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Chapter

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

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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 2000, about 700 million tourist arrivals were counted worldwide (Gossling, 2002).

The problem of landscape sustainable development and planning cannot be managed by the single research institution. Accordingly, no separate scientific disciplines are able to manage or to have a full competence in the problem of managing landscape environment. Integration of perspectives in a multidisciplinary approach and cooperation between different actors in the landscape is the only reasonable way to successfully complete this task (Cortner et al., 1996; Healey, 1997).

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 Figure 1.

The region 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; 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.

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

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).

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 main challenge in land planning is not only to design and effectively manage landscape using, but also to address all major environmental and human points of concern and issues presented nowadays (Forman, 2006). Hence, the philosophic framework of this study might be summarized in a motto: "Think globally, plan regionally, and act locally"

2. METHODOLOGICAL FRAMEWORK

The methodological framework for the land planning of recreational activities is based on the methodology of ecologic carrying capacity (Hrnčiarová et al., 1997). The methodology is adapted from the steps of Landscape Ecological Planning (LANDEP), initially drawn by Ružička and Miklós (1982, 1990). This methodological framework for the regional development is directly recommended by Agenda 21 in Chapter 10 of this work. Land planning, especially landscape ecological planning, has a long research tradition in Slovakia. The methodology of LANDEP applies original scientific process for landscape planning, which is designed to be environmentally friendly alternative in spatial arrangement of the human activities within the landscapes. Landscape planning is an activity that regulates human impact on landscapes within a range of sustainable development. The aim of landscape planning is to harmonize trends of the development of human society with the principles of nature and landscape protection (Ružička; Miklós, 1982, 1990; Ružička, 2000; Sklenička, 2007).

According to Forman (2006), planning based on landscape ecology usually focuses on men, and how land can be effectively designed for their use.

Environmental or land characteristics, as well as visual quality or cultural characteristics are carefully examined to scale human activities in the landscape with the least impact. There are numerous useful research works, syntheses and reviews which provide particular insight into this problem. Thus, this concept has been very well studied previously in Great Britain (Best, 1981; Green, 1985; Turner, 1987; Lucas, 1991) Central Europe (Ružička, Jurke, Kozová, Žigrai; Svetlosanov, 1982; Schmid; Jacsman, 1987; Kiemsted, 1993; Hrnčiarová et al., 1997; Hrnčiarová, 1999), Canada (Hills, 1974; Kehm, 1993) US (McHarg, 1969; Zube; Zube, 1977; Fabos, 1979; Turner, 1987; Marsh, 1991; Steiner, 1991; Steiner et al., 1988; Steinitz, 1990; Turner, 1992; Gustafson; Parker, 1994).

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 local microclimate puts limits on the range of species and natural processes, though varied topography, natural disturbances, and human activities still provide a rich diversity of ecological conditions within a region (Goldstein, 1992). 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).

Pointed methodology of ecological carrying capacity is considered as a system that consists in five elements (steps). Each element in the methodology is correlated to others. By this methodology it is possible to draw up suitable activities as a basis for sustainable regional development.

3. RESULTS

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. Without qualitative landscape planning, it is impossible to reach balance and harmony between natural resources and society's needs.

This section brings database of spatial environmental information of Štiavnické Bane region. Information focused on abiotic, biotic and socio-economic elements of landscape.

3.1. Analysis of Landscape Elements within the Study Area

Any type of areas represents an important subset of the landscape elements being managed (Leopold, 1933; Forman, 1986; Salwasser et al., 1987; Wagner; Kay, 1993). 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), which is spatially represented and recorded on the maps.

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 a 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.

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.

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.

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.

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

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.

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

Code	Name of landscape elements	j	k	L	m	n	Σ	S	Area (ha)	Area (%)
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	

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.

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	5^{th} degree of protection by national law	89,82	4,09
N_2	2^{nd} 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

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 landscape signification is expressed by scale value for each one biotic landscape element.

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 (Klauco 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 determined limit value includes, for example, concentration of pollutants, or slope angle that should be not exceeded. 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.

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.

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	-	-	-	-	-	-

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
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	5^{th} 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	2^{nd} 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

Type of limits: Over_0- excluded activities, L- inappropriate activities. Under_1- suitable activities, 2- less suitable activities. Unclassified_- does not affect limitation, * assessed separately.

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. 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 (Figure 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 (Figure 2) are ‘c3’ - service facilities (cafeterias, parking lots, etc.); c5 - therapeutic recreational facilities.

4. DISCUSSION

Our planet must be planned, used and kept sustainably, because there is no another known place for humankind to live (Forman, 2006). The planet Earth is unique as a sensitive ecological system, since though there is renewable energy available, only few matter incomes from and goes back to outer space (Woodwell, 1990; Mooney, 1991).

In this sense, the biosphere of the planet Earth is a closed and finely adjusted system with finite resources, both economic for production and non-economic of natural and human value. (Woodwel, 1983; Turner et al., 1990).

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.

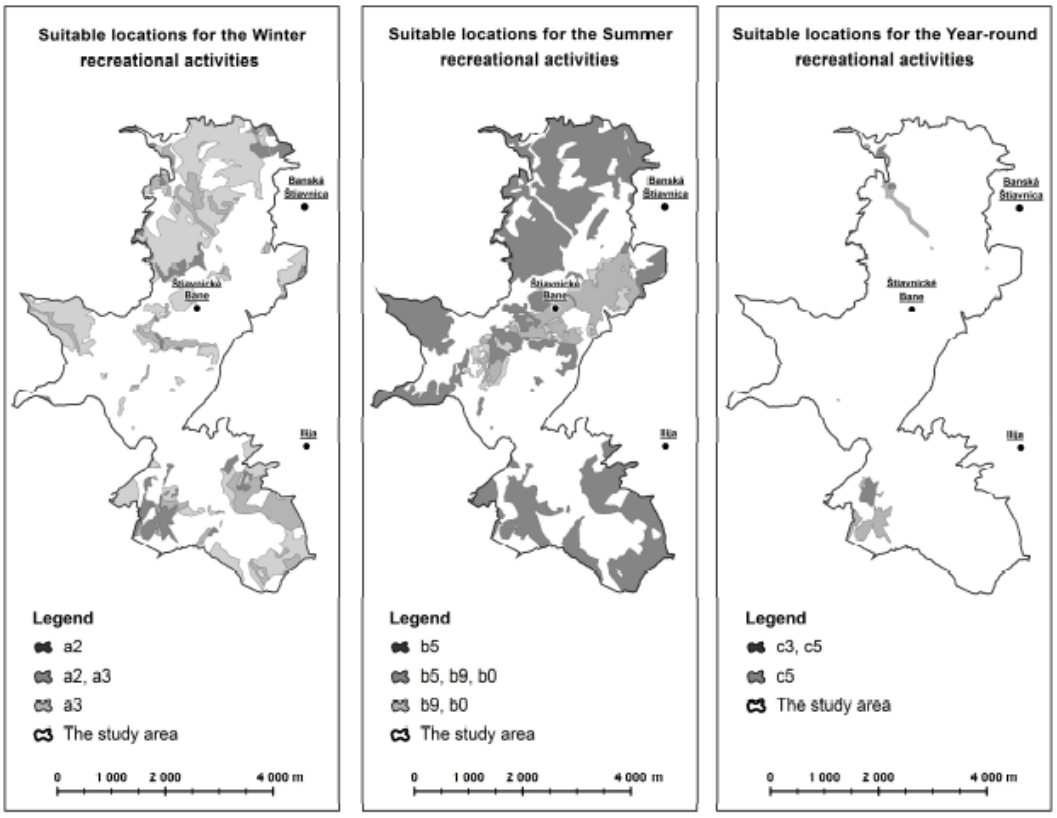

Figure 2. The Most Suitable Recreational Activities.

Implementation of sustainable development at regional level is possible by the wide scale of planning documentation, and is permanently developing and gradually updating. For instance, 'Local Agenda 21' became modified, updated and transformed into 'Local Action 21'and after the environmental meeting 'Johannesburg Summit 2002'. It is a type of document where it is possible to integrate landscape planning tools, such as ecologic carrying capacity of landscape. However, in many cases this document still misses professional approach of environmental and ecological researchers and needs improvements.

Methodological framework for documentation of Local Agenda 21 was developed by Kozová et al. (2003). The main characteristic of the methodology consists in two different approaches for creation Local Agenda 21. The first approach is based on the community request, which should be based on landscape usage and natural resources. The second one is the expert direction, designed to use landscape ecology planning tools, such as LANDEP or ecological carrying capacity of the landscape. According to Švihlová and Wilson (1999) and Švihlová (2004) it is possible to use other tools as well, mostly for the promotion of regional development which is based on a wide range of sustainability, for example:

- Territorial zoning plans
- Program of social and economic development
- Environmental action planning
- Waste management plans
- Environmental impact assessment (EIA)
- Strategic environmental assessment (SEA)
- Various plans for nature and landscape protection

The ecological carrying capacity focuses on confrontation and co-existence between human requirements and landscape properties. A result of this confrontation implies respect of configuration of natural environment and selecting suitable activities for social and economic development.

To apply more effectively ecological principles in management, planning, and policy, a rich variety of approaches is emerging. These include sustainable development, adaptive management, ecosystem management, and new forestry. Sustainable environments may integrate all the approaches (Clark, Munn, 1986; Lubchenko et al., 1991).

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.

CONCLUSION

All human economic activities, as well as social life, are realised in the landscape. 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. Development of any area, respectively landscape, should be committed to basic environmental and ecologic variables of the space, where it is located and realized.

Hence, 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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