O 16. LANDSCAPE CONNECTIVITY IN PLANNING AND IMPLEMENTING CONSERVATION AND RESTORATION APPROACHES IN CENTRAL ALBANIA CARSTIC LAKES SYSTEM

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ABSTRACT*:* The main aim of this contribution is to present the case of experiences with Lake Dumrea (Central Albania) when human intervention through land use change, deforestation, intensive agriculture development and habitat fragmentation led to a dramatic loss of water bodies and landscape degradation. As human interventions of before '90 converted land for resource extraction and for settlement and agricultural uses, and as our impacts on local scale continue to grow, there is a rapid changes of the physical, chemical, and biological character of these landscapes. Land use changes were significantly reduced the number of water bodies i.e. Dumrea lakes from historical 80 to current 50, while the amount of a aquatic habitat or fragment it, breaking it up into smaller or differently arranged units, including riparian habitats. From analyses process changed not only the size of habitat patches (Lakes surface and water volume) but also other landscape features, such as patch geometry or the amount of edge habitat, that are be of fundamental importance to species, communities, and ecological functions.

Keywords: *Landscape, planning, connectivity of habitats, aquatic ecosystems, environment*

1. INTRODUCTION

In different situations the land use and development planning it is common to bring vegetation into play as a synthesis-indicator of many environmental circumstances (Ellenberg, 1979), and further on many authors treat naturalness as one more descriptor of vegetation (Blume & Sukopp, 1976). Another much larger group of authors refers to the naturalness/ artificialness of the landscape either only in its perceptual aspect or as a more general system. Evaluation alternatives and the impact of fragmentation is highly considered (Canter, 1997), further on assessing the interest of conservation of particular subsystems, i.e. vegetation for the complex ecosystems (Loidi, 1994; Edarra, 1997; Meaza & Cardinanos, 2000) and elaborating suitability matrixes (Gomez Orea, 2002). Several connectivity approaches and indices have been suggested
so far for conservation approaches (Keitt et al., 1997; Tischendorf and Fahrig, 2000; Goodwin, 2003; Pascual-Hortal and Saura, 2006).

The purpose of this approach is to encourage the inclusion of proactive wetland management into watershed and regional plans because wetlands play an integral role in the healthy functioning of entire watershed. This approach promotes using a watershed approach that not only protects existing freshwater wetlands but also maximizes opportunities to use restored, enhanced, and created freshwater wetlands of Dumrea Lakes to address watershed problems such as habitat loss, hydrological alteration and water quality impairments. As usual the primary users for the approach are members and staff of watershed managers, local government, organizations and local/state agencies.

Dumrea Lakes – Current designation: Nature monument: Seferani, Dega Lake Location: Latitude 40°58'58" N; Longitude 19°54'22" E. The Dumrea Lakes are a complex of about 85 lakes of various sizes (ECBY, 2009), which have in general a circular or oval shape. The biggest lake of the group is Çestija with 94.5 ha surface, followed by Seferani, Merhoja, Dega and Belshi with 87.5, 65.5, 37.4 and 18.1 ha surface respectively. The lake with biggest water volume is Merhoja ($11.3x10^6 m^3$), followed by Çestija, Seferani, Dega and Belshi. The Lakes of Dumrea in general have an average depth of 7 m.

Merhoja is exception as its average depth is 17.9 m, while its maximum is 61 m. Some of the lakes have been named after the villages, like the lakes of

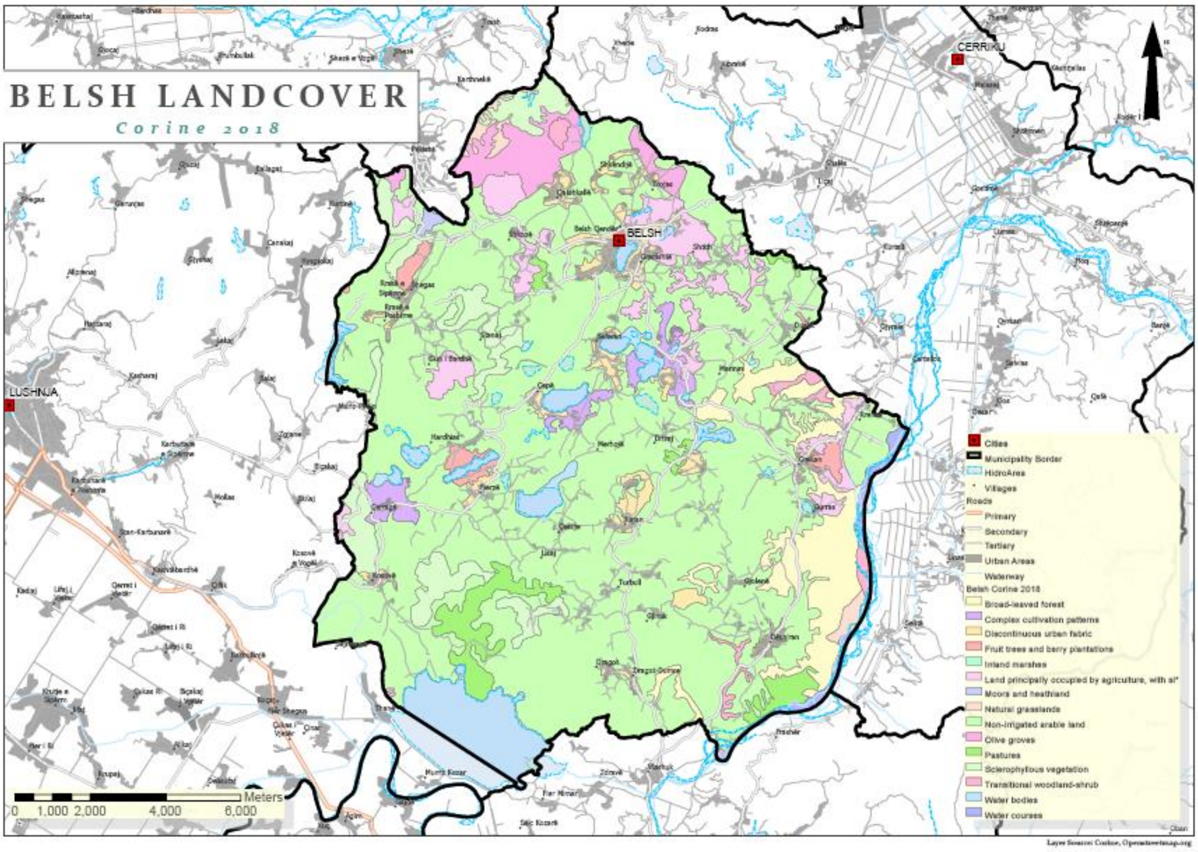

Figure 1. Land cover map of the Dumrea Lakes region

Seferani, Katundi, Cerraga etj, and some others after persons, like Millosh, Abaz, Todri, Bici. Finally, the names of some lakes are defined by their transparency or the colors of the waters, like Black Lake, the Red Lake, etc. The average monthly temperature of the surface waters of the lakes of Dumrea in winter is bellow 7.5°C and goes up to 26°C in summer. The amount of oxygen in the surface is 6.5-7.5 mg/l and decreases to 1.5 mg/l at 15 m depth. At bigger depths start to appear the presence of hydrosulfides (H_2S).

The ecosystem stability and integrity, biodiversity conservation and sustainable planning of a certain area is very much linked with landscape connectivity (Taylor et al., 1993), while it has been highlighted as a crucial issue for biodiversity conservation and for the maintenance of natural ecosystems stability and territorial integrity (Taylor et al., 1993; With et al., 1997; Collinge, 1998; Crist et al., 2005; Sheldon *et al*., 2005).

Following the human interventions of several decades through converted land, there is a rapid changes of the physical, chemical, and biological character of these landscapes. Land use changes were significantly reduced the number of water bodies i.e. Dumrea lakes from historical 80 to current 50, while the amount of a aquatic habitat or fragment it, breaking it up into smaller or differently arranged units, including riparian habitats. From analyses process changed not only the size of habitat patches (Lakes surface and water volume) but also other landscape features, such as patch geometry or the amount of edge habitat, that are be of fundamental importance to species, communities, and ecological functions.

2. MATERIAL AND METHODS

Development of index of naturalness (following advanced improvements of Machando, 2004) for the Dumrea Lakes district is the main approach. The proposed index does not consider solitude, beauty and other intangible values of nature that are not strictly linked to ecology. All diagnostic criteria are based on aspects of the ecosystem that can be measured.

Analysis of data

Table 1. Naturalness categories (Source: Maschado, 2004)

[10]	Natural virgin system; only natural elements and processes. Possible anecdotal presence of negligible or hardly noticeable anthropic elements, or totally insignicant physical-chemical pollution coming from exterior anthropic sources
[9]	Natural system; presence of few exotic biological elements (no qualitative effects); minimal articial infrastructure, temporary or removable. Physical-chemical pollution absent or of no signicance
[8]	Sub-natural system; possible extended presence of wild exotic species, but not dominant (low impact); articial elements located, not extensive. Occasional pollution processed by the system (does not go beyond resilience). Possible minor extraction of renewing resources. Fragmentation irrelevant. Natural dynamic little altered
[7]	Quasi-natural system; extensive anthropic activities of low physical impact; facilities if present, dispersed, not connected; wild exotic species well established but not dominant; natural structures modied but not distorted (re-location of physical or biotic elements). Moderate extractions, if present. Little alteration of water dynamics
[6]	Semi-natural system; anthropic infrastructure scarce or concentrated; possible dominance of wild exotic species; native elements considerably reduced. Occasional addition of energy and/or extraction of renewable resources or of non-relevant materials. General dynamic still controlled by natural processes. It may include abandoned cultural systems undergoing natural recovery
[5]	Cultural self-maintained system; processes conditioned by extensive activities of man; biological production not too forced. Native species altered, occasionally managed. Little or no presence of constructions or artefacts. Little or no management of water cycle (passive)
[4]	Cultural assisted system; important infrastructures and/or conditioning of the physical environment; forced biological production; moderate addition of matter (usually with pollution associated). Natural elements intermixed, in patches or corridors. Active management of water
[3]	Highly intervened system: still areas with biological production (natural/cultivated/breeding) mixed (mosaic) with buildings and infrastructures. Natural biodiversity severely reduced; its elements rather isolated (intense fragmentation). Water dynamic manipulated. Geomorphology usually altered; soils eventually removed
[2]	Semi-transformed system; biological production not dominant, disarticulated. Predominance of constructed elements. Occasional moderate vertical development of facilities. Intensive input of energy and matter (food, water) from the outside. Intensive control of water
[1]	Transformed system; anthropic processes governing; clear dominance of articial elements; frequent intensive vertical development; vestiges of natural elements; those exotic confined, decorative or not visible. Full dependence of external inputs of matter and energy. Absolute control of waters
[0]	Articial system; high closure; without self-maintained macroscopic life; microscopic life absent or in containers

All useful information compiled has been transferred to a cartographic base (transparencies or GIS). It is practical to work on a topographic base map reflecting the major watersheds (bold lines). Aerial photography (1:18 000–1:25 000) were the best ally for land interpretation and almost an indispensable tool to work with large territories. Further on other maps of land use activities, infrastructure, cultivation, vegetation, cattle range or any other which reflects human influence on the territory.

Field inspection

The field checks of the territory were done in order to contrast the impressions derived from the analysis of available compiled data and, particularly, when needed to solve doubts or discriminate among close situations. Moreover, some aspects, like the presence/dominance of exotic species, are not normally registered in land or urban-planning processes.

3. RESULTS AND DISCUSSIONS

Based on Edarra (1997) and Mochado (2004), who proposes to estimate the naturalness of plant communities from 0 to 10, according to the grade of human influence, where value 0 corresponds to areas intensively urbanized, fully occupied by buildings, roads, etc, almost without plants; and 10 is the value for mature forests that are not exploited, vegetation on rocks, cracks and gravel beds, peat land, marsh lands, coastal salt marshes, etc., the Figures 2, 3 and 4 represents the current naturalness rate of considered Dumrea lakes.

	Natural virgin system	Natural system	Sub-natural system	Quasi-natural system	Semi-natural system	Cultural semi maintained system	Cultural assisted system	Highly intervened system	Semi-transformed system	Transformed system	Artical system
Belshi Lake	0%	2%	5%	0%	0%	5%	40%	30%	10%	8%	0%
Seferani Lake	0%	5%	10%	20%	15%	20%	15%	5%	10%	0%	0%
Merhoe lake	0%	10%	10%	30%	0%	10%	30%	0%	10%	0%	0%
Dega Lake	0%	20%	20%	20%	20%	0%	20%	0%	0%	0%	0%
Ceraga lake	0%	0%	20%	20%	0%	35%	25%	0%	0%	0%	0%

Figure 2. Rate of naturalness of selected Dumrea Lakes

Following field analyses and elaborated data that are based different land use and land cover maps, it seems that the most impacted water body is Lake of Belshi (40% of shore line considered as Cultural assisted system and 30 as Heavily intervened system), remaining at only 2% as Natural system. Further on the Lake Dega, proclaimed also as a Nature monument along with Lake Seferani, seems to be less affected one with 20% as Sub-natural system, 20% as Quasi-natural system and 20% as Semi-natural system of entire shoreline (See Figure 2 and 3).

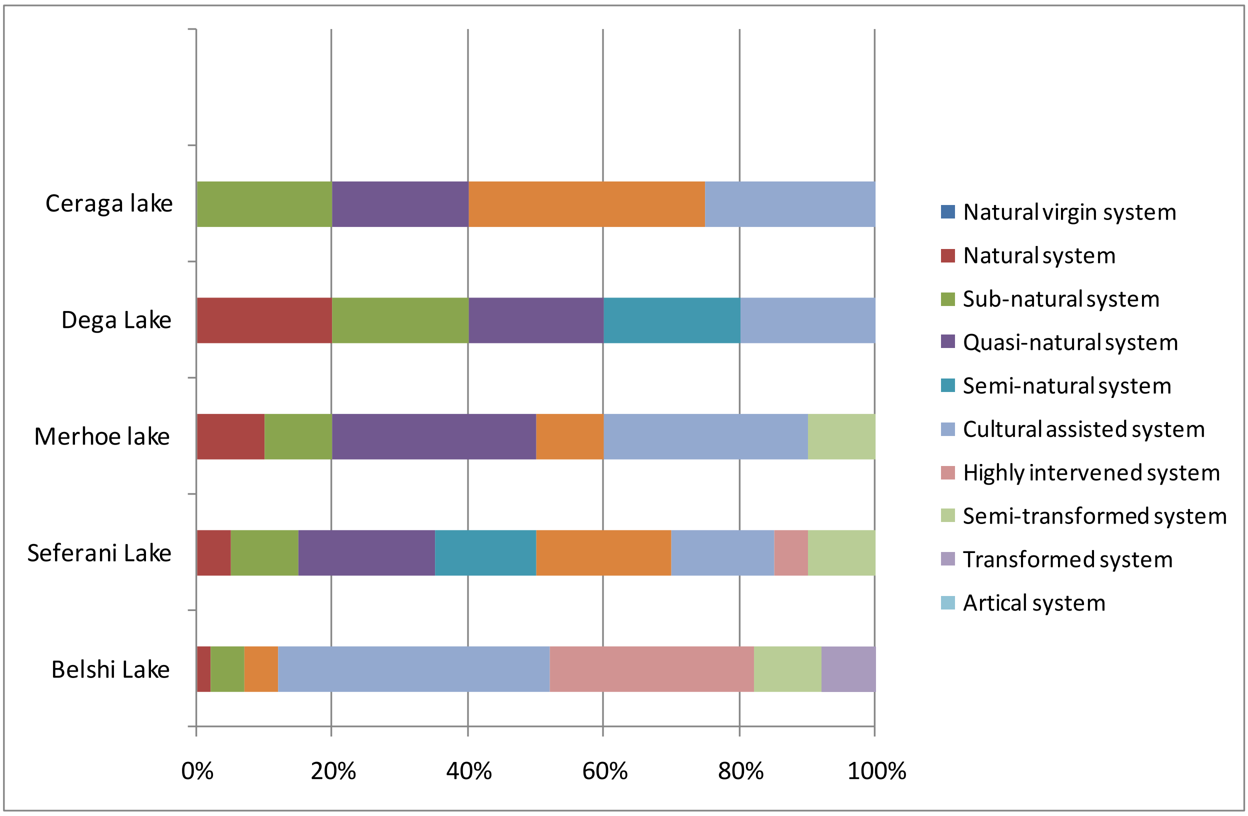

Figure 3. Different categories expressing current naturalness rate of Dumrea lakes

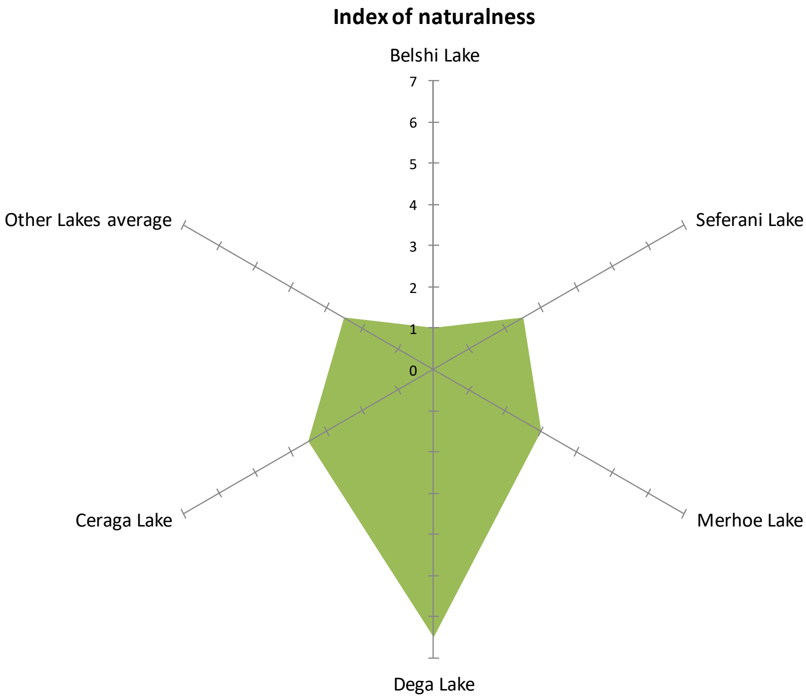

Figure 4. Assessed index of naturalness for selected lakes in Dumrea District

In the Figure 4 are shown the values of calculated Index of naturalness. The highest score 6.3 is calculated for the Lake Dega, while the lowest one of 1.1 is calculated for the Lake Beshi, reflecting directly the serious status of impacts, where 30% of entire shore line is considered as Highly intervened system. It is worth to mention that in our case the system is defined by its limits, its elements and the relations among these and with the exterior; it has a structure and behavior (Machado, 2004). This approach was implemented to our lakes ecosystem, and following Machado (2004), the naturalness index is based on a simple principle: ecosystems are artificially altered basically by three often interrelated causes: the incorporation of new elements (i.e. exotic species, pollutants, arte facts); the specific relocation or loss of its own elements as previously dominated from oak forest and currently by farming systems etc.

4. CONCLUSIONS

Following analyses of the current wetlands connectivity and ecosystem functionality:

(i) In the local or regional plan there is a need for recognizing the role and significance of the wetlands (ecosystems, economy-tourism, etc) in spatial long term planning;

(ii) (The vision of Municipality should be centered on water ecosystems;

(iii) Ensuring full awareness of the values and functions of wetlands in the area and this is fundamental in designing mid-term and long term objectives for balancing development and conservation;

(iv) Addressing the integration of current land cover, land use, conservation and sustainable use of wetlands in broad-scale integrated ecosystem management.

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