Regional development and tourism through landscape ecological planning

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Sustainable development through landscape ecological planning solves localization of the suitable recreational activities in area of cadaster Štiavnické Bane (The Protected Landscape Area of Štiavnica Mountains). Ecological carrying capacity of landscape is primary tool for determinations of the most suitable places for human requirements (recreational activities). Methodology of this tool analyses abiotic, biotic and socio-economic elements of the landscape. The ecological planning tool is based on the intersection of environmental, social and economical of sustainable development. Any type of regional development must to be based on sustainable development. Without qualitative landscape planning tools is impossible to reach harmonization between natural sources and society requirements. The ecological carrying capacity of landscape focused on methodology by that is

possible to determinate such activities for tourism which are without negative impact on the landscape.

1. Introducion

„Think globally, act locally" is a phrase much in vogue. According to Forman [3] it has two problems. First, few people will ever give primacy to the glove in decision making. Second, local considerations overwhelmingly determine actions. Indeed, these are two roots of environmental and societal problems etched widely in the land.

This work is focused on landscape ecological planning approach for growing-up of regional development through tourism. Landscape ecological planning is based on ecological carrying capacity of landscape for the selecting recreational activities. Ecological carrying capacity is According to Hrnčiarová [7] as a purposeful feature of the landscape which expresses the degree of permissible landscape load by anthropical activities. Loading of the landscape must be subjected that not changing of natural landscape elements its functions and processes, as well as environmental quality.

The main purpose of this work is to shows on landscape ecology planning tools by which is possible to determinate recreational activities in range of ecological limits and principles of sustainable development.

Cadaster of Štiavnické Bane is selected case area (2194,80 hectares) for determination recreational activities by landscape ecological planning. Cadaster is located in the Landscape Protected Area of Štiavnica Mountains, which is the biggest stratovolcano in Slovakia. The protected area includes a set of unique mining monuments. At present time, the using landscape of cadaster Štiavnické Bane is harmonized with the natural resources. This is the reason why is the area under protection. In the last three decades is reported a massive tourism „boom" with a variety of recreational activities. Many of human activates are located without respected natural characteristics of the landscape. Ecological carrying capacity is the tool to determinate suitable tourism which will be in accordance with natural conditions

2. Material and methods

Ecological carrying capacity is suitability for landscape using that is based on specified ecological limits for activities of human society. The main subject of ecological carrying capacity is the landscape elements (abiotic, biotic and socio-economic) that are confronted to society requirements. Determination of the ecological carrying capacity is based on methodology of the Landscape Ecological Planning (LANDEP) [14, 15]. Own process of determination is possible to formulate to following steps [7]:

2.1. Landscape ecological analysis

This step is focused on obtaining of the input landscape environmental information (abiotic, biotic and socio-economic), which are spatial represented and recorded on maps. The methodological steps are consists by:

- **Analysis of the abiotic landscape elements**, such as geo-relief, geological substrate complex, soils, atmosphere and hydrosphere.
- **Analysis of the biotic landscape elements**, such as herbal – grassland vegetation, complex herbal – grasslands, forest vegetation, agricultural cultures on arable land, rivers and reservoirs, industrial and mining components, energy pipes, road network, settlements elements, elements of tourism.
- **Analysis of environmental and cultural priorities**, such as protected landscape elements, significant elements of natural resources – soils, forest and mineral springs, the elements of protected cultural heritage and significant landscape structure.
- **Analysis of the current load capacity**, such as immission pollution, pollution of water sources, soil degradation, pollution of geological environment, noise levels for the environment, damage to vegetation in buffer zones and technical elements.

2.2. Landscape ecological synthetis

This step provides a synthesis of the analytical environmental information. The results of a synthesis are characteristics and classification of homogeneous spatial data complexes with approximately the same landscape ecological properties. Realization of synthesis is based on progressive superposition of the all developed analytic spatial information.

This step is possible to replace for Spatial Analyst of landscape analytical data. According to Horák [5] Spatial Analyst are set of techniques for analyzing and modelling localized structures, where the results of the analysis depends on the spatial arrangement of these objects and their properties. Fortheringham and Rogerson [2] see modelling and Spatial Analysis as an operation that allows emulating geographic processes in the real world in different time series.

2.3. Landscape ecological interpretations

The main purpose of this step is using the analytical, part-synthetic and synthetic properties of the country to establish its purpose (function) properties. It is a helping criterion to locate social (recreational) activities in the country. This step consists by:

- **The landscape vulnerability** is characteristic of the country, which expresses the expected response to the landscape's external (interference, stress) factors (tab. 1). By the vulnerability is expressed susceptibility, resistance to the destruction of the landscape to various anthropical factors. To each one landscape element is given summary vulnerability by average values of all landscape's external factors. The vulnerability is expressed by scale values (tab. 1) for each one landscape element.
- **Ecological landscape signification** establishing how natural (self-regulatory) processes in the ecosystem to maintain and sustain the conditions for 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 (tab. 1).

Table 1. Legend for landscape ecological interpretations

Landscape elements	External factors of landscape elements	Degree of landscape vulnerability	Degrees of ecological landscape significance
Abiotic	**a** as 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	**x** irrelevant value; **1** less vulnerable area selected disturbances; **2** moderately vulnerable area; **3** the territory of very vulnerable	**1** very signification land cover patches; **2** signification land cover patches; **3** moderately signification land cover patches; **4** almost insignificant land cover patches; **5** insignificant land cover patches
Biotic	**j** mechanical disturbance of the soil surface; **k** change the groundwater level; **l** chemicals environment; **m** lack of change in traditional use; **n** removal or destruction of vegetation.		

Source: [7].

2.4. Landscape ecological evaluations

It is the process of determining the suitability of human activities in landscape. Evaluation is a core decision-making process in which individual human requirements confronted to actually existing values (interpreted) of landscape elements. To the evaluation process input following parameters:

- **Landscape documents** – a set of analytical basement from landscape analysis and synthesis.
- **Society requirements** – represents atrophic pressure on landscape by using in following sphere such as tourism, agriculture, forestry, water management, landscape conservancy, housing, transporting, etc.

Evaluation process is focused on limitation of human requirements to landscape documents. The limitations determined (recommended) threshold (value), for example concentration of a pollutant, the value of the slope that will be not exceeded. Limit the maximum allowable value, which was not observed in significant adverse changes in the landscape. The limits expressed a file of still appropriate conditions and phenomena

which constitutes satisfactory conditions for the location of proposed activities in the landscape without their significant disruption. To each one human requirement is given limit in categories which are designed in table 2.

Table 2. Types of human activities limitation

Type of limits	Human requirement on landscape using
Over	**0** excluded activities **L** inappropriate activities
Under	**1** suitable activities **2** less suitable activities
Unclassified	**-** does not affect the limitation * assessed separately

Source: [7].

2.5. Landscape ecological propositions

Landscape ecological propositions make a selection of unlimited activities and their location in the landscape. It is the selection and spatial expression of the society requirements activities by limits from landscape ecological evaluation. Other side of propositions of landscape ecological carrying expresses the scale degrees towards to current using of landscape:

- **1st degree** of ecological carrying capacity – appropriate landscape using. There is no need to change the current structure of land using.
- **2nd degree** of ecological carrying capacity – appropriate medium (less satisfactory) landscape using. There is no need to change the structure of land using, because the current land use is consistent with maximum of limits values.
- **3rd degree of ecological carrying capacity** - inadequate (unsatisfactory) is used. This means that landscape using in not in range of ecological limits. There is need to change current land using.

3. Theory overview of landscape plannig

Landscape planning has a long tradition in Slovakia, particularly in developing the methodology LANDEP. The Methodology of LANDEP brings original scientific process designed to be environmentally friendly alternatives spatial arrangement of the proposed activities in the landscape [14, 15].

Landscape planning is an activity that regulates the human impact on landscape within a range of sustainable development. The aim of landscape planning is to harmonize the trends of development of human society with the principles of nature and landscape protection [14, 15, 12, 18]. According to Lipský [11] must play a key role factors such as the potential and capacity of the ecological landscape stability, natural and ecological limits of land use and its components. At the same time Salašová [16] states that is necessary to understand to landscape the responding on human impact. One of the basic planning tools which can verify the possibility of ecological and socio-economic optimal spatial organization of the landscape is a landscape plan.

According to Forman [3] planning based on landscape ecology usually focuses on humans, and how the land can be effectively designed for their use. Environmental or land characteristics and visual quality or cultural characteristics are carefully examined to place human activities in the landscape with the least amount of impact. Useful syntheses and review provide particular insight. This approach was formed by following authors Wiesman [25] Schmid, Jacsman [17], Ružička, Jurke, Kozová, Žigrai, Svetlosanov [13], Turner [19, 20], Kaule [9], Kiemstedt [10], Gustafson, Parker [4] Special attention is devoting to author Hrnčiarová [6, 7] which determined methodology for ecological carrying capacity for human activities. This methodology is based on ecological approach in planning of landscape using. According to this author carrying capacity is often puts to limitation of landscape elements for their using. Understanding of the ecological carrying capacity is possible to find in the methodology of landscape ecological planning [14, 15] which have been associated with the suitability of using landscape parametric aggregated landscape elements. Ecological carrying capacity is according to Hilbert

et al. [22] viewed as properties of natural sphere which decisive qualitative pressure where landscape properties are not markedly changed.

Result of the ecological carrying capacity is evaluating of human impact on the landscape and determined the proposal plan for land using. Landscape planning is current period very actual theme, especially within regional development. The concept of a region involves a broad geographic area, a common macroclimate and a common sphere of human activity and interest. The single macroclimate 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 [21]. The sphere of human activity and interest, commonly tied together by transportation, communication, and culture, also limits the range of human activities. Yet diversity exists within this range as human interact with topography and ecological conditions [3].

4. Results

This chapter is focused on the results of landscape spatial analysis and their interpretative and evaluations by which was located optimum space for recreational activities. The results are spatial environmental information about landscape in cadaster of Štiavnické Bane. Information focused on abiotic, biotic and socio-economic elements of landscape.

4.1. Landscape analyst of the abiotic landscape elements

The abiotic elements of landscape are represented by types of georelief, types of geological – substrate complex and units of soils. From Table 3 is possible to recognize that the cadaster area of Štiavnické Bane is mostly situated in moderately dissected uplands (flat ridges and gentle slopes). Types of geological – substrate complex confirms strong volcanic basement of this area. The majority of the area is covered by cambisols. Each one abiotic element in cadaster is necessary to use in different levels – limits. Without difference in using is impossible to reach the sustainable development of landscape elements.

Table 3. Landscape analyst of abiotic elements and their interpretative

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	Strong rugged highlands (highlands slopes polygenic)	x	x	x	3	2	x	x	x	3	**3**	282,39	12,87
A_3	Strong rugged mountainous lower (slopes of the 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 deluviálne	2	x	x	2	1	x	x	x	2	**2**	424,11	19,32
B_3	Weathered aluminum and alumina	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 aluminum and alumina	x	x	x	x	x	2-3	2-3	x	1	**2**	136,64	6,23
B_6	Anthropogenic sediment	*	*	*	*	*	*	*	*	*	*	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 pesudoglue	x	x	x	x	2	x	x	x	2	**2**	693,81	31,61
C_4	Lithic leptosols and other leptosol	x	x	x	3	2	2	2	3	x	**2**	134,23	6,12
C_5	Anthropogenic soil	*	*	*	*	*	*	*	*	*	*	27,53	1,25

Source: Michal Klaučo, PhD., 2010.

Table 4. Landscape analyst of biotic elements and their interpretative

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	Reclaimed grasslands	1-2	1	1	2	1	**1**	3	2,53	0,12
E_x	**Complex herbal - grasslands and ligneous vegetation**	**2**	**2**	**2**	**3**	**3**	**3**	**2**	**189,5**	**8,6**
E_1	Complex of scrub vegetation undergrowth	2	1	2	x	3	2	1-2	177,08	8,07
E_2	Meadows and pastures with advanced successional stages of plant air raid	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 forest	1	x	2	x	1	1	2	359,49	16,38
F_4	Lime – maple forest	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 overhead	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 with predominantly single-family houses	x	x	x	x	x	x	4	111,24	5,07
L_2	Vegetation and ornamental park, 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	

Source: Michal Klaučo, PhD., 2010.

4.2. Spatial analyst of the biotic landscape elements

Analyze focused on biotic landscape elements and their spatial covering of the landscape (table 4). Forest vegetation and herb – grassland vegetation are the most represented land cover patches. Proportions of the landscape covering pointed on some area potential for location of the recreational activities. Current land use in the cadaster Štiavnické Bane is image of how human activities reflect on the abiotic and biotic component of landscape structure. It should be expressed by degree of anthropogenic land cover transformation. It gives a framework for understanding the current state of biota and landscape using. The intensity of land using should be consistent with natural conditions. Their mutual incompatibility causes various conflicts in the landscape.

4.3. Analyst of ecological priorites

Ecological priorities elements represent positive human activities in landscape, such as conservation of landscape or natural resources. Cadaster area of Štiavnické Bane protected in full range by second level of landscape conservation in national law level. Table 5 focused on area difference with positive activities in landscape.

Table 5. Landscape analyst of ecological priorities elements

Code	Name of landscape elements	Area (ha)	Area (%)
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 biocentres	273,65	12,47
O_2	Very important biocentres	6,71	0,31
O_3	Significant bio-centers, bio-corridors of	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

Source: Michal Klaučo, PhD., 2010.

4.4. Analyst of current landscape load

Current landscape load represents the set of negative human influences on the landscape. In the table 6 is possible to view types of loaded which are expressed by scale range. The most loaded landscape element is soils and water sources.

Table 6. Landscape analyst of ecological priorities elements

Code	Name of landscape elements	Area (ha)	Area (%)
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	**Immission 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 eriosion	440,91	20,09

Source: Michal Klaučo, PhD., 2010.

4.5. Landscape interpretations

This part of work is focused on determination of the landscape purpose-built properties. It is assistance criterion for localization recreational activities in the landscape. Interpretative is based on determinate of vulnerability of selected abiotic, biotic landscape elements and ecological signification of the biotic landscape elements.

Vulnerability is committed to abiotic and biotic elements and its natural disturbances factor. To each one landscape elements is given scale range of vulnerability by natural disturbances factors. From the table 3 is possible to state that most vulnerable element is individual types of geo-relief, mainly Strong rugged highlands (highlands slopes polygenic) and Strong rugged mountainous lower (slopes of the highlands). Table 4 shows vulnerability of biotic landscape elements. The most disturbed land cover elements are rivers and reservoirs and complex of herbal – grasslands.

According to Hrnčiarová [7] the ecological significance is resulting from the operation of the ecological processes in landscape. Table 4 pointed on ecological signification of biotic landscape elements in cadaster Štiavnické Bane. Ecological signification is expressed by scale level, where first level is the most significant landscape element and the last one level is insignificant landscape elements. The most significant are forest landscape elements.

4.6. Landscape ecological evaluation

It is the core of whole land planning process, in which are confronted the requirements of the recreational activities to existing values of landscape properties. By this evaluation process was determined suitability of recreational activities by limits of landscape elements (abiotic, biotic, positive and negative human influences). On the base of landscape properties has been to each one recreational activity assigned the degrees of suitability. Table 7 shows assigned degrees for the coded following activities:

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

B) **Summer recreational activities** – **b1** camping, public campsites; **b2** mass 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 collect wild fruits (including mushrooms in meadows and dams); **b9** water sports and recreational activities linked to water; **b0** sport fishing; **ba** recreational hunting.

C) **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 7. Landscape evaluation – limitation of society requirements

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_x	**Types of geo-relief**																						
A_1	Moderately dissected uplands (flat ridges and gentle slopes)	0	2	1	1	2	2	L	0	0	1	1	1	-	-	-	-	2	2	L	2	-	2
A_2	Strong rugged highlands (highlands slopes polygenic)	0	2	2	1	2	2	0	0	0	1	2	2	-	-	-	-	L	L	L	1	-	L
A_3	Strong rugged mountainous lower (slopes of the highlands)	0	1	0	L	0	L	0	0	0	1	L	L	-	-	-	-	L	L	0	1	-	0
B_x	**Types of geological - substrate complex**																						
B_1	Loam to sandy – alluvial sediments	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B_2	Pebble - clayey sediments deluviálne	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-
B_3	Weathered aluminum and alumina	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B_4	Clay, gravel and stone weathered rocks on effusions	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B_5	Weathered aluminum and alumina	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B_6	Anthropogenic sediment	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C_x	**Types of soil units**																						
C_1	Haplic Luvisoils	-	-	-	-	-	L	L	L	1	-	-	-	-	-	-	-	L	L	-	-	-	L
C_2	Cambisols unsaturated	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C_3	Cambisols pesudoglue	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C_4	Lithic leptosols and other leptosol	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C_5	Anthropogenic soil	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
D_x	**Herbal - Grassland vegetation**																						
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 grassland	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 grassland	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_x	**Complex herbal - grasslands and ligneous vegetation**																						
E_1	Complex of scrub vegetation undergrowth	-	-	2	-	-	0	0	0	-	1	L	L	2	-	-	L	0	0	0	0	0	0
E_2	Meadows and pastures with advanced successional stages of plant air raid	-	L	2	L	L	L	L	L	-	1	2	2	2	-	-	2	L	L	L	L	L	0

F_x	**Forest vegetation**																							
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 forest	-	2	1	0	2	L	L	0	0	1	2	0	L	-	-	1	L	L	L	2	0	L
F_4	Lime - maple forest	-	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_x	**Agricultural cultures on arable land**																							
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_x	Rivers and reservoirs																							
H_1	Water streams	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
H_2	Artificial lakes	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	2	-	-	-	-	-	-
I_x	Industrial and mining components																							
I_1	Factory site with objects	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
I_2	Underground mining	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
J_x	Energy pipes																							
J_1	Electric overhead	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
K_x	Road network																							
K_1	Road network	-	0	2	-	-	-	-	-	-	1	1	2	-	-	-	-	-	-	-	-	-	-
L_x	Settlements elements																							
L_1	Settlements area with predominantly single-family houses	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
L_2	Vegetation and ornamental park, cemeteries	-	-	0	-	-	-	-	-	-	L	0	L	L	-	-	-	0	0	0	-	0	0
M_x	Forest vegetation																							
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_x	Protected landscape elements																							
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_x	Elements of the territorial system of ecological stability																							
O_1	Extremely important biocentres	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 biocentres	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 bio-centers, 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_x	Significant natural resources - forest resources																							
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_x	Other significant landscape structure elements																							
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_x	Air pollution																							
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_x	Pollution of watercourses																							
T_1	Very clean and pure, almost without pollution	-	-	-	-	-	1	-	-	-	-	-	-	-	1	1	-	1	1	-	-	1	1
U_x	Immission pollution and erosion of soil resources																							
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 eriosion	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	0	0	0	0	0	0	0

Source: Michal Klaučo, PhD., 2010.

4.7. Landscape area proposition

The final determination of suitable recreational activities is spatial overlay of the outputs from ecological evaluation. Spatial overlay determined suitable places for winter, summer and year-round activities. Result of the spatial overlay process is only non-limited recreational activities and their location. The maps attachments represent area for suitable activities which are in accordance with natural conditions. In this places are recreational activities under the limitations, which accepted natural properties of the landscape.

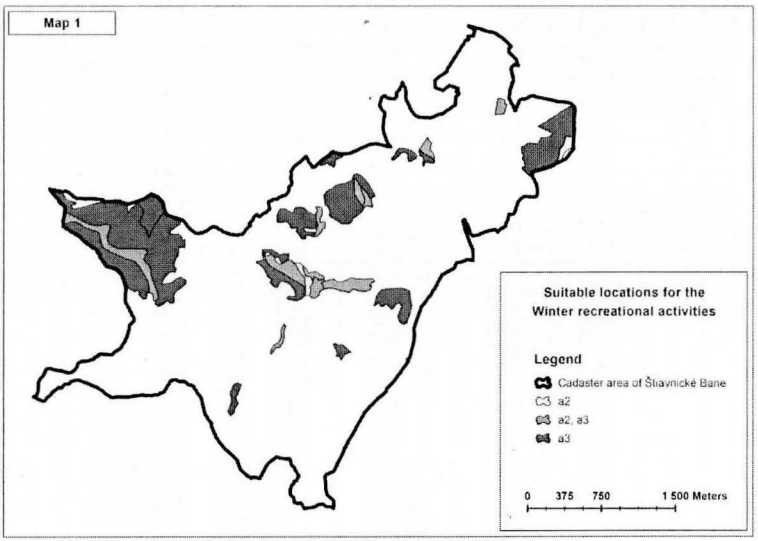

Fig. 1. Map 1 Suitable locations for the Winter recreational activities

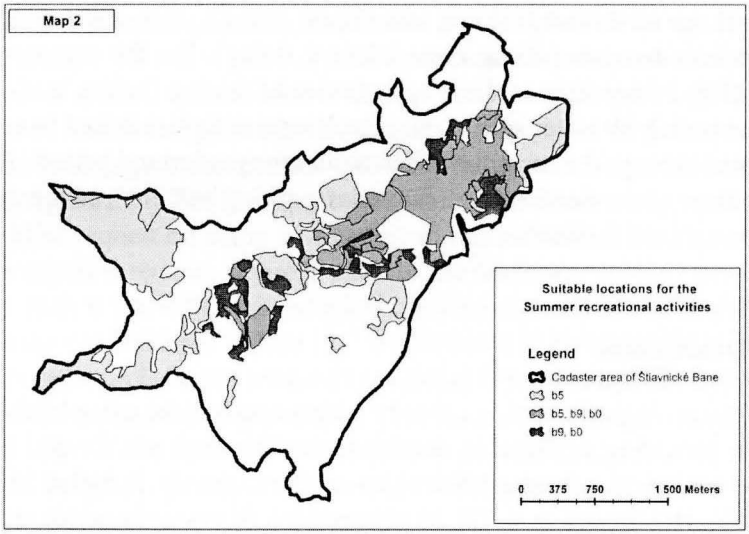

Fig. 2. Map 2 Suitable locations for the Summer recreational activities

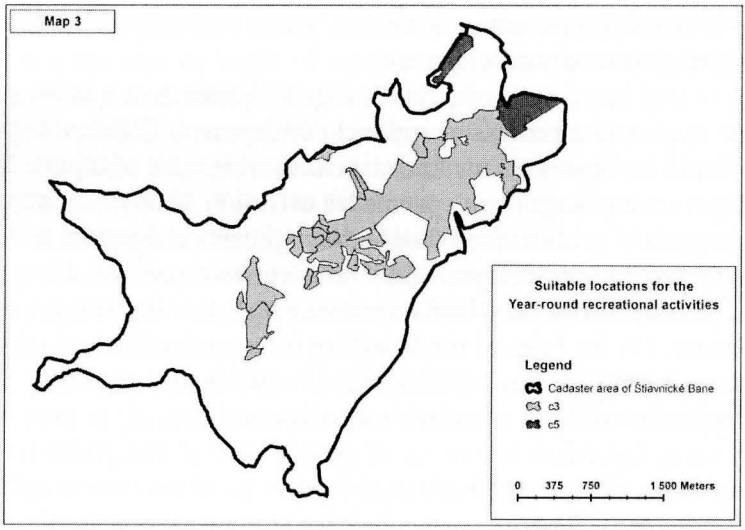

Fig. 3. Map 3 Suitable locations for the Year-round recreational activities

The most suitable recreational activities for winter period (Fig. 1 Map 1) are **a2** downhill skiing (ski slopes) and **a3** cross-country skiing and winter tourism (skiing cross-country skiing). For the summer period (Fig. 2 Map 2) are following activities **b5** hiking (hiking trails and nature trails); **b9** water sports and recreational activities linked to water; **b0** sport fishing. The most suitable activities for year-round period (Fig 3. Map 3) are **c3** service facilities (cafeterias, parking lots, etc.); **c5** therapeutic recreational facilities.

5. Discussion

The ecological carrying capacity is planning tool for using landscape which providing sustainable development. This tool was formed landscape ecological school by Slovakian authors, mainly Ružička, Miklós [14, 15], Hrnčiarová et al. [7], Hrnčiarová [6]. Many tools as this are not accepted in nation legislations, also a process of regional planning ignores in many cases environmental sphere. Just sustainable development is characterized by intersection of all three spheres social, economic and environmental. If one sphere fall out it is impossible to call sustainable development it is only development.

Any tool based on landscape ecological approach is suitable to integrate to planning process of regional development. Different types of documents are open systems for integrating wide scale of inputs. Many developers using these open systems for extrusion of own requirements and completely modified sustainable development on financial development. Global Document Agenda 21 is only one from numbers documents which directly recommend landscape ecological planning in regional development. On the basis of the Slovakian proposal landscape ecological planning (LANDEP) was introduced in Chapter 10 of Agenda 21.

Implementation of sustainable development strategy is possible in many ways. Individual behaviour of people in local and global level of society is one effective method. Implementation of sustainable development on regional level is possible by local strategic and planning document, for example Local Agenda 21 and after Johannesburg Summit 2002

it is now Local Action 21. It is type of document where is possible to integrate landscape planning tools such as ecological carrying capacity of landscape. In many cases in this document absents professional approach of environmental and ecological workers. Kozová et al. (2003) designed methodology for Local Agenda 21. The main characteristic of the methodology is that contain two different approaches for creating of Local Agenda 21. The first approach is based on community request. It should be request on using landscape and natural resources. The second is the expert direction, where is place to use landscape ecology planning tools, such is LANDEP or ecological carrying capacity of the landscape. According to Švihlová, Wilson [24] and Švihlová [23] is possible to use as well as other tools for the promoting regional development based on 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

Each one tool for regional development must to contain following principles of sustainability (IUCN, 1991):

1) The basis of sustainable development is ethics based on respect and care between individuals and in relation to the Earth.
2) Development objective is to improve the quality of human life, fulfilling and dignified life of individuals.
3) The development must be based on protection of nature, must protect the structure, function and diversity of natural systems on which human survival is dependent.
4) Strategic documents must be conceptual land use into compliance with carrying capacity of the Earth and the conservation of exhaustible natural resources.
5) Population and consumption of resources must be at sustainable levels.

6) Society must promote values that promote ethics and values consistent with sustainable development.
7) Communities to implement activities promoting sustainability of the necessary skills, knowledge and authority.
8) At the national level is necessary to build institutions, a comprehensive system of rights, protection and rational use of resources in the economy, strengthening of research capacity and monitoring.
9) Each country must take its responsibility and engage in global activities, undertake international commitments and strengthen capacity to achieve sustainability.

The Ecological carrying capacity is focusing on confrontation human requirements to landscape properties. Result of this confrontation will be respecting of configuration of natural environment and selecting suitable activities for social and economic development.

In this work is pointed on base steps of methodology ecological carrying capacity which selected just the activities which provide development of area and will not destroy any natural environment.

6. Conclusions

All human economic activities as well as social life are realised in landscape. Therefore it is necessary to know how it will react on different potential loads and to what extent it can be affected by existing anthropic interferences. Landscape is recognised mainly through its attributes. By this work were determined suitable recreational activities for tourism development in cadaster area of Štiavnické Bane. Determinate activities are in accordance with natural conditions and landscape properties.

The ecological carrying capacity is possible considered the tool for landscape ecological planning which influence regional sustainable development. Any area, respectively landscape development must to be committed to basic environmental and ecological variables of the space, where it will be realize. Ecological carrying capacity identified and lo-

calized pallet of recreational activates which account natural properties landscape elements and requirements of human society.

Proposal of recreational activities which was determined is also possible to realize by future generation because their current realization not disturb natural resources and environment. This is very important approach to understanding of sustainable development.

Design of such human activities in landscape which by using not destroying landscape, it should be the main idea of „thinking globally and acting locally"!

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