely to visit the park, they have more opportunities to do other things during the trip, eg shopping, walking a dog. The results of the research confirmed that the biggest problem of seniors in the public space are numerous architectural barriers, limiting their mobility and threatening the sense of security (Trakul-Masłowska 2015). Of particular importance to them are the smooth surface, wide stairs with stable handrails and the presence of wide slipways (a key factor for people using wheelchairs) (Bujacz et al., 2012). Older people perceive security precisely through the prism of no risk of collapse, damage to the body, and not as "no threat from the attackers". The results of the research have also confirmed the conclusions presented by other authors (Trakul-Masłowska 2012) that the comfort and time spent in the park by seniors depends on the availability of toilets.

The research results supported the conclusions that physical activity is related to the availability of green areas (Stewart et al. 2016, Takano 2002). Nevertheless, the respondents considered walking and resting on benches as the main activity, as well as observing the environment, which he points to the need for social contacts, which other researchers wrote about (Heikkinen 1989). Importantly, the respondents did not express interest in participating in events organized in the park, considering them to be addressed to younger people. They definitely perceived themselves as observers or silent users of space.

The respondents' comments on the park's equipment (number and type of seating, stair accessibility, slipways, appropriate terrain features) coincided with the problem described by Baris and Uslu (2009) and Celik and Seyidoglu (2010): physical environment features are a tool for discrimination against people the elderly. In the case of the analyzed objects, the way the park was installed did not exclude

the presence of elderly people in them, although it did not guarantee them full accessibility and comfort. The respondents' opinions about the fear of a potential fall may also indicate that a significant problem for them is confrontation with the features of space, in which they can feel as "unsuitable" to society (Leońska 2000, Saniewska-Kilim et al.2008).

Particularly noteworthy is the fact that respondents recognized nature as the most attractive element of the park and the reason for their presence in the studied facilities. This shows a strong need for contact with nature, which may suggest that for seniors, the estate park is a kind of regenerative environment (Said 2007), and the green itself has a positive effect on their mental and physical condition. However, it should be noted that "uniform" vegetation can be perceived by older people as a "monolith", which makes it difficult for them to identify individual elements of space, even as important as entering the park. Therefore, the right selection and plant composition seems to be an extremely important matter - they will facilitate orientation in space and increase the comfort of staying in it.

## Conclusion

The research results confirmed that the quality of life of older people in cities is directly related to the availability (proximity and quality) of estate parks. Seniors have a strong need for a compact with nature and social contacts. In the context of demographic phenomena (aging of the population), access to space for seniors becomes an extremely important issue.

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## **Souhrn**

Starší populace stále roste a stává se větším a větším segmentem společnosti moderních měst. Kvalita života seniorů, stejně jako jejich zdraví, sociální vztahy nebo každodenní aktivity jsou ovlivněny přístupem do zelených oblastí. Jak upozorňují vědci, parky v blízkosti sídlišť jsou pro lidi obzvláště důležité. Kvalitativní studie se zúčastnilo 15 starších uživatelů tří vybraných parků ve Varšavě a odhalilo jejich postoje a názory na parkové prvky. Jako výzkumná metoda byly použity debutní rozhovory. Výsledky prokázaly, že blízkost parků má zásadní význam pro přítomnost starších osob. Kontakt s přírodou a sociálními vztahy byl hlavním důvodem, proč starší lidé trávili čas v parcích. Dostupnost parkovacích prvků (tj. Schodiště, landform) určovala vnímanou úroveň bezpečnosti. Výsledky ukázaly, že parky jsou místy určující kvalitu života starších občanů města.

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# WATERCOURSES AND THE STATE OF THE OBJECTS IN THE RIVERBEDS IN THE RECREATIONALLY INTENSELY USED LOCATION OF TRAINING FOREST ENTERPRISE MASARYK FOREST KŘTINY

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## **Abstract**

This article is based on the results of fieldwork on the territory of the Training Forest Enterprise Masaryk Forest Křtiny (TFE). When in the framework of the project of the purpose-oriented activities the passportization of the objects in the streams in 2017 and 2018 was the territory of the forest districts Vranov and Bílovice nad Svitavou fields were evaluated. The status and location of the objects, photographic documentation, detailed descriptions and, if appropriate, proposed interventions for improvement have been recorded. The article also assesses the impact of human activity on objects and on the status of watercourses in the locality, which is burdened by intensive short-term recreation, forestry management as well as permanent use for housing and community development. At a time when there is a growing scarcity of water in the landscape, it is necessary to focus on small water courses in the forest

**Key words:** stream, structure, sill, barrage

## **Introduction**

The territory of TFE is a very exposed locality situated close to the city of Brno.

Forest land property of MZLU Brno has an area of 10,265 ha. Forests form a continuous complex immediately linking with the northern limits of the Moravian metropolis of Brno and reaching as far as to the town of Blansko. About a third of the TFE area is situated within the Protected Landscape Area of the Moravian Karst.

The aim of the research was to identify transverse objects in the selected locality, focus the location of individual buildings (GPS), detailed description of the structure and its condition, measure the object, evaluate functionality, suggestions for improvement. On the basis of the field research, a catalogue of transverse structures was created on the territory of the SLP with a detailed description of the structure, the condition of the building and the possible problems of their functionality. Furthermore, a GIS layer was created with an overview of individual objects and their description..

## **Materials and methods**

On the basis of negotiations with the management of the Bílovice nad Svitavou and Vranov forests, streams were set up for detailed field research. Seven streams in the Bílovice forest and five streams in the Vranov forest, whose troughs were closely monitored, were selected as a priority. These are: nameless left-hand tributary of Svitava, Žilůvecký stream, watercourse of Skok, watercourse of Česnýř, Kuní stream, Ušakovský stream and watercourse in Těsnohlídek valley, in the area of Bílovice Forest (Fig. 1). Zaječí stream, Kubelín, Rakovec, Melatín and Útěchovský stream in the Vranov forest district (Fig. 2). In the field, objects on the watercourse were directed by GPS, photographed, and subsequently described in a text message.

A simple spatial database was created in the QGIS software, containing location data in the JTSK system, the type and status of a particular object and additional information (flow kilometre, CHP IVth order, stewardship, cadastral territory). A well-arranged map of the identified objects was prepared on the basis of the Base Map of the Czech Republic 1:50 000, the map of objects in detailed maps in the scale 1: 5 000 was processed in the current map of the FMP 2013–2022 ).

Only the flows that can be tourist or recreational significant for the site are presented in the article.

## Results

### Flows of forest district Bílovice nad Svitavou

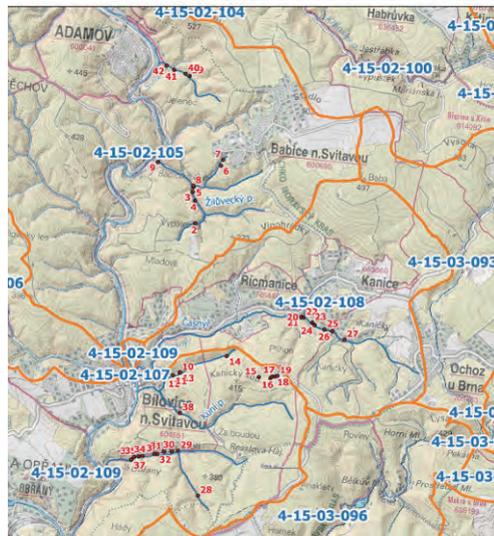


Fig. 1: Overview of mapped streams with identified objects in the Bílovice forest

#### Žilůvecký stream

The Žilůvecký stream is the left-hand tributary of the Svitava River, where it flows in its rivers km. 20.7 at 240 m above sea level, near the railway station Babice. The stream springs between the villages of Kanice and Babice nad Svitavou at an altitude of 330 m above sea level. The basin is wooded. A detailed description of the river basin and its characteristics is given by (Pelikán, 2011).

According to the central register of watercourses, the Žilůvecký stream and its tributaries are managed by LČR. The flow is unadjusted and contains only small objects, thresholds, steps. The tributaries are also untreated again only with small objects in the trough. A blue hiking trail passes through the valley. In the lower part of the stream, where the path lies close to the right bank, there are several small structures in the trough, these are shoots and dams made of concrete tiles. These adjustments look very aesthetic, probably the fishermen's objects, which break down the flow into fish-breeding sections. These objects should be replaced by sills from logs. Flow revitalization and its surroundings are solved (Šlezinger, 2014). A small water tank could be created at the location of the existing tumbler in the bed.

#### Těsnohlídkovo valley

The flow through the Těsnohlídkovo valley is nameless, the yellow valley trail passes through the entire valley. From 0.550 km to 1,350 km, the road is unpaved, in the lower part it is a narrow path, in the middle part the path is often straight, or waterlogged. In the lower part up to km approx. 0.700, the flow crosses the road without objects, a culverts or fords. From 1,350 km it is a paved road running along the left bank. The basin is asymmetrical and is wooded, with a relatively narrow trough covered with branches in the upper part. In the central part, the trough is wider and the levelling line extends to the level of the road leading along the left bank. The path is crossed several times by the trough. Moving along the road can be difficult, especially in the aftermath of the rain, when the road is flooded, and in places of intersection it can become unpredictable for hikers for a long time.

#### Kuní stream

The Kuní stream is the left-hand tributary of the Svitava River, which flows into the southern edge of Bílovice nad Svitavou at an altitude of about 225 m above sea level. The basin is forested and frequently visited by tourists. The upper half of the flow is conducted in a narrow cut bed, in a dense stand of mostly spruce. The lower part of the flow leads along the paved road, the road follows the flow along the right bank to the mouth. On the flow there is the only major object, a small water reservoir in km 0.850. The reservoir has a dam made of quarry stone. It is located near the intersection of forest paths, the sitting area is nearby, the area is well maintained, so the reservoir is an important place to visit.

## Flows of Vranov forest

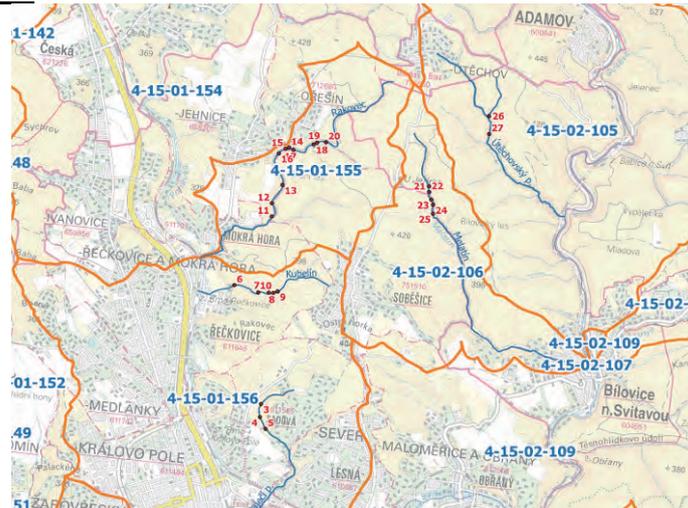


Fig. 2: Overview of mapped streams with identified objects in the Vranov forest

### Zaječí stream

Zaječí stream is located in the northern outskirts of Brno, flows through the cadastral area of the city part Sadová. The flow is untreated, located in a wooded relatively deep valley. The trough itself is shallow and loamy, clogged with fall from the surrounding stands. Although the marked hiking trail does not pass through the valley of the stream, the area is widely used for walks of inhabitants from the surrounding buildings and gardeners, as well as the movement of tourists on horses. There are several water bodies on the river, all in a very poor state of both technical and ecological. Some parts of the banks are very damaged due to abrasion and trampling, here it is advisable to use stabilization structures (Pelikán 2018).

### Rakovec stream

It is an unmodified stream in the northern part of Brno, flowing through the territory of the cadastral districts of Ořešín, Jehnice and Mokrá Hora. A blue hiking trail leads along the stream from the mouth to the crossroads below Kněží Mountain. There are eleven objects on the stream, mainly small reservoirs and pools. In the lower part there are newer tanks in good technical condition, with regard to the marked hiking path it would be appropriate to create vistas in dense shrub vegetation between the reservoir and the road, so that a view of the water areas is possible. Below the village of Ořešín, just below the Ořešínský brook outlet, there are side tanks that are in very poor condition. A good example is the pools and reservoir above the confluence of the Ořešín stream and Rakovec (Fig.3). These water areas significantly increase the attractiveness of the area, the banks, which are largely grassed, attract to access the water surface or to sit on the grass.

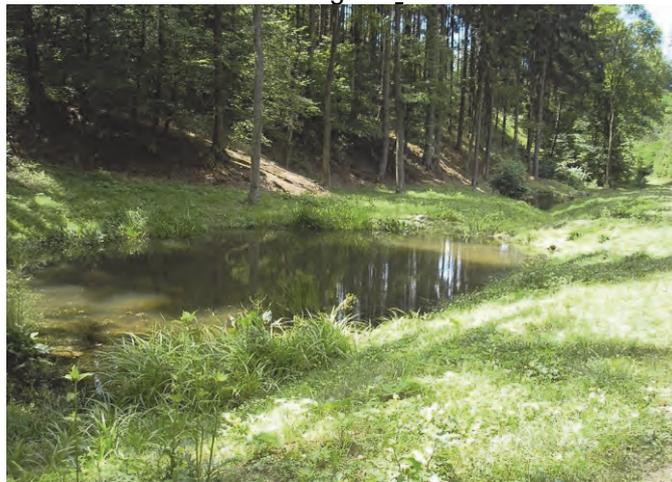


Fig. 3: Flow rate pools, Rakovec stream

### Melatín stream

The Melatín stream flows mostly through the cadastral district of Bilovice nad Svitavou. It is the left-hand tributary of the Svitava River, in the upper part it flows through forest stands in the lower part of

the village. There is a yellow hiking trail along the stream, with several gabion dams on the stream and a walled stone barrier with permanent water. There are signposts along the road and a seating area.

### **Discussion**

Out of the twelve monitored flows, we can designate six as flows that are or could be more significant for recreation. It is a short-term tourism mainly for pedestrians or cyclists. The most loaded watercourse in the area of the Bílovice Forest is the Kuní stream. The path leading through the valley is a paved forest road and the hiking trail leads either directly to the road or runs in close proximity. The increased number of visitors is mainly due to the accessibility of the boarding place, in Bílovice, where there is good train connection with Brno, the cycle path along the Svitava River. There is only one important tourist point on the river itself and it is a small water reservoir. The building is very nicely integrated into the surroundings, which is maintained. The nearby wooden bridge is also attractive. There is a seating area for tourists. Another stream, which is copied by the hiking trail, is the Žilůvecký stream. Here, however, the flow itself is not attractive for tourists. In the lower part of the track, where the hiking trail is in close proximity to the right bank, there are several transverse concrete structures in the bed, whose construction is not adequate. If they were replaced by stone or wooden structures, they would certainly not only be functionally, but also aesthetically more suitable, after the surroundings were modified. The creek in Těsnohlídek valley is copied along the entire hiking trail. The movement of hikers and cyclists is complicated by the tracing of the road in some parts of the river bed and, in frequent cases, rutting and waterlogging at the crossing points of the road with the road. In the lower section, it would be advisable to reinforce the crossing of the road with the flow of stone fords in the places of movement of forestry equipment, where the tourists only move the larger stones for easy crossing.

On the territory of the Vranov forest, we can mark three of the five monitored streams as more touristic. The trail, which runs along the Melatín watercourse, is very popular with tourists, again for a good connection to public transport. There is a small water reservoir and several gabion dams on the stream, along the route there are information signs and a rest area. The Rakovec stream is lined with a blue tourist trail, the route leads through the peripheral parts of Brno and so there is a considerable movement of tourists. In the upper part there is, under the village Ořešín, several pools and a small water reservoir, the space is adjusted and maintained. The third flow that can be assessed as potentially attractive to tourists is the Zaječí stream. At present, there is no marked trail through the valley, but it is clear that the area is frequently visited. There are several small water reservoirs that are in poor technical condition. After their reconstruction and adaptation, there is a great recreational potential due to the growing housing construction in the adjacent parts of Brno Lesná and Kociánka.

### **Conclusion**

A detailed field survey was carried out on selected seven streams on the solved area of the Bílovice nad Svitavou forest area. A total of 42 objects were identified, described and evaluated, of which 23 are in poor condition, or require less or greater intervention, measures have been proposed to maintain them or restore functionality properly. There are mainly culverts on the streams.

The most striking impact is on the flow in the Těsnohlídek valley, here in the lower part there is a collision between the flow and the way. It is necessary to clean, repair the culverts and solve the reinforced fords crossing the path with the river bed. In the lowest section, about 100 m long, there is a path in the trough, the trough is waterlogged in the whole valley. It is advisable to excavate the trough and fortify it, concentrate the flows to one side of the valley and shape along the path, pouring the path along the flow.

On the Kuní stream, it is possible to build a smaller sedimentation tank about 300 m above the existing reservoir, to collect sediments and reduce sediment in the existing reservoir.

There is a system of thresholds and shoots of concrete tiles in the lower part of the stream on the Žilůvka stream. There is a tumbler in 0.110 km, at which point MVN could be built.

A total of twenty-five buildings were identified, described and evaluated on selected five watercourses in the Vranov forest area, nine of which are in poor condition and measures have been proposed to maintain them or restore functionality. There are mainly small water reservoirs, dams and pools. The presented streams are selected from a total of twelve streams, such as flows, interesting for tourists for short-term recreation near Brno.

Spatial database and map attachments prepared in the QGIS program are part of the final report (Marková 2018, Marková 2019) in electronic form in pdf (map) and shp (ESRI shapefile) formats.

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## Souhrn

Na 12. mapovaných tocích v polesí Vranov a Bílovice nad Svitavou, bylo identifikováno 68 objektů, z nichž 32 bylo v nevyhovujícím stavu. Na tocích se nacházejí hlavně propustky, malé vodní nádrže a prahy. Presentované toky jsou vybrány jako toky, turisticky zajímavé pro krátkodobou rekreaci v blízkosti Brna.

Nejvýraznější zásah je na toku v Těsnohlídkově údolí, zde v dolní části dochází ke kolizi mezi tokem a cestou. Je potřeba vyčistit, opravit propustky a vyřešit zpevněné brody pro křížení cesty s korytem toku, aby byl usnadněn pohyb turistů po značené stezce. Na Kuním potoce, je možné nad stávající nádrží zbudovat menší sedimentační nádrž, pro zachycení splavenin a snížení sedimentu ve stávající nádrži. Na Žilúveckém potoce v dolní části toku, kde vede v těsné blízkosti turistická stezka, by bylo vhodné provést revitalizační úpravy. V korytě je soustava prahů a výhonů z betonových dlaždic, úpravy jsou poněkud nevzhledné a patrně amatérské. Presentované toky na území Školního lesního podniku mají velký rekreační potenciál. Jedná se o toky, kde již nyní, můžeme zaznamenat zvýšený pohyb turistů, navržené úpravy by měly přispět k atraktivnější a příjemnější lokalitě.

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Krajina - provází nás celý život. Proto my, krajinní inženýři, máme zájem o to, aby se krajina nestala jen pouhým výrobním faktorem, ale zůstala hrdým národním dědictvím poskytujícím lidem více než domov.

### **To je naše práce, to je náš cíl.**

Během práce se opíráme o 6leté zkušenosti z projekce i realizace různorodých projektů jak v intravilánu, tak i ve volné krajině. Při naší práci hraje prim selský rozum, poctivá práce a razíme heslo: „Obnovme biotop, vrátí se i druhy na něj vázané.“

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### Žijeme v pozoruhodné době:

- Stále více návštěvníků **hledá klid** nebo autentické místní akce, a současně sociální sítě dokážou takové akce nebo skrytá místa přes noc **zviditelnit** a proměnit.
- Marketingové týmy úspěšně pracují na přilákání **většího počtu** návštěvníků, a přitom sílí hlasy po **omezení masového** cestovního ruchu (Český Krumlov, Praha, Adršpach...).
- **Nabídka volnočasových aktivit roste**, vznikají další a další naučné stezky, muzea, expozice, stezky v korunách stromů..., a přitom výzkumy ukazují, že klasické panely v terénu skutečně čtou **jednotky procent** okolo jdoucích, zajímají je spíše trasy než obsah.
- Destinační managementy, ale i kulturní památky a muzea, měří svou úspěšnost **růstem počtu** návštěvníků, ale na **kvalitu jejich zážitku** se skoro nikdo neptá.
- Nároky návštěvníků na **kvalitu služeb** a infrastruktury rostou, a současně si provozovatelé služeb v cestovním ruchu dlouhodobě stěžují na **nedostatek kvalitních pracovních sil**.
- Počty návštěvníků **chráněných území**, památkových **rezervací** a zón se zvyšují, ale ochota návštěvníků **respektovat pravidla a nutná omezení** klesá.

### Co s tím?

- Odmítat cestovní ruch?
- Přijmout negativní dopady intenzivního cestovního ruchu jako nutné zlo a soustředit se na ekonomické přínosy?
- Ukazovat nejcennější místa a doufat, že zvýšená pozornost veřejnosti je pomůže ochránit, nebo nejkrásnější místa z obavy před zničením jejich genia loci skrývat?

Podobné otázky řešíme při každém **interpretačním plánování**, při každé tvorbě **Koncepce práce s návštěvníckou veřejností**, které děláme.

**Ptáme se na názor** správců „pokladů“ (chráněných území, kulturních památek, muzeí...) i jejich návštěvníků (*turista v CHKO Brdy: „...hlavně ať to tady nedopadne jako na Šumavě“*).

**Hledáme řešení pro konkrétní situaci** a využíváme přitom dlouholeté zkušenosti ze zahraničí i z České republiky. Pomáháme zadavatelům i tvůrcům ujasnit si **proč** něco vytvářet (cíle), **pro koho** (cílové skupiny), **co mu říct** (hlavní sdělení) i **jak** to nejlépe říct (prostředky komunikace), a jak si ověřit, že to funguje (způsoby **monitoringu efektivity** komunikace s veřejností a **dopadů** do území).

**Řešení problémů je v lidech, jejich komunikaci a rozhodování. S tím vám můžeme pomoci.**

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