LAND PLANNING AS A SUPPORT FOR SUSTAINABLE DEVELOPMENT BASED ON TOURISM: A CASE STUDY OF SLOVAK RURAL REGION

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Abstract

Current research details methodological framework for the land planning of the recreational activities based on ecologic approach. Human impacts on landscapes caused by touristic activities should be in accordance with sustainability level, i.e. without changing natural landscape elements, their function and processes, as well as environmental quality. Region of Štiavnické Bane in Slovakia represents a case study area that is completely under nature and landscape conservation. The methodological framework for the planning of recreational activities is based on the methodology of ecologic carrying capacity which is implemented by the Landscape ecological planning. The main result from this work is suitable tourism activities determined by the ecological approach. Methodological steps include spatial analysis, interpretation, evaluations and propositions which were suggested for recreational activities. The most suitable activities for winter periods are downhill skiing, cross-country skiing and winter tourism. For the summer period the best activities are the following ones: hiking, water sports and recreational activities linked to watering and sport fishing. The most suitable activities for the year-round period are service facilities and therapeutic recreational facilities. This sum of the activities represents the level of the land using that has not any negative environmental impact.

Keywords: environmental management, land use planning, landscape management, nature-based tourism, sustainable development, sustainable tourism.

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1. Introduction

Human population growth combined with the decrease of natural areas and their fragmentation makes a point of concern and current challenge for planners, landscape ecologists and conservation biologists throughout the world (Sanderson et al., 2002). In the recent decades planning and regulation of natural areas have proven to be insufficient measures for the balancing of complex interplay of social, natural, cultural, environmental, and economic factors within the landscape. The continued development and landscape usage raise problems that transcend traditional boundaries (Jakobsen et al., 2004). Since 1950s, the tourism sector increased dramatically and became a mass phenomenon. In 2012, about 1 035 million tourist arrivals were counted worldwide (UNWTO, 2002).

Many definitions of carrying capacity, based on different aims and various conditions, have been proposed. The definition of carrying capacity for protected areas focuses on the acceptability of natural resources and the human impact of visitation in form of a tourism activities, as well as considers biophysical characteristics of a protected area, social factors, and management policies to be more important determinants of carrying capacity than the number of visitors (Prato, 2001). In planning and managing urban development, carrying capacity is defined asthe level of human activity, population growth, land use, and physical development that can be sustained by the urban environment, without causing serious degradation and irreversible damage (Oh et al., 2005). In general, carrying capacity could be defined as the maximum human, livestock, or wildlife population size that a given habitat can support without being permanently damaged (Hui, 2006; Haraldsson and Ólafsdóttir, 2006).

The objective of this paper is to show a conceptual and methodological framework for land planning of recreational activities based on the ecologic approach without forthcoming impact on environment. The framework consists in landscape ecologic planning, aimed to determine suitability tourism activities with regards main goals of sustainable development. This framework focuses on developing a process of regional and local development based on tourism, especially within the protected areas. Impact on the landscapes should not trigger changes in natural landscape elements, as well as their function, processes and environmental quality. Many of the human activities have no respect to natural characteristics of the landscapes. Therefore, a wide range of the spatial environmental data is used for the current research to highlight current problems in the local landscapes. The data spatially cover study area - Region of Štiavnické Bane (2 194,80 ha) in Slovakia. The location of the study area is demonstrated on the Fig. 1.

Therefore, the study is focused on the identifying and describing the most suitable recreational activities on the basis of the ecological approach of tourism. The approach of ecologic

carrying capacity as the support of landscape ecological planning has in the Slovakia long tradition. Most of case study was developed by following authors Miklós and Špinerová (2010), Zaušková, Midriak and Šebeň (2012). Gajdoš, Klaučo and Škodová (2012), Klaučo et al. (2013).

1.1 Introduction of the study area

The region of "Štiavnické Bane" is located in the Landscape Protected Area of Štiavnica Mts., which is the biggest stratovolcano in Slovakia. The protected area includes a set of unique mining area and especially historic monuments. The mining activities, known in this area since centuries, have a strong influence on the formation of the current landscapes (Grega and Vozár, 1964). According to Lichner (2005), special elements of the landscape are artificial lakes called "tajchy", which were formerly created for mining and today are used for recreation purposes. The landscape conservation belongs to the second level in Slovakian Law of Nature and Landscape Protection. The target aim for the landscape protection is balanced relationship between the land cover types and land use types, which is affected by a massive "tourism attack" on landscapes since the last three decades, as reported by (Králik, 2001).

According to Lapina et al. (2002) the climate of the region cannot be categorized as one type. The climate is sorted into the temperate climate zone (84.9% of the total area of the region) and moderately cold climate area (15.1% of the total area of the region). The region belongs to the hydrological basin of two rivers and Ipľa and Hron. Soil conditions in the region derives from several factors, such as climate, geomorphology and substrate-hydrological conditions. However, in a region dominated by Cambisols (Šály and Šurina, 2002).

According to Plesník (2002) territory belongs to the region of Western Carpathian flora, the group pre-Carpathian flora (Praecarpaticum). At the same time the territory is under Jedlička and Kalivodová (2002) to Carpathian area deciduous forests. Almost 62% of the region is covered by forest vegetation. Agricultural land is represented by 28%. The rest consists of built-up area and other areas.

According to The National Statistic authority in 2012 was registered 53 290 nights, which is an annual increase of 20% compared to 2011.

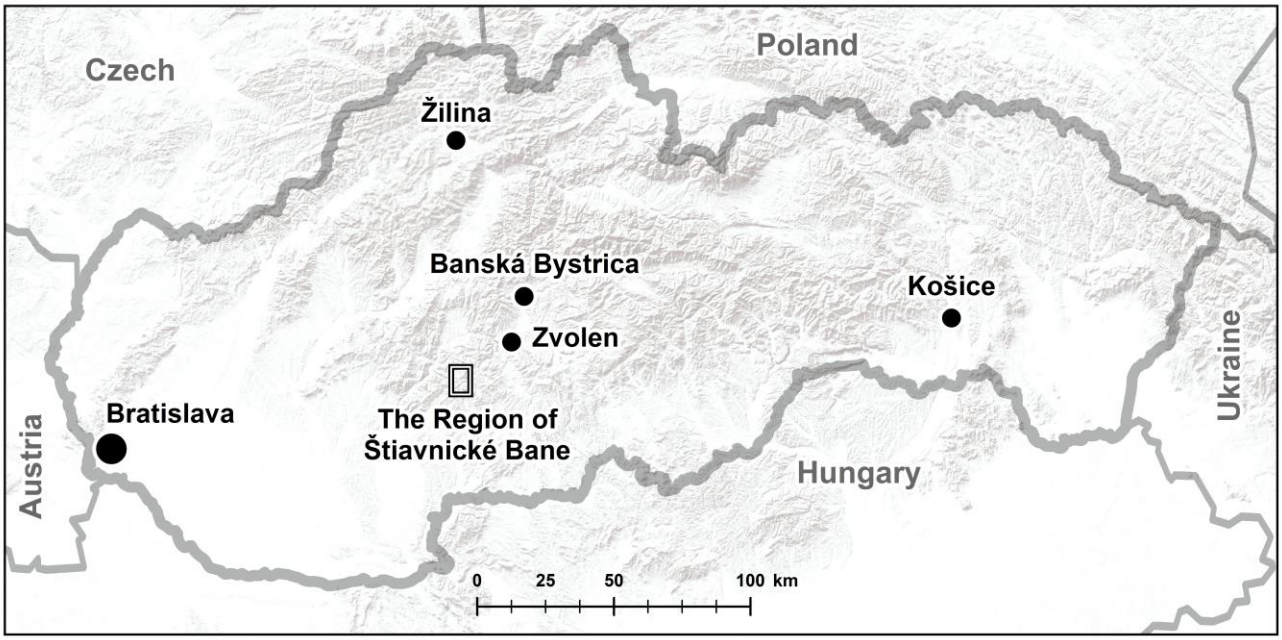

Fig. 1. The Localization the Region of Štiavnické Bane (study area)

2. Methodological Framework

In the physical sciences, a ecological threshold under carrying capacity is described as a point or zone where there is a dramatic change in the state matter or a system. In the literature of ecology, many definitions of ecological threshold have been put forth (Drdoš 1994; Izakovičová 1995; Huggett, 2005). Muradian (2001) regarded thresholds as critical values of an independent variable, around which a change from one stable state to another occurs. Sasaki et al. (2008) introduced concepts of preventive and restoration thresholds (Bestelmeyer, 2006). According to Groffman et al. (2006) is an ecological threshold as a point at which there is an abrupt change in an ecosystem quality, property or phenomenon, or where small changes in an environmental driver produce large responses in the ecosystem. Meyers and Walker (2003) defined an ecological threshold as a bifurcation point between alternate states that, when passed, causes a system to "flip" to a different state.

The methodological framework for the land planning of recreational activities is based on the methodology of ecologic carrying capacity (Hrnčiarová et al., 1997; Hrnčiarová, 1999) by threshold limitation for selected recreational activities. The methodology is adapted from the steps of Landscape Ecological Planning (LANDEP), initially drawn by Ružička and Miklós (1990).

According to McKindsey et al. (2006) at the first level of any carrying capacity is the physical carrying capacity and is determined based on the available natural conditions and the needs of the operation and bivalves to be cultured. Second, the production carrying capacity of the available area is calculated based on modelling efforts. Third, the ecological carrying capacity of

the area is estimated, again with modelling efforts, by evaluating the range of possible outcomes for production estimates varying between none (and/or the current level) and the maximum calculated as the production carrying capacity.

The main subject of ecological carrying capacity requires good inventories of the landscape elements (abiotic, biotic and socio-economic) that are confronted to the society requirements. For example, such elements of the landscape as vegetation, soil, water, elevation, etc. are traditionally visualized on maps. Perhaps more important are inventories of flux centres, natural disturbance regimes and differential sensitivities to human impact (Forman; Godron, 1986). Almost every factor that involves flows or movements proves that management cannot be based on the usual static maps where boundaries are drawn as if they were barriers. No absolute barriers exist in nature, but only filters. Environmental or land characteristics on the one hand, and visual quality or cultural characteristics on the other, are carefully examined to place human activities in the landscape with the least amount of impact. In the current research we applied and adopted useful syntheses and reviews provided, in particular by (Forman, 2006).

Landscape planning became nowadays very actual research topic, especially within regional development. A result of the ecological carrying capacity is evaluating of human impacts on the landscape and determining of the proposal plan for the land using. The concept of a region involves broad geographic area, a local microclimate and a common sphere of human activity and interest. The sphere of human activity and interest, commonly tied together with transportation, communication and culture, also limits the range of human activities. However, diversity exists within this range, since humans interact with topography and ecological conditions (Forman, 2006).

According to Hrnčiarová et al. (1997) pointed methodology of ecological carrying capacity is considered as a system that consists in five steps:

1) Analysis of landscape elements – obtaining initial information on the characteristics of the country (abiotic, biotic and socioeconomic background), which characterizes particularly parametric and spatially recorded in maps.
2) Synthesis of landscape elements – production, characterization and classification of homogeneous spatial area with approximately the same characteristics of landscape.
3) Interpretation of landscape elements - a purpose of this step is through analytic, part-synthetic and synthetic properties of landscape to establish its purpose (function) properties, as an auxiliary criterion for locating social activities.
4) Landscape elements evaluation – a process of determining the suitability of the landscape for localization of selected social activities based on optimization measures.
5) Landscape elements proposition – choose uncapped activities and their spatial transmission in the country, respectively on the map base.

3. Results and Discusion

The main result of this work is determined suitable tourism activities performed by the ecological approach. Ecological carrying capacity of the landscape is a primary tool for determinations of the most suitable places for human recreation activities. The ecological planning tool is based on the intersection of the environmental, social and economic factors for sustainable development.

3.1 Analysis of Landscape Elements within the Study Area

Analytical section lists landscape elements within the inventory of Štiavnické Bane Region. It is the process of obtaining landscape environmental information (abiotic, biotic and socio-economic). Ecological analyses underlined importance of simultaneous detection of spatial and scaling variations across a range of landscape formats (Dungan et al., 2002). Single landscape elements are arranged in the general landscape pattern, where each element has different size and shape (Han et al., 2005). Composition and configuration of the landscape components form basic properties of landscape pattern (Wagner; Fortin, 2005).

The abiotic elements of landscape are represented by geomorphological relief, types of geological substrate complex and units of soils. From the Table 1 one can recognize that region of Štiavnické Bane is mostly situated in moderately dissected uplands (flat ridges and gentle slopes). Geological types of substrate complex confirm strong volcanic basement of this area. The majority of the area is covered by cambisols. Each one abiotic element in the region is necessary to use at different levels – limits. Difference in usage makes it possible to determine sustainable development levels for landscape elements.

Table 1. Analysis and Interpretation of the Abiotic Landscape Elements

Code	*Name of landscape elements*	*a*	*b*	*c*	*d*	*e*	*f*	*g*	*h*	*i*	*Σ*	*Area (ha)*	*Area (%)*
A_x	**Types of geo-relief**	**x**	**x**	**x**	**3**	**2**	**x**	**x**	**x**	**3**	**3**	**2194,80**	**100**
A_1	Moderately dissected uplands (flat ridges and gentle slopes)	x	x	x	2	2	x	x	x	2	**2**	771,07	35,13
A_2	Strongly rugged highlands (polygenic slopes of highlands)	x	x	x	3	2	x	x	x	3	**3**	282,39	12,87
A_3	Strongly rugged mountainous lowlands (slopes of highlands)	x	x	x	3	2	x	x	x	3	**3**	1141,34	52,00
B_x	**Types of geological - substrate complex**	**2**	**1**	**2**	**2**	**1**	**2**	**2**	**x**	**2**	**2**	**2194,80**	**100**
B_1	Loam to sandy – alluvial sediments	3	2	2	x	x	x	x	x	x	**2**	17,86	0,81
B_2	Pebble - clayey sediments deluvial	2	x	x	2	1	x	x	x	2	**2**	424,11	19,32
B_3	Weathered clay and debris on sand rocks	1	x	x	x	x	1-2	1-2	x	3	**2**	75,40	3,44

B_4	Clay, gravel and stone weathered rocks on effusions	x	x	x	x	x	1-2	2-3	x	1	**2**	1389,05	63,29
B_5	Weathered clay and debris on volcanic rocks	x	x	x	x	x	2-3	2-3	x	1	**2**	136,64	6,23
B_6	Anthropogenic sediments	*	*	*	*	*	*	*	*	*	*****	151,74	6,91
C_x	**Types of soil units**	**1**	**x**	**x**	**3**	**2**	**2**	**2**	**3**	**2**	**2**	**2194,80**	**100**
C_1	Haplic luvisoils	1	x	x	3	2	x	x	x	3	**2**	121,81	5,55
C_2	Cambisols unsaturated	x	x	x	2	2	x	x	x	2	**2**	1217,43	55,47
C_3	Cambisols pseudo-clay	x	x	x	x	2	x	x	x	2	**2**	693,81	31,61
C_4	Lithic leptosols and other leptosols	x	x	x	3	2	2	2	3	x	**2**	134,23	6,12
C_5	Anthropogenic soils	*	*	*	*	*	*	*	*	*	*****	27,53	1,25
Legend	**External factors of landscape elements: a** potential leak; **b** flooding area surface water; **c** wetting from groundwater sources; **d** soil erosions by water; **e** soil erosions by wind; **f** rock fall; **g** gravitational movements; **h** avalanches of slopes; **i** slopes upheaval												
	Degree of landscape vulnerability: x irrelevant value; **1** less vulnerable area selected disturbances; **2** moderately vulnerable area; **3** very vulnerable area; ***** non-evaluated												

The biotic landscape elements and their spatial coverage of the landscape represents Table 2. Forest's vegetation and herb – grassland vegetation are the most representative land cover patches. Proportions of the landscape covering pointed on some area potential for location of the recreational activities. Current land use in the region of Štiavnické Bane demonstrates how human activities are reflected in the abiotic and biotic components of landscape structure, which is expressed by degree of anthropogenic land cover transformation. It gives a framework for understanding current state of biota and landscape using, since the intensity of land using should be consistent with natural conditions: their mutual incompatibility may cause various conflicts in the landscape.

Table 2. Analysis and Interpretation of the Biotic Landscape Elements

Code	*Name of landscape elements*	*j*	*k*	*L*	*m*	*n*	*Σ*	*S*	*Area (ha)*	*Area (%)*
D_x	**Herbal - grassland vegetation**	**2**	**1**	**2**	**2**	**2**	**2**	**2-3**	**442,4**	**20,2**
D_1	Fresh meadows and pastures	2	1	2	2	2	**2**	2	61,46	2,80
D_2	Dry and semi-arid grassland	2-3	x	2	1-2	2-3	**2**	2-3	331,47	15,10
D_3	Meso- and oligotrophic grassland	1-2	x	3	1-2	2-3	**2**	2-3	46,92	2,14
D_4	Recovered grasslands	1-2	1	1	2	1	**1**	3	2,53	0,12
E_x	**Complex herbal - grasslands and woody vegetation**	**2**	**2**	**2**	**3**	**3**	**3**	**2**	**189,5**	**8,6**
E_1	Complex of shrub vegetation undergrowth	2	1	2	x	3	2	1-2	177,08	8,07
E_2	Meadows and pastures	2	2-3	2-3	3	3	3	2-1	12,39	0,56
F_x	**Forest vegetation**	**1**	**1**	**2**	**x**	**1**	**1**	**2**	**1310,5**	**59,7**
F_1	Hornbeam - oak forests	1	x	1	x	1	1	2	11,77	0,54
F_2	beech - oak forests	1	x	1	x	1	1	2	194,12	8,84
F_3	oak - beech forests	1	x	2	x	1	1	2	359,49	16,38
F_4	Lime - maple forests	2	x	3	x	2-3	3	2	45,98	2,10
F_5	Beech forests	1	x	2	x	1	1	2	457,55	20,85

F_6	Beech – spruce forests	2	1	2	x	2	2	2	159,68	7,28
F_7	Coniferous monocultures	1	x	2	x	1	1	3-2	81,94	3,73
G_x	**Agricultural cultures on arable land**	**1**	**1**	**2**	**2**	**2**	**2**	**2**	**16,7**	**0,8**
G_1	Arable land – small blocks	1	1	2	3	2	2	3	5,30	0,24
G_2	Arable land – large blocks	1	1	2	1	1	1	4	11,40	0,52
H_x	**Rivers and reservoirs**	**2**	**3**	**3**	**x**	**2**	**3**	**2**	**30,70**	**1,40**
H_1	Water streams	2	3	3	x	x	3	2-1	*52 839 meters*	
H_2	Artificial lakes	1	2	3	x	2	2	3-2	30,71	1,40
I_x	**Industrial and mining components**	**1**	**2**	**1**	**x**	**1**	**2**	**5**	**16,7**	**0,8**
I_1	Factory site with objects	1	1	1	x	1	1	5	8,10	0,37
I_2	Underground mining	x	3	x	x	x	3	5	8,64	0,39
J_x	**Energy pipes**	2	**x**	**x**	**x**	**x**	2	5	**6 592 m**	
J_1	Electric high-voltage lines	2	x	x	x	x	2	5	6 592 m	
K_x	**Road network**	**3**	**x**	**2**	**x**	**x**	**3**	**5**	**67 253 m**	
K_1	Road network	3	x	2	x	x	3	5	67 253 m	
L_x	**Settlements elements**	**2**	**2**	**3**	**2**	**3**	**2**	**2**	**112,3**	**5,1**
L_1	Settlements area	x	x	x	x	x	x	4	111,24	5,07
L_2	Vegetation and parks, cemeteries	2	2	3	2	3	2	2	1,09	0,05
M_x	**Elements of tourism**	**2**	**x**	**x**	**x**	**1**	**2**	**4-5**	**75,9**	**3,5**
M_1	Cottages, cottage and rustic villages	x	x	x	x	x	x	**5**-4	60,42	2,75
M_2	Camping sites	x	x	x	x	x	x	**5-4**	1,65	0,08
M_3	Courses	2	x	x	x	x	2	5	1,80	0,08
M_4	Ski	x	x	x	x	x	x	5	12,06	0,55
M_5	Cross-country ski	2	x	x	x	1	2	4-5	5 703 m	
M_6	Education and tourism trails	3	X	x	x	1	2	4	41 230 m	
Legend	**External factors of landscape elements: j** mechanical disturbance of the soil surface; **k** changes in groundwater level; **l** chemicals environment; **m** lack of change in traditional use; **n** removal or destruction of vegetation.									
	Degree of landscape vulnerability: x irrelevant value; **1** less vulnerable area selected disturbances; **2** moderately vulnerable area; **3** very vulnerable area; ***** non-evaluated									
	Degrees of ecological landscape significance (S): 1 very significant land cover patches; **2** significant land cover patches; **3** moderately significant land cover patches; **4** less significant land cover patches; **5** the least significant land cover patches									

Ecological priority's elements represent positive human activities in landscapes, such as conservation of landscape or natural resources. Region of Štiavnické Bane protected in the full range by second level of landscape conservation at the national law level. The Table 3 focused on the area difference with positive activities on the landscape. Impacted landscapes represent a set of negative human influences on the landscape. Thus, Table 3 illustrates types of impacted landscapes, which are expressed by the scale range. The most vulnerable and affected landscape elements are soils and water sources.

Table 3. Analysis of the negative and positive human influences on the landscape

Code	*Name of landscape elements*	*Area (ha)*	*Area (%)*
A. Ecological Priorities Elements			
N_x	Protected landscape elements	**1242,62**	**56,6**
N_1	5th degree of protection by national law	89,82	4,09
N_2	2nd degree of protection by national law	1152,80	52,53
O_x	Elements of the territorial system of ecological stability	**417,7**	**19,1**
O_1	Extremely important biocenters	273,65	12,47
O_2	Very important biocenters	6,71	0,31
O_3	Significant biocenters, bio-corridors	137,35	6,26
P_x	Significant natural resources - forest resources	**163,3**	**7,4**
P_1	Protective forests	137,35	6,26
P_2	Special purpose forests	25,97	1,18
R_x	Other significant landscape structure elements	**249,28**	**11,4**
R_1	Prospective landscape structure elements	249,28	11,36
B. Landscape Loading Elements			
S_x	Air pollution	**1592,17**	**72,4**
S_1	Medium air pollution	1592,17	72,54
T_x	**Pollution of watercourses**	**417,7**	**19,1**
T_1	Very clean and pure, almost without pollution	30,71	1,40
U_x	**Emission pollution and erosion of soil resources**	**163,3**	**7,4**
U_1	Medium soil pollution	69,32	3,16
U_2	Strong erosion	61,70	2,81
U_3	Extreme erosion	440,91	20,09

3.2 The Interpretation of the Landscape Elements within the Study Area

This working step focuses on determination of the landscape purpose-built properties. It is performed using assessment criterion for the localization of recreational activities within the landscape. Interpretation is based on the determination of the vulnerability of selected abiotic, biotic landscape elements and ecological significance of the biotic landscape elements as well.

Landscape vulnerability represents a characteristic of the landscape, which expresses the expected response to the landscape's external (interference, stress) factors. The vulnerability is expressed by the scale values determined for each one from the landscape elements. It mainly encompasses abiotic and biotic elements and factors of their natural resilience. The scale range of vulnerability is assessed by the natural disturbance, or resilience, factor for every landscape element. From the Table 1 one can notice that the most vulnerable element is individual types of geo-relief. In fact, the most impacted geomorphic relief types are 'strong rugged highlands' (polygenic slopes of highlands) and 'strong rugged mountainous lowlands' (slopes of highlands).

The Table 2 shows vulnerability of the biotic landscape elements. The most disturbed land cover elements are water bodies (rivers and reservoirs) and complex of herbal grasslands.

Landscape signification is establishing how natural (self-regulatory) processes within the ecosystem maintain and support conditions for the regeneration and genetic resources, natural resources, ecological stability and biodiversity. The ecological significance is assessed according to Hrnčiarová et al. (1997), which results from the operation of the ecological processes in the landscape. The Table 2 pointed on ecological signification of biotic landscape elements in Štiavnické Bane Region.

The ecological signification is expressed on the scale level where the first level is the most significant landscape element, and the last one is, on the contrary, the least significant landscape element. The most significant landscape elements are forest landscapes. The values of the landscape significance are possible to modify by the quantification of the landscape changes in form of landscape metrics. The set of the outputs is indicating directly how the on-going ecological processes are operating within the landscape (Klaučo et al., 2012).

3.3 The Landscape Elements Evaluation of the Study Area

The evaluation of the landscape elements is the core task of the whole land planning process. It implies assessment of how the human requirements in form of recreational activities are confronted with existing values of landscape properties. Each landscape element has the own recommended limit threshold value for its using. The limit threshold sets up the maximum acceptable level under which the landscape will not be affected by significant adverse changes and negative human impacts. These limits are expressed as a combination of appropriate and acceptable conditions and phenomena, which constitutes satisfactory conditions at the location of the proposed activities on the landscape without their significant disruption. Based on the landscape properties the degrees of suitability have been assigned to every recreational activity. The Table 4 shows assigned degrees for the coded following activities:

– **Winter recreational activities – a1** alpine; **a2** downhill skiing (ski slopes); **a3** cross-country skiing (skiing cross-country skiing); **a4** ski jumping, tobogganing (jumps, bobsled and toboggan runs); **a5** technical infrastructure associated with winter activities.

– **Summer recreational activities – b1** camping, public campsites; **b2** public sports and cultural activities, sports games; **b3** (playgrounds, tennis courts, etc.); **b4** climbing, **b5** hiking (hiking trails and nature trails); **b6** cycling (cycling tourist routes); **b7** horse riding; b8 gathering wild fruits (including mushroom picking in meadows and dams); **b9** water sports and recreational activities linked to watering; **b0** sport fishing; **ba** recreational hunting.

– **Year-round activities** – **c1** dwellings; **c2** hotels, motels; **c3** service facilities (cafeterias, parking lots, etc.); **c4** mountain transport facilities; **c5** therapeutic recreational facilities; **c6** allotment.

Table 4. The Landscape Elements Evaluation

Code	Name of landscape elements	a1	a2	a3	a4	a5	b1	b2	b3	b4	b5	b6	b7	b8	b9	b0	ba	c1	c2	c3	c4	c5	c6
A_1	Moderately dissected uplands	0	2	1	1	2	2	L	0	0	1	1	1	-	-	-	-	2	2	L	2	-	2
A_2	Strong rugged highlands	0	2	2	1	2	2	0	0	0	1	2	2	-	-	-	-	L	L	L	1	-	L
A_3	Strong rugged mountainous low slopes	0	1	0	L	0	L	0	0	0	1	L	L	-	-	-	-	L	L	0	1	-	0
B_1	Loam to sandy – alluvial sediments	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B_2	Pebble - clayey deluvial sediments	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-
B_3	Weathered clay and debris on sand rocks	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B_4	Clay, gravel and stone weathered rocks on effusions	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B_5	Weathered clay and debris on volcanic rocks	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B_6	Anthropogenic sediments	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C_1	Haplic Luvisoils	-	-	-	-	-	L	L	L	1	-	-	-	-	-	-	-	L	L	-	-	-	L
C_2	Cambisols unsaturated	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C_3	Cambisols pseudo-clay	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C_4	Lithic leptosols and other leptosol	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C_5	Anthropogenic soil	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
D_1	Fresh meadows and pastures	0	2	1	L	L	2	2	L	2	2	2	2	2	-	-	2	2	L	2	2	L	L
D_2	Dry and semi-arid grasslands	0	2	1	L	L	2	2	L	2	2	2	2	2	-	-	2	2	L	2	2	L	L
D_3	Meso-and oligotrophic grasslands	0	2	1	L	L	1	2	L	1	1	2	2	2	-	-	2	2	L	2	2	L	2
D_4	Reclaimed grasslands	-	2	1	L	L	2	2	0	-	1	2	1	2	-	-	1	2	L	2	2	L	1
E_1	Complex of shrub vegetation undergrowth	-	-	2	-	-	0	0	0	-	1	L	L	2	-	-	L	0	0	0	0	0	0
E_2	Meadows and pastures	-	L	2	L	L	L	L	L	-	1	2	2	2	-	-	2	L	L	L	L	L	0
F_1	Hornbeam - oak forests	-	0	2	0	2	0	L	0	-	1	2	2	2	-	-	1	L	L	L	L	0	L
F_2	Beech - oak forests	-	0	2	0	2	0	L	0	-	1	2	2	2	-	-	1	L	L	L	L	0	L
F_3	Oak - beech forests	-	2	1	0	2	L	L	0	0	1	2	0	L	-	-	1	L	L	L	2	0	L

F_4	Lime - maple forests	-	0	0	0	0	0	0	0	0	2	0	0	L	-	-	0	0	0	0	0	0	0
F_5	Beech forests	-	2	1	0	2	L	L	0	0	1	2	0	L	-	-	1	L	L	L	2	0	L
F_6	Beech – spruce forests	-	2	1	0	L	L	L	0	0	1	2	0	L	-	-	L	L	L	L	2	0	0
F_7	Coniferous monocultures	-	L	2	L	1	L	L	0	L	2	L	L	L	-	-	1	L	L	L	L	2	0
G_1	Arable land – small blocks	-	0	2	-	0	0	0	0	-	2	L	L	-	-	-	1	0	0	0	0	0	2
G_2	Arable land – large blocks	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	L	-	-	-	-	-	-
H_1	Water streams	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
H_2	Artificial lakes	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	2	-	-	-	-	-	-
I_1	Factory site with objects	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
I_2	Underground mining	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
J_1	Electric high-voltage lines	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
K_1	Road network	-	0	2	-	-	-	-	-	-	1	1	2	-	-	-	-	-	-	-	-	-	-
L_1	Settlements	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
L_2	Vegetation and parks, cemeteries	-	-	0	-	-	-	-	-	-	L	0	L	L	-	-	-	0	0	0	-	0	0
M_1	Cottages, cottage and rustic villages	-	-	L	-	L	0	2	1	-	1	2	0	2	2	2	L	1	0	2	L	-	0
M_2	Camping sites	-	-	L	-	L	1	1	1	-	2	2	0	1	-	-	-	-	2	1	L	0	0
M_3	Courses	-	-	L	-	-	-	1	1	-	2	L	1	-	-	-	-	2	L	1	-	-	-
M_4	Ski	-	1	1	1	1	-	2	-	-	2	-	-	-	-	-	-	-	-	2	1	-	-
M_5	Cross-country ski	-	-	1	-	2	-	2	-	-	1	0	0	-	-	-	-	-	-	L	L	-	-
M_6	Education and tourism trails	-	-	1	-	-	-	L	-	-	1	L	0	-	-	-	-	-	-	0	0	-	-
N_1	5th degree of protection by national law	L	0	L	0	0	0	0	0	L	L	0	0	L	0	0	0	0	0	0	0	0	0
N_2	2nd degree of protection by national law	1	1	1	2	2	2	2	L	2	1	2	2	2	2	2	2	2	2	1	2	1	0
O_1	Extremely important biocenters	L	0	L	0	0	0	0	0	L	L	0	0	L	0	0	0	0	0	0	0	0	0
O_2	Very important biocenters	L	0	L	L	L	0	0	0	L	L	L	L	L	0	0	L	L	L	L	L	2	0
O_3	Significant biocenters, bio-corridors of	2	2	1	2	2	L	2	L	2	1	2	L	2	L	L	2	L	L	2	2	1	0
P_1	Protective forests	0	0	0	0	0	0	0	0	0	2	L	0	L	L	L	L	0	0	0	0	0	0
P_2	Special purpose forests	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1	0
R_1	Prospective landscape structure elements	0	0	2	0	0	L	2	2	0	1	2	2	2	-	-	2	0	0	2	2	0	0
S_1	Medium air pollution	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1	1	1
T_1	Very clean and pure, almost without pollution	-	-	-	-	-	1	-	-	-	-	-	-	-	1	1	-	1	1	-	-	1	1
U_1	Medium soil pollution	1	1	1	1	2	1	1	1	1	1	1	1	1	-	-	1	1	1	1	1	1	1
U_2	Strong erosion	L	L	L	L	L	L	L	L	L	L	L	L	L	-	-	L	L	L	L	L	L	L
U_3	Extreme erosion	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	0	0	0	0	0	0	0
Lege	**Type of limits**																						

	Over	**0** **L**	excluded activities inappropriate activities
	Under	**1** **2**	suitable activities less suitable activities
	Unclassified	**-** *****	does not affect limitation assessed separately

3.4 The Spatial Proposition for Recreational Activities in the Study Area

The spatial proposition sets up selection of the unlimited activities and their location within the landscape. The final determination of suitable recreational activities is the spatial overlay of the outputs with the ecological evaluation. Spatial overlay determines suitable places for winter, summer and year-round activities. The result of the spatial overlay process is only non-limited recreational activities and their location. It is a variant ecological selection on the basis of overlap limits for recreational activities arising from landscape elements. Retain only those activities that have limited value, but just when the activity was limited to only one value becomes inappropriate / limited. The cartographic attachments represent the area for the suitable activities, which are made in accordance with natural conditions. In these places recreational activities are under limitations with regards to natural properties of the landscape.

The most suitable recreational activities for winter periods (Fig. 2) are ‘a2’ - downhill skiing (ski slopes) and ‘a3’ - cross-country skiing (skiing cross-country skiing). For the summer periods (Figure 2) the best suitable are the following activities: ‘b5’ - hiking (hiking trails, and nature trails); ‘b9’ - water sports and recreational activities linked to watering; ‘b0’ - sport fishing. The most suitable activities for the year-round periods (Fig. 2) are ‘c3’ - service facilities (cafeterias, parking lots, etc.); c5 - therapeutic recreational facilities.

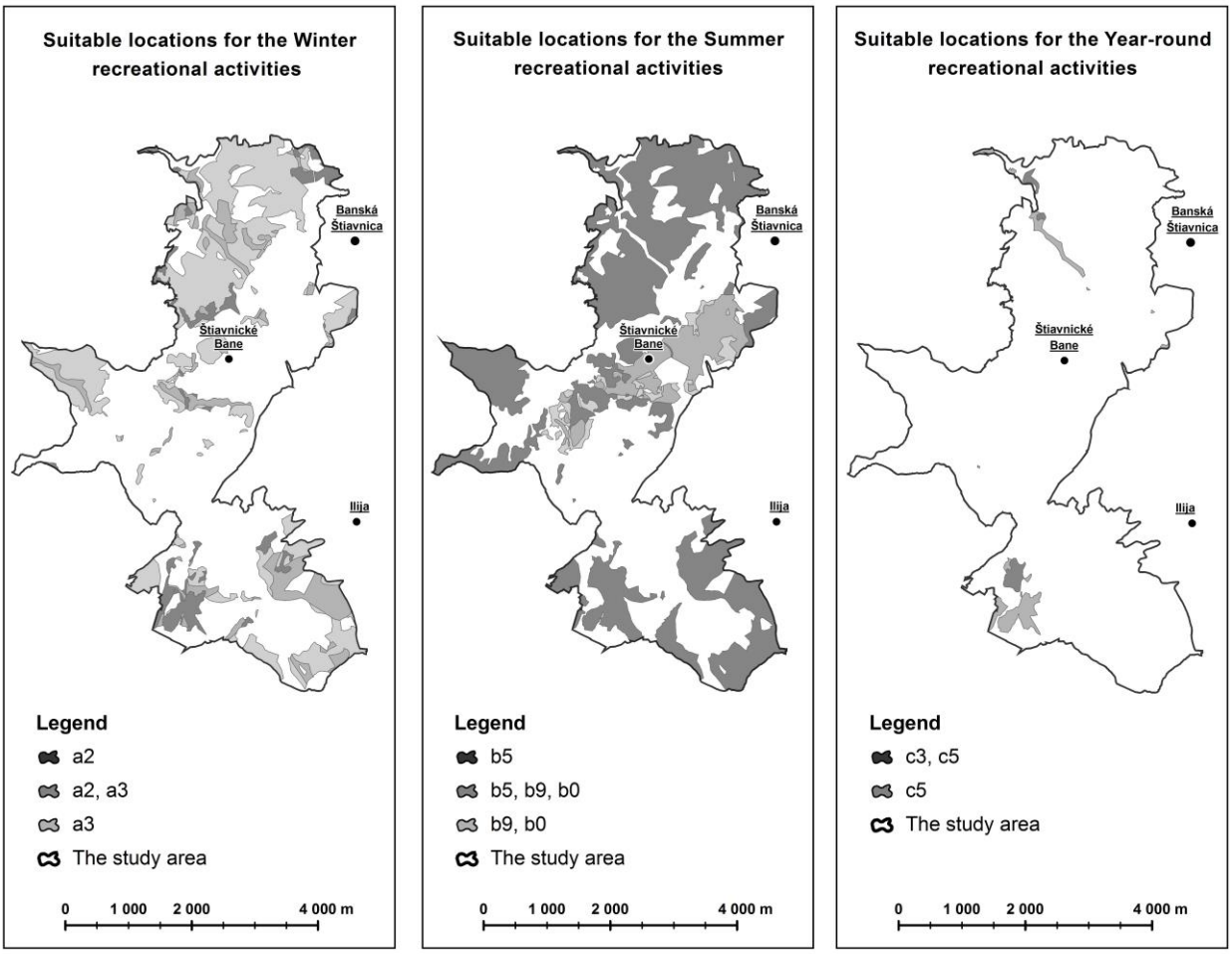

Fig. 2. The Most Suitable Recreational Activities

Implementation of sustainable development strategy is possible in many ways. Individual reasonable behaviour of people at local and global level of society is one effective method. Implementation of sustainable development at regional level is possible by the wide scale of planning documentation, and is permanently developing and gradually updating. To sum up, this work details base steps of methodology of ecological carrying capacity, which selects human activities that provide sustainable development of the study area and hence, will not destroy natural environment. The process of determination of suitable recreational activities is drawn up according to the landscape-ecological planning concept with ecological approach.

4. Conclusions

Landscapes are recognized mainly through their attributes. Therefore, it is necessary to understand how different potential human induced factors impact on landscapes, inter-relate and

react, and to what extent landscapes can be affected by existing anthropogenic interferences. In this work there were determined suitable recreational activities for the tourism development in the region of Štiavnické Bane. Determined activities are assessed in accordance with natural conditions and landscape properties. Ecological carrying capacity is identified and localized as a pallet of recreational activates, which does not disturb natural resources and environment. This is a very important approach for understanding of sustainable development.

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