SPATIAL DIFFERENTIATION OF THE INTERPRETIVE NATURE TRAILS IN THE LARGE-AREA PROTECTED NATURAL TERRITORIES

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Abstract

The large-area protected territories within tourist regions the South Bohemia and the Šumava Mountains were observed – the National Park Šumava and the Šumava Protected Landscape Area, the Třeboňsko Protected Landscape Area, the Blanský les Protected Landscape Area and the Natural Park Novohradské hory. Location of the routes of particular interpretive nature trails was observed in types of relief, land use and climate. Observed and expected lengths of interpretive nature trails were compared. General natural relations in the creating of interpretive natural trails were successfully proved primarily for the particular types of land use. The most interesting is the obvious interconnection between interpretive nature trails and urban structures, which means the point of the usual entrance in the interpretive nature trail, and this even if the core of most of interpretive nature trails lies out of these urban structures. On the contrary, the use of the territory for routing according to the types of relief and first of all according to the type of climate reflects the specifics of particular areas. Not only the impact of existence of a natural occurrence plays a role when creating the interpretive nature trails but the frequency of appearance of such event is also of importance.

Key words: tourism geography, ecotourism, South Bohemia.

INTRODUCTION

Interpretive nature trails have various subject orientations (Rogerson 2007) and they acquire a huge number of geographic scales as for their spatial extent (Laurens 2007). One of the most common concepts of interpretive nature trails all over the world is the trail of historical heritage (Moulin and Boniface 2001) or viticultural trail (Hall 2005). These trails are usually intended for cars and multiple-days visits (Meyer 2004). The same concept is used quite often, however, also in case of the thematic interpretive trails of natural or cultural heritage that are marked out in the terrain in national parks and other protected areas (Li et al. 2005; Leung 2012). The main forms of movement in case of those trails are hiking or trekking, cycle tourism or equian tourism (Hughes and Morrison-Saunders 2002).

The interpretive nature trails in protected natural areas play particularly an environmental educational role (Cecioni 2005) and they increase as well the level of visitors' awareness about the value of the area, where they are at the moment (Ferreira 1998). The substance

of the potential benefit of tourism to the sustainability is just in the educational aspect of visits to the naturally or culturally interesting locations and thus in their positioning in the visitors' awareness (Epler Wood 2002). So the interpretive nature trails constitute an important component of the support to both the sustainable development of tourism (Dantzler et al. 2008; Topole 2009) and the inhabitants' environmental awareness (Clark 1997; Prah and Kolnik 2007), even if the transferred information could be sometimes unobjective (Braithwaite and Leiper 2010).

Protected natural areas, as well as other types of tourism destinations (Ritchie and Crouch 2003) are, however, visited by visitors due to various motives (Bansal and Eiselt 2004). Various groups have different expectations and behave, thereafter, in the visited environment in a variety of ways (Horner and Swarbooke 1996). A detailed knowledge of the structure of tourists' relations to the partial elements of the mountain landscape enable such sustainable management as it is advantageous for the landscape, nature, culture and tourism (Geneletti and Dawa 2009). Visitors of protected natural areas are one of the keystones of the appropriate planning management (Veal 2002; Goeldner and Ritchie 2009) because "without visitors, without satisfied visitors, parks and protected areas will cease to exist" (Bushell et al. 2007).

Although the interpretive nature trails have a long and interesting history in the Czech Republic (Čeřovský and Záveský 1989) and likewise their value for the sustainable development of tourism in destination is very well known (Briedenhann and Wickens 2004), this topic has received very few attention from literature. That is why we turned out attention to study of different aspects of building of natural trails. Our research shows that the interpretive nature trails are visited by a quite wide spectrum of visitors and the visitors' preferences to the offered interpretive nature trails are different. The basic acquired findings are as follows (according to Navrátil et al. 2011):

- Number of tourists that prefer cycling or walking to come visiting the trail is similar to that of tourists preferring car or public transport when they travel to the trail.
- Information boards seem to be the best possibility to transfer information, as they at the same time report to the current position of the visitor (Youngs et al. 2008); likewise the printed guides are preferred as a source of information and the potential of further development is in the electronic handling over of information (more common in case of the historical monuments).
- The most preferred way of marking is the classic terrain marking by tourist marks. However, an important part of tourists prefer only the marking by the directional signposts on the main crossroads, which is typical for cycle tourism (Siderelis et al. 2010).
- Tourists prefer generally oriented interpretive nature trails or the trails oriented on the landscape.
- Preferences of attributes of interpretive nature trails differ between walking tourists and cycle tourists (contrarily to the walking tourists, cycle tourists prefer longer trails beginning and ending in two different points).
- Men prefer longer trails, women prefer the shorter ones, men prefer technical orientation of interpretive nature trails as well as the possibility of cycling or using inline skates, women prefer walking or horse riding; the share of men preferring electronic information on the particular points of the interpretive nature trail is higher and they also more than women prefer non-marked trails.
- With the increasing age of respondents, the preference of walking to the trail are increasing together with the decrease of the preference for the transport by bicycle. Preferences for printed guide are increasing as for the getting information while the preferences for electronic ways are decreasing. There is also a clear increase of preference for tourist marking on the interpretive nature trails as well as for shorter trails and for the possibility to go through the trail on foot or on cross-country skis.
- Experienced visitors of interpretive nature trails are looking for longer trails and preferring the non-marked trails. They also prefer electronic information over the printed guide.

The results of our previous surveys pointed out rather differentiated preferences of the partial elements of nature trails. We already know as well from our practical field experience that the interpretive trails are in different areas built within different environments. This fact could reflect the preferences of tourists, to which the governments of large-area protected territories try to accommodate (Bushell and McCool 2007), but we suppose that the principal influence on the building of those trails originated from the sources of attractiveness. These sources are quite often object of the protection (Marion and Reid 2007). That is why we opted for the identification of spatial differentiations in the creation of interpretive nature trails in large-area protected territories of nature to be the aim of this paper. We determine three hypotheses within this aim:

H1: Routing of interpretive trails depends on the differentiation of climate in the large-area protected territory.
H2: Routing of interpretive trails depends on the differentiation of relief in the large-area protected territory.
H3: Routing of interpretive trails depends on the differentiation of land use in the large-area protected territory.

These three categories were chosen, as they represent the main drivers of the motivation to visit such areas (Ritchie and Crouch 2003). We will seek particularly to answer the question whether the character of the protected territory influences the location of the routes of the interpretive trails. In connection with this orientation, we could also find an answer to the question whether particular territories differ in the rules of routing the interpretive trails.

METHODS

Topological routing of interpretive nature trails was acquired from the tourist maps of the Czech Tourists Club 1 : 50 000, issues of edition 2010, 2011 and 2012. The on-field rectification of the routing was done in case of doubts. Locations of the routes of particular interpretive nature trails were observed in types of relief, land use and climate. The types of relief and climate are based on categories being earlier analyzed for the localization of accommodation establishments (Navrátil et al. 2012). Climatic types were determined according to Quitt (1971). The climatic areas were united according to a key similar to the key used in the School Atlas of the Czech Republic (Basařová et al. 2001): all cold areas were comprised into the cold temperate area, MT3, MT4 and MT5 into the colder moderately warm area (MW), MT7 and MT9 into the middle MW area and MT10 and MT11 into the warmer MW area. The types of relief were determined according to framework relief types (Löw and Novák 2008). Land use was classified into the units based on the CORINE methodology (European Environment Agency 1994). These units were adjusted in the partial surveyed areas, with regards to the appearance rate of particular types of land use, to the artificial units: urban spaces (comprising CORINE units 1.1.2, 1.2.1, 1.3.1, 1.3.2 and 1.4.2), arable land (CORINE unit 2.1.1 was employed), meadows and pastures (comprising CORINE units 2.3.1 and 3.2.1), agricultural areas with natural vegetation (corresponding with the CORINE unit 2.4.3), coniferous forests (corresponding with the CORINE unit 3.1.2), broadleaf and mixed forests (comprising CORINE units 3.1.1 and 3.1.3), low forest vegetation (corresponding with the CORINE unite 3.2.4), water and wetlands ecosystems (comprising CORINE units 4.1.1, 4.1.2 and 5.1.2). Other units were neglected for reason of minimal appearance.

All underlying information were vectorised in the Quantum GIS 1.7.0 software (Athan et al. 2011). The position of the interpretive nature trails in particular types of the natural environment was assessed based on the spatial analysis (Hlásny 2007). Difference between the part of measured interpretive nature trails in particular types of relief, land use and climate and the part of appearance of the particular types of relief, land use and climate on the overall area of the surveyed territories (Hypotheses 1-3) was tested by the chi-square goodness-of-fit test (Meloun and Militký 2006). The objective was to identify the "attractive" types of territory (Navrátil 2012) for routing the interpretive nature trails. Calculations were done for all the surveyed

Table 1 Real and expected part (%) of length of interpretive nature trails in the surveyed area according to the appearance of particular types of relief (Chi-Square = 34.107; d.f. = 6; $p < 0.001$).

	Observed	Expected
Landscapes of hilly area and highlands of Hercynian	35	45
Landscapes of wide river floodplains	6	3
Landscapes of distinct slopes and rocky mountain ridges	28	27
Landscapes of carved valleys	6	1
Landscapes of plains	21	15
Landscapes of highly situated plateaus	3	7
Landscapes of highlands	1	1

area as well as for particular large-area protected territories (types of relief, land use and climate with a proportion below 1% were not included). General events of higher probability of routing of natural trails in particular types of relief, land use and climate across all the observed partial territories (validation of Hypotheses 1-3) were tested by means of the paired Wilcoxon signed-rank test for related samples (Hendl 2006). This was done specially for each type of relief, land use and climate.

Territory of tourist regions the South Bohemia and the Šumava Mountains was chosen to be a model area for our survey. The large-area protected territories were then observed in those territories – namely: the National Park Šumava and the Šumava Protected Landscape Area (NP Šumava, Šumava PLA), the Třeboňsko Protected Landscape Area (Třeboňsko PLA), the Blanský les Protected Landscape Area (Blanský les PLA) and the Natural Park Novohradské hory. Although the last cited park is not a large-area protected territory according to the Act No. 114/1992 Coll., it has such character. It is only a political decision that it was not so far declared a protected area.

RESULTS AND DISCUSSION

The impact of relief, land use and climate on the spatial distribution of interpretive nature trails was proved in all five surveyed territories.

Impact of the type of relief on the creation of interpretive nature trails

Most frequent type of relief, where the interpretive nature trails are localized, is the relief of carved valleys. Those valleys occur typically on the edge of mountainous areas of the Šumava Mountains and the Novohradské hory (Table 1). On the contrary, the interpretive nature trails are routed into shorter sections than it would correspond with the size of area of hilly areas and highlands. It is possible to consider those two types of landscape to be usual and less attractive shape of relief. Compared to the expected length, the trails are longer also in case of highly attractive and among tourists popular types of landscape, namely the mountain cirques with glacial lakes (their impact has no significant manifestation – under 1% – in the analysis but the length of trails in such landscape is in absolute terms more than triple than it should be according to the expectations). Quite attractive for creating the interpretive nature trails are also landscapes of uplands related again particularly to the National Park Šumava. On the other way around, the interpretive nature trails in the highly situated plateaus comprised to the 1st strictly protected zones of the National Park Šumava are distinctively shorter. Likewise the interpretive nature trails in the area of wide river floodplains and plains are longer than expected. Though, this is caused by inclusion of interpretive nature trails from the Třeboňsko PLA in our analysis.

Table 2 Real and expected part (%) of length of interpretive nature trails in the NP Šumava, the Šumava PLA and the Blanský les PLA according to the appearance of particular types of relief.

	NP Šumava		Šumava PLA		Blanský les PLA	
	Obs.	**Exp.**	**Obs.**	**Exp.**	**Obs.**	**Exp.**
Landscapes of hilly area and highlands of Hercynian	44	24	40	61	31	61
Landscapes of wide river floodplains	6	3	.	.	.	.
Landscapes of distinct slopes and rocky mountain ridges	22	39	49	38	54	36
Landscapes of karst	.	.	.	.	7	2
Landscapes of carved valleys	10	2	11	2	8	1
Landscapes of plains	1	1	.	.	.	.
Landscapes of cirques	12	27	.	.	.	.
Landscapes of highly situated plateaus	5	3	.	.	.	.
Chi-Square	53.676		51.620		84.517	
d.f.	6		2		3	
p	< 0.001		< 0.001		< 0.001	

The above mentioned assumptions are then confirmed even by partial analysis in particular protected areas. Those analyses indicate also varied strategies of creating the interpretive nature trails with regard to the possibilities of the respective area (Table 2, Table 3). In case of the only national park in the surveyed area, the most important shift between measured and expected values of length of routing the interpretive nature trails manifested itself by the shorter length than expected in the landscape of distinct slopes and highly situated plateaus. Both types form, however, the substantial part of the 1st zones and are then legally inaccessible. A big part of trails are routed, contrary to the above presented results, in the areas of hilly lands and highlands, which could be a consequence of the usually low level of protection when considering the present valuableness of the area and its capacity to provide an attractive territory for creation of the interpretive nature trails. The carved valleys represent a tourist attraction in the surveyed area and besides, the function as communication corridors among different parts of the national park. Therefore, the interpretive nature trails in that area are routed almost in the quadruple length than it should be in a landscape of the National Park Šumava according to their appearance.

Quite different seems to be the situation in routing of interpretive nature trails in the neighbouring Šumava PLA (Table 2). More trails are routed in landscapes of distinct slopes, particularly to the detriment of the landscapes of hilly area and highlands. The reason could be the shift in the attractiveness and their appearance within the total area of small-area protected territories in the Šumava PLA. Similarly to the National Park Šumava, one of the important elements used for routing the interpretive nature trails is a watercourse as a significantly higher number of trails than expected is situated in the landscapes of the wide river floodplains and particularly the carved valleys.

The situation of the Blanský les PLA is analogical to the results from the Šumava PLA (Table 2). From the physical-geographic point of view, it is the matter of parts of the same geomorphologic unit (Demek and Mackovčin 2006). We can thus deduce from the results certain rate of generality in the links of routing the interpretive nature trails in such type of relief. It is above all the matter of the disproportion in lengths of routing in landscapes of hilly areas and highlands versus distinct slopes. Likewise, it is the case of carved valleys. The Český

Table 3 Real and expected part (%) of length of interpretive nature trails in the Třeboňsko PLA and the Natural Park Novohradské hory according to the appearance of particular types of relief.

	Třeboňsko PLA		Natural Park Novohradské hory	
	Obs.	**Exp.**	**Obs.**	**Exp.**
Landscapes of hilly area and highlands of Hercynian	6	28	64	75
Landscapes of wide river floodplains	14	9	.	.
Landscapes of distinct slopes and rocky mountain ridges	.	.	27	22
Landscapes of plains	80	63	8	3
Chi-Square	24.651		11.083	
d.f.	2		2	
p	< 0.001		< 0.01	

Krumlov area offers also the appearance of the karst type of landscape (Chábera 1985). The overall length of interpretive nature trails in such landscape is triple than expected. It is reflective of the attractiveness of karst types of relief in tourism (Miklós 1978).

The relief of the Třeboňsko PLA is specific by the predominance of its situation to the flat landscape of the Třeboň basin. This area is then importantly different from other large protected areas in the surveyed territory (Table 3). Nevertheless, the significantly lower appearance of interpretive nature trails in the relief of highlands and hilly areas is true even in this area. The lengths of interpretive nature trails in two remaining types of relief occurring within the Třeboňsko PLA are contrarily longer than expected. It is about wide river floodplains (as in case of the Blanský les PLA) and then plains, which are not usually considered to be attractive for tourism (Mariot 1983). In this case, it is caused by the character of the land cover (see further text).

The impact of relief on the overall length of interpretive nature trails was tested also in the Natural Park Novohradské hory (Table 3). This area is predominated by the relief of highlands and hilly areas and the overall length of interpretive nature trails in this area is shorter than expected, similarly to the three previous protected areas of landscape. However, the shift is not as considerable as in previous cases. Even this area is endowed with the higher length of interpretive nature trails in the relief of distinct slopes (similarly to the Šumava PLA and the Blanský les PLA). The length of trails in the plain type of relief is also higher in the Natural Park Novohradské hory, similarly to the Třeboňsko PLA.

General events of higher probability of routing of interpretive natural trails in particular types of relief, land use and climate across all the observed partial territories were tested by means of the paired Wilcoxon signed-rank test. Difference in the parts of the really measured lengths and potential lengths of the routes of interpretive nature trails in the specific type of relief was identified in case of the relief of hilly areas and highlands ($n = 2$; $Z = 2.023$; $p = 0.043$). In this case the lengths of really measured interpretive nature trails are shorter than expected. The differences in measured and hypothetic parts of lengths are on the limit of significance in case of the distinct slopes, where the really measured lengths are contrarily longer than expected. However, the hypothesis on the identity of distribution of measured and expected lengths is not possible to falsify in this case. We can thus summarize that the results of tests of the sameness of distribution of measured and expected lengths of interpretive nature trails in the partial types of relief confirm

Table 4 Real and expected part (%) of length of interpretive nature trails in the surveyed area according to the appearance of particular types of land use (Chi-Square = 84.604; d.f. = 7; $p < 0.001$).

	Observed	Expected
Urban spaces	9	1
Arable land	8	6
Meadows and pastures	12	14
Land principally occupied by agriculture, with significant areas of natural vegetation	14	6
Coniferous forest	43	56
Broadleaf and mixed forest	9	6
Transitional woodland-shrub	2	6
Water and wetland ecosystems	2	5

the results identified by the goodness-of-fit tests for the structure of types of reliefs in particular protected areas – namely the routing is dependent on the possibilities of the respective area and it does not have a general character.

The impact of the type of land use on the creation of the interpretive nature trails

With regard to the previous results we can anticipate even the impact of the land use on the routing of interpretive nature trails, as the use of the area is highly related to the relative altitude and of course to the climate as well (Bradshaw and Weaver 1995). The goodness-of-fit test confirmed this assumption (Table 4). Nevertheless, it is obvious when regarding the comparison of measured and expected values that on the level of all surveyed protected areas this difference is not caused by the more attractive types of land use (Navrátil and Navrátilová 2011) as it was the matter of the relief. The difference was particularly identified in the case of urban structures, where the number of routed trails is relatively higher compared to expectations (roughly octuple). This could indicate the fact that the interpretive nature trails are led towards the points of concentration of visitors in settlements, which are a place of localization of accommodation establishments (Navrátil et al. 2012). The trails are also importantly routed in agricultural areas with the natural vegetation, which means usually in locations that are extensively exploited and have then their own landscape importance (Ot'ahel' 1980), they have a semi-natural state of vegetation cover but enable views into the surroundings. Almost twice the amount of trails is routed through the mixed and broadleaf forests, particularly in the detriment of the coniferous forests that dominate the landscape cover of the overall surveyed protected areas.

The impact of urban structures and then the concentration of visitors are evident at the level of the NP Šumava, where the part of routing the interpretive nature trails in settlement structures strongly exceeds the expected length. Contrarily, the trails appear less in landscapes with those types of land use that are more important from the protectionist point of view, e.g. wetlands, meadows or low forest vegetation – here it is particularly the matter of the mountain pine bogwoods with *Pinus mugo* on the mountain uplands (Chytrý et al. 2010). Moderately surprising is the result of the appearance of routing in type of land use "agricultural areas with natural vegetation", which is created in the surveyed area particularly by waste lands on the abandoned agricultural lands. The same result was achieved in the case of the Šumava PLA, where the important part of length occurred, besides to the urban structure, even in the areas of arable land and then in the intensively farmed landscape, which is missing in the NP

Table 5 Real and expected part (%) of length of interpretive nature trails in the National Park Šumava, the Šumava PLA and the Blanský les PLA according to the appearance of particular types of land use.

	NP Šumava		Šumava PLA		Blanský les PLA	
	Obs.	**Exp.**	**Obs.**	**Exp.**	**Obs.**	**Exp.**
Urban spaces	4	1	4	1	19	3
Arable land	.	.	7	1	1	20
Meadows and pastures	9	5	12	27	20	8
Land principally occupied by agriculture, with significant areas of natural vegetation	14	7	15	3	5	13
Coniferous forest	61	65	49	55	31	41
Broadleaf and mixed forest	5	7	9	5	20	11
Transitional woodland-shrub	4	11	3	4	5	4
Water and wetland ecosystems	4	5	1	5	.	.
Chi-Square	24.672		107.688		126.026	
d.f.	6		7		6	
p	< 0.001		< 0.001		< 0.001	

Šumava. The trails are thus routed more in land use being less attractive from the natural-cognitive tourism point of view. Similar is the structure of differences in the routing of interpretive nature trails in the Blanský les PLA. The biggest shift compared to the expected length was noticed again in the case of urban built-up areas. No appearance of routing in the category "arable land" and "agricultural areas with natural vegetation" was noticed (contrarily to the Šumava PLA) and even the length in category "agricultural areas with natural vegetation" is lower than expected. These losses are compensated particularly by the routing of natural trails in meadows and pastures.

The structure of differences between the expected and measured lengths of interpretive nature trails in the Třeboňsko PLA is analogic to the differences identified in the National Park Šumava – longer than expected routes are in the types of land use "urban structures" and "agricultural areas with natural vegetation". On the contrary, differences in the routing of interpretive nature trails according to the types of land use in the Natural Park Novohradské hory correspond as for their character rather to the Blanský les PLA (besides the urban structures, the trails are longer here even in the type of land use "meadows and pastures").

An interesting thing is the survey of routing the interpretive nature trails in forests that dominate in land use in all surveyed large-area protected territories. Forests belong to the important recreation areas (Kostrowicki 1970) and their regeneration impact on the human organism is generally known, which is plentifully exploited in tourism (Kostrowicki 1975). The assumption could then be that the interpretive nature trails are routed just through the forests. When regarding the Tables 5 and 6, we can see that it is not true. Particularly the shorter lengths of interpretive nature trails were measured in coniferous forests in all surveyed areas (the most noticeable is the case of the Třeboňsko PLA, where the real length is almost one half shorter than expected). Contrarily, the routing through the mixed and broadleaved forests is, except the NP Šumava, always longer than expected (almost twofold in case of the Šumava PLA and the Blanský les PLA and even almost triple in the case of the

Table 6 Real and expected part (%) of length of interpretive nature trails in the Třeboňsko PLA and the Natural Park Novohradské hory according to the appearance of particular types of land use.

	Třeboňsko PLA		Natural Park Novohradské hory	
	Obs.	**Exp.**	**Obs.**	**Exp.**
Urban spaces	16	3	8	1
Arable land	17	21	11	10
Meadows and pastures	11	13	14	5
Land principally occupied by agriculture, with significant areas of natural vegetation	16	6	15	18
Coniferous forest	25	45	43	59
Broadleaf and mixed forest	9	3	9	4
Transitional woodland-shrub	.	.	1	2
Water and wetland ecosystems	5	10	.	.
Chi-Square	96.592		77.722	
d.f.	6		6	
p	< 0.001		< 0.001	

Třeboňsko PLA and the Natural Park Novohradské hory). Mixed and broadleaf forests represent a dominant of the natural vegetation in all surveyed protected areas (Chytrý 2012) and their appearance is very often subject of the protection within the small-area protected territories (Albrecht et al. 2003). According to the fact that those forests constitute currently a small part of the area of surveyed territories, they become in their entire environment the attraction of the nature-based tourism (Sjøholt 2000).

We have succeeded to prove, by means of the two-sample paired Wilcoxon signed-rank test, that the type of land use has the biggest general impact on the decision making concerning the routing of interpretive nature trails. It was possible to falsify the hypothesis on the identity of distribution of measured and expected parts of lengths of the interpretive nature trails for three surveyed types of land use. There is a significant distinction in the distribution of the appearance of the interpretive nature trails in urban structures ($n = 5$; $Z = 2.023$; $p = 0.043$), where the real length of interpretive nature trails is longer than it could theoretically be. On the contrary, shorter than the theoretically expected are the routes of interpretive nature trails in coniferous forests ($n = 5$; $Z = 2.023$; $p = 0.043$) and in the water and wetland types of land use ($n = 5$; $Z = 2.023$; $p = 0.043$). The limit signification of results is in the case of broadleaf forests ($n = 5$; $Z = 1.753$; $p = 0.080$ – see the above mentioned discussion) and also the transitional woodland-shrub ($n = 5$; $Z = 1.753$; $p = 0.080$), where the parts of real lengths of routes are also shorter than expected. It is not possible in those cases, however, to falsify the hypothesis on the sameness of distribution of measured and expected lengths.

Impact of the type of climate on the creation of interpretive nature trails

The climate belongs also to the basic indicators of the tourism environment (Mariot 1983) that indicate a wide scale of tourism activities (Ritchie and Crouch 2003). That is why the impact of the climate on the overall length of tourist routes in the large-area protected territories in the surveyed areas. The goodness-of-fit test has confirmed this impact,

Table 7 Real and expected part (%) of length of interpretive nature trails in the surveyed area according to the appearance of particular types of climate (Chi-Square = 11.895; d.f. = 3; $p < 0.01$).

	Observed	Expected
Warmer MW	21	11
Middle MW	3	7
Colder MW	22	2
Cold	54	57

as they were identified differences between the real length of routes and the expected length of routes in particular defined types of climate (Table 7). The differences in the types of the average moderately warm, cold moderately warm and cold climate are not fundamental. In all three cited cases is the real length lower than it should be (this change plays relatively biggest role in the case of the average moderately warm area where the difference is approx. one-third). On the contrary, of the biggest length are the interpretive nature trails in warmer moderately warm areas, which is in the context of the previous findings quite surprising. But it corresponds with the localization of the accommodation establishments in the surveyed region (Navrátil et al. 2012).

The appearance of two types of climate according to the simplified Quitt's climatic classification was registered in the NP Šumava – cold areas and colder moderately warm areas. The impact of climate was not successfully proved (Yates corrected chi-square = 0.82; d.f. = 1; $p = 0.365$). The same types of climate were found out even in the Šumava PLA. Contrarily, differences between real lengths and expected lengths of routing were proved in this protected area (Table 8). The interpretive nature trails in the Šumava PLA are statistically significantly routed more in cold areas than in colder moderately warm areas. This finding could relate with the result that was identified in case of the lengths of interpretive nature trails in the types of relief of the Šumava PLA, where the most preferred environments were rather the mountainous types of relief. Those types of relief are also related to the cold climate in the area of the Šumava PLA.

An identical shift of real lengths of interpretive nature trails to the warm areas was identified in the Blanský les PLA. It was not, however, statistically significant (chi-square = 3.106; d.f. = 1; $p = 0.078$).

The inverse trend was found in the Třeboňsko PLA (Table 8). The interpretive nature trails within this protected area are created particularly in warmer moderately warm areas. Markedly shorter than they should theoretically be are the sections of interpretive nature trails in the middle MW areas and, particularly, in colder MW areas. This result relates also to the relief as it was confirmed by the situation of interpretive nature trails mainly in the central lower laid (and thus warmer) plains. It is thus clear that the main impact on the character of location of the interpretive nature trails in the surveyed tourist regions have just the principal differences in the Třeboňsko PLA. These differences in the absolute values of lengths of interpretive nature trails have fundamentally influenced the final result.

The inverse trend tendency in the routing of interpretive nature trails was found in the case of the Natural Park Novohradské hory. Namely the significantly longer sections of interpretive nature trails are situated to the warmer areas. It is caused by the influence of cycling interpretive nature trail "Through Landscape of the Nové Hrady Area" (Krajinou Novohradska), which is routed with its substantial part through the Natural Park Novohradské hory and participates importantly on the total number of lengths of the trails. The interpretive nature trails for hikers in the Novohradské hory belong rather to the category of shorter trails.

Table 8 Real and expected part (%) of length of interpretive nature trails in the Šumava PLA, the Třeboňsko PLA and the Natural Park Novohradské hory according to the appearance of particular types of climate.

	Šumava PLA		Třeboňsko PLA		Natural Park Novohradské hory	
	Obs.	**Exp.**	**Obs.**	**Exp.**	**Obs.**	**Exp.**
Midle MW	.	.	85	45	.	.
Colder MW	7	20	10	29	78	37
Cold	93	80	5	26	22	63
Chi-Square	10.563		64.965		72.115	
d.f.	1		2		1	
p	< 0.05		< 0.001		< 0.001	

General events of higher probability of routing of natural trails in particular types of climate across all the observed partial territories were not successfully proved. So the routing of interpretive nature trails in particular types of climate reflects the specific conditions of the respective territory.

CONCLUSIONS

This study examines the impacts of selected environmental factors on spatial distribution of educational trails in large-area protected territories of nature. The analysis of the lengths of routing of the interpretive nature trails in five large-area protected territories situated in South Bohemia helped us to successfully detect interesting connections of the creation of interpretive nature trails in those vulnerable areas. Three main factors influencing the general localization of tourism activities were analyzed: relief, land use and climate. The existence of the protectionistically important areas is reflected when creating the interpretive nature trails in all surveyed large-area protected territories. Though, the part of lengths of the interpretive nature trails is usually lower than the part of such territories on the overall area of particular regions. This concerns particularly the NP Šumava, where the natural scientifically most interesting (according to the type of relief and type of land use) is accessible by means of interpretive nature trails only very partially.

General natural relations in the creating of natural trails were successfully proved primarily for the particular types of land use. The most interesting is the obvious interconnection between interpretive nature trails and urban structures, which means the point of the usual entrance in the interpretive nature trail, and this even if the core of most of interpretive nature trails lies out of these urban structures. We can cite among other interesting findings the relation between the interpretive nature trails and the dominant land use of all surveyed protected territories, which is coniferous forest. The territory of coniferous forests comprises in all cases shorter lengths of the interpretive nature trails than they should theoretically be. On the contrary, the use of the territory for routing according to the types of relief and first of all according to the type of climate reflects the specifics of particular areas.

It was successfully proved that not only the impact of existence of a natural event plays a role when creating the interpretive nature trails. Also the frequency of appearance of such event is of importance. And what is more, the relative situation of the partial types of relief and land use in the whole of the protected area is interesting as well, from the point of view of creating the interpretive nature trails. It is visible particularly in case of relief that there is a tendency in the decision-making on the creation of a interpretive nature trail with regard to the mutual proportion of three

factors: attractiveness for tourism, percentage of the appearance of a given phenomenon and interests of the protection of nature and landscape. Typical example is represented by the fundamental disproportion in the use of landscapes of highlands and hilly areas versus the types of landscape belonging to the mountainous types among the NP Šumava on the one hand and the Šumava PLA and the Blanský les PLA on the other hand.

Findings of the present study have to be considered within the limitations of the research methodology. Our research was focused only on three main conditions of tourism and they were tested on a relatively small area. Our results and their comparison with previous findings in discussion suggest on the other hand some future research possibilities. First, in order to obtain more general results, it would be interesting to replicate the model for a wider range of geographical types of vulnerable areas. Second, it could be interesting to analyse the impact of other factors of localization of tourism on the routing of the interpretive nature trails, particularly in the relative importance within the partial protected territories. Third, further research could focus the assessment of the impact of environment on the routing of classic tourist trails or else their comparison e.g. with routing of interpretive nature trails, equian trails etc.

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References

Albrecht, J. et al. 2003: Českobudějovicko. In **Mackovčin, P., Sedláček, M. eds.** *Chráněná území ČR, svazek VIII*. AOPK ČR a EkoCentrum Brno, Praha.

Athan, T., Blazek, R., Contreras, G., Dassau, O., Dobias, M., Ersts, P. et al. 2011: *Quantum GIS user guide, Version 1.7.0* 'Wroclaw'. (http://download.osgeo.org/qgis/doc/manual/qgis-1.7.0_user_guide_en.pdf), accessed 2011-10-20.

Bansal, H., Eiselt, H. A. 2004: Exploratory research of tourist motivations and planning. *Tourism Management* 25 (3), 387-396.

Basařová, M., Brandejs, T., Hloušek, P., Hodonická, R., Jeníčková, M. et al. 2001: *Školní atlas České republiky*. Kartografie Praha, Praha.

Bradshaw, M., Weaver, R. 1995: *Foundations of physical geography*. Wm. C. Brown Publishers, Dubuque.

Braithwaite, R. W., Leiper, N. 2010: Contests on the River Kwai: how a wartime tragedy became a recreational, commercial and nationalistic plaything. *Current Issues in Tourism* 13 (4), 311-332.

Briedenhann, J., Wickens, E. 2004: Tourism routes as a tool for the economic development of rural areas – vibrant hope or impossible dream? *Tourism Management* 25 (1), 71-79.

Bushell, R., McCool, S. F. 2007: Tourism as a tool for conservation and support of protected areas: Setting the agenda. In **Bushell, R., Eagles, P. F. J. eds.** *Tourism and protected areas: Benefits beyond boundaries*. The Vth IUCN World Parks Congress. CABI, Wallingford, 12-26.

Bushell, R., Staiff, R., Eagles, P. F. J. 2007: Tourism and protected areas: Benefits beyond boundaries. In **Bushell, R., Eagles, P. F. J. eds.** *Tourism and protected areas: Benefits beyond boundaries*. The Vth IUCN World Parks Congress. CABI, Wallingford, 1-11.

Cecioni, E. 2005: Environmental education and geography of complexity. *International Research in Geographical and Environmental Education* 14 (4), 277-294.

Chábera, S. 1985: Horopis. In **Chábera, S., Demek, J., Hlaváč, V., Kříž, H., Malecha, A., Novák, V., Odehnal, L., Suk, M. et al.** *Jihočeská vlastivěda, Řada A, Neživá příroda*. Jihočeské nakladatelství, České Budějovice, 9-36.

Chytrý, M. 2012: Vegetation of the Czech Republic: diversity, ecology, history and dynamics. *Preslia* 84 (3), 427-504.

Chytrý, M., Kučera, T., Kočí, M., Grulich, V., Lustyk, P. eds. 2010: *Katalog biotopů České republiky*. AOPK ČR, Praha.

Clark, G. 1997: The educational value of the rural trail: a short walk in the Lancashire countryside. *Journal of Geography in Higher Education* 21 (3), 349-362.

Čeřovský, J., Záveský, A. 1989: *Stezky k přírodě*. SPN, Praha.

Dantzler, D. W., Gering, L. R., Straka, T. J., Yarrow, G. K. 2008: Creating a destination for tourism, recreation, and education on an active solid waste landfill site. *Natural Areas Journal* 28 (4), 410-413.

Demek, J., Mackovčin, P. eds. 2006: *Zeměpisný lexikon ČR. Hory a nížiny*. AOPK ČR, Praha.

Epler Wood, M. 2002: *Ecotourism: Principles, practices and policies for sustainability*. UNEP, Nairobi.

European Environment Agency 1994: *CORINE*. (http://www.eea.europa.eu/publications/COR0-landcover) accessed 2012-09-21.

Ferreira, G. 1998: Environmental education through hiking: A qualitative investigation. *Environmental Education Research* 4 (2), 177-183.

Geneletti, D., Dawa, D. 2009: Environmental impact assessment of mountain tourism in developing regions: A study in Ladakh, Indian Himalaya. *Environmental Impact Assessment Review* 29 (4), 229-242.

Goeldner, C. R., Ritchie, J. R. B. 2009: *Tourism: Principles, practices, philosophies*. Wiley, New York.

Hall, C. M. 2005: Rural wine and food tourism cluster and network development. In **Hall D., Kirkpatrick, I., Mitchell, M. eds.** *Rural tourism and sustainable business*. Channel View Publications, Clevedon, 149-164.

Hendl, J. 2006: *Přehled statistických metod zpracování dat: analýza a metaanalýza dat*. Portál, Praha.

Hlásny, T. 2007: *Geografické informačné systémy: priestorové analýzy*. Agentúra Zephyros, Banská Bystrica.

Horner, S., Swarbrooke, J. 1996: *Marketing tourism, hospitality and leisure in Europe*. International Business Press, London.

Hughes, M., Morrison-Saunders, A. 2002: Impact of trail-side interpretive signs on visitor knowledge. *Journal of Ecotourism* 1 (2-3), 122-132.

Kostrowicki, A. S. 1970: Zastosowanie metod geobotanicnych w ocenie przydatności terenu dla potrzeb rekreacji i wypoczanku. *Pregląd Geograficzny* 42 (4), 631-645.

Kostrowicki, A. S. 1975: Podojście systemowe w badaniach nad rekreacja. *Pregląd Geograficzny* 47 (2), 263-278.

Laurens, M. 2007: Route tourism: a roadmap for successful destinations and local economic development. *Development Southern Africa* 24 (3), 475-489.

Leung, Y.-F. 2012: Recreation ecology research in East Asia's protected areas: Redefining impacts? *Journal for Nature Conservation* 20 (6), 349-356.

Li, W. J., Ge, X. D., Liu, C. Y. 2005: Hiking trails and tourism impact assessment in protected area: Jiuzhaigou Biosphere Reserve, China. *Environmental Monitoring and Assessment* 108 (1-3), 279-293.

Löw, J., Novák, J. 2008: Typologické členění krajin České republiky. *Urbanismus a územní rozvoj* 11 (6), 19-23.

Marion, J. L., Reid, S. E. 2007: Minimising visitor impacts to protected areas: The efficacy of low impact education programmes. *Journal of Sustainable Tourism* 15 (1), 5-27.

Mariot, P. 1983: *Geografia cestovného ruchu*. Akadémia, Bratislava.

Meloun, M., Militký, J. 2006: *Kompendium statistického zpracování dat*. Academia, Praha.

Meyer, D. 2004: *Tourism routes and gateways: Key issues for the development of tourism routes and gateways and their potential for Pro-Poor tourism*. Overseas Development Institute, London. (http://www.odi.org.uk/resources/download/3100.pdf), accessed 2010-12-25.

Miklós, L. 1978: Náčrt biologického plánu krajiny v povodí Gemerských Turcov. *Quaestiones Geobiologicae* 21, 5-120.

Moulin, C., Boniface, P. 2001: Routeing heritage for tourism: Making heritage and cultural tourism networks for socio-economic development. *International Journal of Heritage Studies* 7 (3), 237-248.

Navrátil, J. 2012: *Návštěvník jako rozvojový faktor navštíveného místa. Aplikovaná geografie cestovního ruchu na příkladu vody v turistických regionech jižní Čechy a Šumava*. Alfa Nakladatelství, Praha.

Navrátil, J., Knotek, J., Švec, R., Pícha, K., Navrátilová, J. 2011: Návštěvnické preference naučných stezek ve velkoplošně chráněných územích. *Czech Hospitality and Tourism Papers* 8 (14), 3-16.

Navrátil, J., Navrátilová, J. 2011: *Geografie pro cestovní ruch*. EF JU v ČB, České Budějovice.

Navrátil, J., Švec, R., Pícha, K., Doležalová, H. 2012: The behaviour in deciding the location of tourist accommodation facilities: Tourist regions Šumava and South Bohemia. *Moravian Geographical Reports* 20 (3), 50-63.

Oťaheľ, J. 1980: Štúdium percepcie krajinnej scenérie a jeho prínos k lokalizácii zariadení cestovného ruchu. *Geografický časopis* 32 (4), 250-261.

Prah, K., Kolnik, K. K. 2007: Didactic analysis of outdoor learning based on the example of the educational water trail in the Sotla river basin. *Didactica slovenica-Pedagoška obzorja* 22 (3-4), 38-52.

Quitt, E. 1971: Klimatické oblasti Československa. *Studia Geographica* 16. Academia, Brno.

Ritchie, J. R. B., Crouch, G. I. 2003: *The competitive destination: A sustainable tourism perspective*. CABI Publishing, Oxon.

Rogerson, M. C. 2007: Tourism routes as vehicles for local economic development in South Africa: The example of the Magaliesberg Meander. *Urban Forum* 18 (2), 49-68.

Siderelis, C., Naber, M., Leung, Y. F. 2010: The influence of site design and resource conditions on outdoor recreation demand: A mountain biking case study. *Journal of Leisure Research* 42 (4), 573-590.

Sjøholt, P. 2000: Eco-tourism and local development. Conceptual and theoretical framework and problems in implementation. Empirical evidence from Costa Rica and Ecuador. *Fennia* 178 (2), 227-241.

Topole, M. 2009: Potential for tourism in the demographically threatened region of Jurkloš-ter. *Acta Geographica Slovenica* 49 (1), 119-141.

Veal, A. J. 2002: *Leisure and tourism policy and planning*. CABI Publishing, Oxon.

Youngs, Y. L., White, D. D., Wodrich, J. A. 2008: Transportation systems as cultural landscapes in national parks: The case of Yosemite. *Society & Natural Resources* 21 (9), 797-811.

Résumé

Prostorová diferenciace naučných stezek ve velkoplošně chráněných územích přírody

Přestože v České republice mají naučné stezky dlouhou a zajímavou historii (Čeřovský a Záveský 1989) a jejich význam pro udržitelný rozvoj cestovního ruchu v cílových oblastech je dlouhodobě znám (Briedenhann a Wickens 2004), je jim věnována v literatuře jen velmi malá pozornost (Navrátil et al. 2011).

Výsledky našich předcházejících výzkumů ukazují na poměrně diferenciované preference dílčích prvků naučných stezek. Z pohledu praxe je jejich optimalizace založena na posouzení aktuálního stavu, a to v prostorových souvislostech. Naučné stezky mají taktéž významné postavení ve vzdělávání návštěvníků a jsou základní oporou udržitelných forem cestovního ruchu především ve zranitelných oblastech. Proto jsme jako cíl tohoto příspěvku zvolili identifikaci prostorových diferenciací v budování naučných stezek ve velkoplošně chráněných územích přírody.

Topologické trasování naučných stezek bylo získáno z turistických map Klubu českých turistů 1 : 50 000, edičních vydání 2010, 2011 a 2012. Poloha tras naučných stezek byla sledována v typech reliéfu, land-use a klimatu. Typy klimatu a reliéfu vycházejí z kategorií dříve analyzovaných pro lokalizaci ubytovacích zařízení (Navrátil et al. 2012). Typy reliéfu jsou založeny na klasifikaci české krajiny podle reliéfu (Löw a Novák 2008). Land-use byl posouzen do upravených jednotek vycházejících z metodiky CORINE (European Environment Agency 1994). Podíl zastoupení délky trasování naučných stezek v typech reliéfu, land-use a klimatu a podílu zastoupení typů reliéfu, land-use a klimatu na rozloze velkoplošně chráněných územích šetřené oblasti byly testovány chí-kvadrát testem dobré shody (Meloun a Militký 2006) s cílem identifikace „atraktivních" typů využití území (Navrátil 2012) pro trasování naučných stezek. Výpočty byly provedeny pro celé šetřené území i pro jednotlivá velkoplošně chráněná území. Obecné jevy vyšší pravděpodobnosti trasování naučných stezek v jednotlivých typech reliéfu, land-use a klimatu napříč všemi dílčími

sledovanými územími byly testovány párovým Wilcoxonovým testem pro závislé výběry (Hendl 2006), a to pro každý typ reliéfu, land-use a klimatu zvlášť.

Na základě analýzy délek trasování naučných stezek v pěti velkoplošně chráněných územích situovaných v jižních Čechách se podařilo odhalit zajímavé souvislosti budování naučných stezek v těchto zranitelných oblastech. Analyzovány byly tři základní faktory ovlivňující obecnou lokalizaci aktivit cestovního ruchu – reliéf, land-use a klima. Při budování naučných stezek je ve všech sledovaných velkoplošně chráněných územích reflektována existence ochranářsky významných oblastí, nicméně podíl délek tras naučných stezek je obvykle kratší než takovéto území zabírá na rozloze jednotlivých oblastí – týká se to především NP Šumava, kde přírodovědecky nejzajímavější území, podle typu reliéfu i typu land-use, je zpřístupněno naučnými stezkami jen z menší části. Obecné zákonitosti v budování naučných stezek se podařilo prokázat především u jednotlivých typů land-use. K nejzajímavějším patří zřejmá provázanost naučných stezek na urbánní struktury, tedy místa obvyklého nástupu na NS, přestože těžiště většiny stezek leží mimo tyto urbánní struktury. K dalším zajímavostem patří vztah naučných stezek a dominantního land-use všech sledovaných chráněných území, jímž jsou jehličnaté lesy, a na jejichž území se nachází ve všech případech kratší délky naučných stezek, než by teoreticky měly být. Naopak využívání území pro trasování podle typů reliéfu a především podle typu klimatu odráží specifika jednotlivých území. Podařilo se prokázat, že při budování stezek se neprojevuje vliv pouze existence nějakého přírodního jevu, ale svůj význam hraje četnost tohoto výskytu. Ale nejen to, z pohledu teorie budování naučných stezek je taktéž zajímavé relativní postavení dílčích typů reliéfu a land-use v celku chráněného území. Především u reliéfu je patrná tendence v rozhodování o budování naučných stezek s ohledem na vzájemný poměr tří faktorů: atraktivnost pro cestovní ruch, podíl na výskytu daného fenoménu, zájmy ochrany přírody a krajiny. Typickým příkladem jsou zásadní disproporce ve využívání krajiny vrchovin a pahorkatin versus typy krajiny přináležejících do horských typů mezi NP Šumava na straně jedné a CHKO Šumava a CHKO Blanský les na straně druhé.