COMPARATIVE STUDY OF PLANT FLORA AND VEGETATION IN PROTECTED WETLANDS: LACUL ROSU AND LACUL CUIEJDEL (COUNTY NEAMT)

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Abstract. The lakes Lacul Rosu and Cuiejdel are the largest aquatic ecosystems of natural dam in our country. This paper presents a comparative study of the two areas from the point of view of physical and geographical features and also from the point of view of the flora and the vegetation. The study is important because, due to their peculiar nature and their value, the lake Cuiejdel is declared natural reservation, and Lacul Rosu is part of the National Park Hasmas- Cheile Bicazului.

Key words: wetland, natural dam lake, Lacul Rosu, Lacul Cuiejdel.

Rezumat. Studiu comparativ asupra florei şi vegetaţiei unor areale umede protejate: Lacul Roşu şi Lacul Cuiejdel (jud. Neamţ). Lacul Roşu şi Lacul Cuiejdel sunt cele mai mari ecosisteme acvatice de baraj natural din ţara noastră. În lucrare se face un studiu comparativ al celor două areale, din punct de vedere al caracteristicilor fizico - geografice, al florei şi vegetaţiei. Studiul este important deoarece, datorită particularităţilor şi valorii lor, Lacul Cuiejdel este declarat rezervaţie naturală, iar Lacul Roşu face parte integrantă din Parcul Naţional Hăşmaş - Cheile Bicazului.

Cuvinte cheie: areal umed protejat, lac natural de baraj, Lacul Roşu, Lacul Cuiejdel.

INTRODUCTION

The basin of Bistrita in Moldova has numerous artificial reservoirs, made for hydro-energetic purposes. Besides there are two more lakes, Lacul Rosu and Lacul Cuiejdel, by their dimensions, are the largest lakes of this kind in our country.

Their genesis is similar. Lacul Rosu was formed in 1837, after the river Bicaz was blocked as a consequence of a powerful slide of the inferior shore of the complex of debris from Mount Ghilcoş, because of the infiltration waters, the 1837 earthquake and heavy rains.

Similarly, Lacul Roşu, the lake on the Cuiejdel brook was formed as a result of the large-area landslide, a long process, climaxing with the event of 1991. The causes of lake forming were natural (heavy rains, the 1990 earthquake), but also of human nature (sectioning the sliding diluvium of the left slope for a forestry road). (RĂDOANE N., 2002)

Geological and morphological considerations

The shape and morphometric characteristics of the two lakes are typical for natural dam lakes, and have many resemblances.

Analyzing morphobatimetric data of the two lakes we can observe: for two of the parameters Lacul Rosu records higher dimensions (surface: 12.63 ha, total length: 1.34 km) as compared to Lacul Cuiejdel (surface: 12.20 ha, length: 1.20 km).

As to the other parameters, the values are higher for Lacul Cuiejdel (average width: 102 m, maximum width: 185 m, average depth: 7.44 m, and maximum depth: 16.40) as compared to Lacul Roşu (average width: 100 m, and maximum width: 140 m, average depth: 5.46 m and maximum depth: 10.50). The water volume contained is about 907,000 m^3 for Lacul Cuiejdel and about 680,084 m^3 for Lacul Roşu respectively.

Lacul Roşu has a central place in the Carpaţii Orientali girdle, being located in the Moldavian Division of crystal-Mesozoic area. It lies in the northern-west part of Hăşmaş Mountain, above Cheile Bicazului.

The climate is temperate-continental, the lake is framed in the climatic land of afforest middle mountains. Average annual temperature is about 6^0C, rainfalls around 750 mm.

The out-zone soil is alluvial and peat, and the in-zone soil is podzolic.

Geographically wise, Lacul Cuiejdel lies in the Cuejdiu brook basin, a tributary of the Bistriţa river, and is part of the larger unit of the Stânişoarei Mountains. From a geological viewpoint, the region is a part of the last unit of flysch (unit Vrancea) placed on the border with inner Carpathians.

Climatically wise, the area belongs to the low mountain areas, near the border with the Cracău corridor.

The average annual temperature is 7.5- 8^0 C, the average quantity of rainfalls is about 650 mm. The soil reflects the pedogenetic conditions of the contact area above, the types of soil are acid, podzolic and carbon soil.

Analysis of the Flora

Most of the flora studies in the Lacul Roşu area have been made by R. Soó, M. GUŞULEAC, E.I. NYÁRÁDY, C. DOBRESCU, V. GHENCIU (DOBRESCU C. & GHENCIU V., 1974), and later by on the author (NECHITA NICOLETA, 2006),

in the water of the lake and in the surroundings (silted up areas, banks), were found 480 species and subspecies of cormophyte.

Being rather new, there are few flora studies, of which we only mentioned those of Gh. Mihai, Elena Podoleanu in the Sălătruc basin – a tributary of Cuiejdiu (MIHAI GH. & PODOLEANU ELENA, 1979), and by Nicoleta Nechita and Bliderişanu for the lake area (NECHITA NICOLETA & BLIDERIŞANU PETRUŢA, 2004). Thus, for the lake Cuiejdel and its neighbouring area 195 species and subspecies of cormophyte have been inventoried so far.

To continue, we present the list of the species inventoried of the Cuiejdel lake:

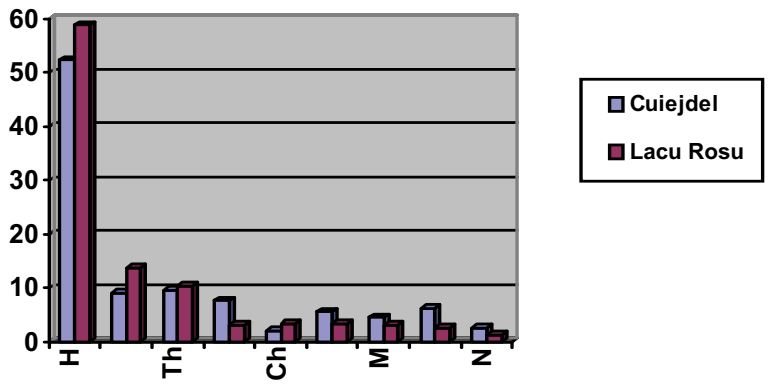
Fam. Betulaceae: *Alnus glutinosa*
Fam. Ranunculaceae: *Hepatica nobilis, Ranunculus cassubicus, Ranunculus ficaria, Ranunculus repens*
Fam. Cruciferae: *Capsella bursa- pastoris*
Fam. Crassulaceae: *Sedum telephium*
Fam. Rosaceae: *Agrimonia eupatoria, Crataegus monogyna, Geum urbanum, Potentilla erecta*
Fam. Leguminosae: *Trifolium aureum, Trifolium campestre*
Fam. Geraniaceae: *Geranium phaeum*
Fam. Thymelaeaceae: *Daphne mezereum*
Fam Onagraceae: *Epilobium hirsutum*, *Epilobium montanum*
Fam. Cornaceae: *Cornus mas*
Fam. Umbelliferae: *Bupleurum falcatum, Heracleum sphondylium* ssp. *eusphondylium, Torilis japonica*
Fam. Rubiaceae: *Galium mollugo*
Fam. Boraginaceae: *Myosotis scorpioides*
Fam. Labiatae (Lamiaceae): *Galeopsis speciosa, Galeopsis tetrahit, Lycopus exaltatus, Salvia glutinosa, Stachys officinalis*
Fam. Scrophulariaceae: *Verbascum lychnitis, Verbascum nigrum, Veronica chamaedrys, Veronica urticifolia*
Fam. Campanulaceae: *Campanula serrata, Campanula rapunculoides*
Fam. Compositae: *Achillea setacea, Bellis perennis, Centaurea phrygia* ssp. *phrygia, Centaurea micranthos, Crepis biennis, Leontodon autumnalis* f. *pinnatifida, Leontodon hispidus*, *Senecio nemorensis, Solidago virgaurea, Sonchus arvensis, Xanthium spinosum*
Fam. Juncaceae: *Juncus articulatus*
Fam. Gramineae: *Bromus arvensis, Catabrosa aquatica, Poa annua, Poa pratensis*
Fam. Sparganiaceae: *Sparganium emersum*

comparative analysis of the two lake floras leads to a series of conclusions.

Lacul Cuiejdel is a young ecosystem, has a low variety of flora comparatively to Lacul Roşu that is a 150 year old. A certain instability of the area can be also noticed especially at the tail of the lake, where the heavy rainfalls in different periods of time caused silted up surfaces, covering parts of the surface with water floods, and the loss of some phytocoenoses from the area.

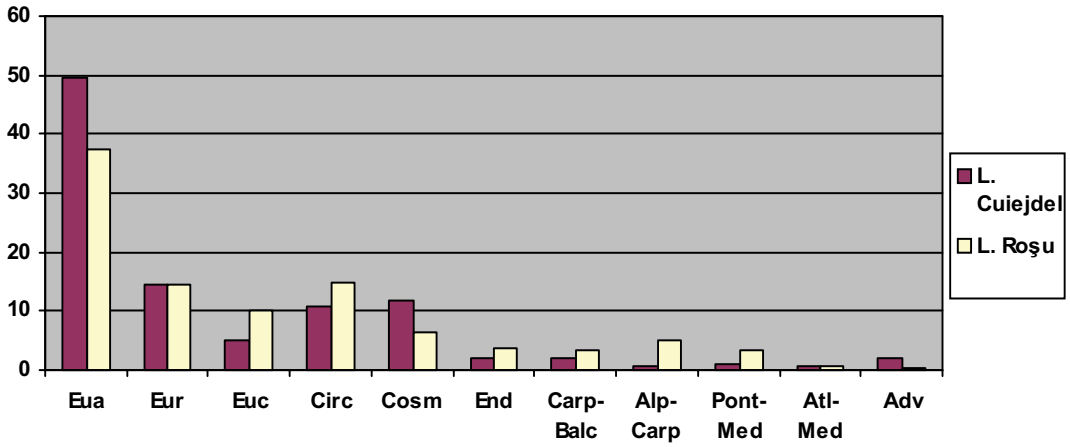
It is recommend to conduct further flora and phytocoenoses studies for the Lacul Cuiejdel area, because flora and vegetation continues to develop, a common characteristic for a young ecosystem.

Analysis of biological forms:



The range of bioforms of the Lacul Cuiejdel lake looks like this: H=52.3%, G= 9.2%, Th= 9.7%, TH= 7.7%, Ch= 2.1%, HH= 5.6%, M= 4.6%, MM= 6.2%, N= 2.6%. Half of the species belong to hemicriptophytes because here there are grasslands, herbaceous species in the neighbouring forest and at the end of it. Terophytes are numerous because the lake lies in a depression area, protected and under human and animals influence. Megaphanerophytes, microphanerophytes, nanophanerophytes are also numerous because of the location of the lake close to the forest.

Flora of Lacul Roşu has the following range of bioforms: H= 58.8%, due to the large surfaces of grassland and herbaceous plants from forests, G= 13.7%, Th= 10.4%, TH= 3.1% as here the human impact is powerful, Ch= 3.4%, HH= 3.4%, and bioforms: M= 3.2%, MM= 2.6%, N= 1.4% are found because of the nearby forest.



The phyto-geographic spectrum shows a high percentage of Eurasian elements (49.7%- Lacul Cuiejdel and 37.5% Lacul Roşu), European (14.4%, also 14.5%), Central European (5.1% and 10%), circumpolar (10.8% and 15%), cosmopolite (11.8% and 6.4%), Carpathian - Balkan (2% and 3.4%), alpine-Carpathian (0.6% and 4.9%), ponto-Mediterranean (1% and 3.5%), Atlantic-Mediterranean (0.6% and 0.8%), adventives (2.0% and 0.4%), and Carpathian endemic (2% and 3.6%).

The Lacul Cuiejdel and its neighbouring area have rare elements: *Hepatica transsilvanica, Ranunculus carpaticus, Symphytum cordatum, Epipactis helleborine.*

Near Lacul Roşu were found endemic species: *Hepatica transsilvanica, Silene dubia, Campanula carpatica, Leucanthemum waldsteinii, Gentiana phlogifolia, Thymus bihorensis, Poa rehmanii,* also glacial relics: *Carex appropinquata and Carex elongata.*

Ecological range looks like this:

		0	1- 1.5	2- 2.5	3- 3.5	4- 4.5	5- 5.5	6
U	Lacul Cuiejdel	2.8	2.0	16.8	45.5	18.8	10.3	4.6
	Lacul Roşu	4.5	3.9	22.9	40.0	18.2	7.5	3.0
T	Lacul Cuiejdel	17.9	1.0	16.5	58.5	6.1	-	-
	Lacul Roşu	20.0	2.8	26.8	45.6	4.6	0.2	-
R	Lacul Cuiejdel	37.9	-	4.6	24.6	30.3	2.6	-
	Lacul Roşu	31.6	0.6	8.8	21.2	34.6	3.2	-

Comparing data related to the humidity variation on species (U), both areas are noticed to have mesophilous species, followed by meso-hydrophilous species, also present in the nearby forests and grasslands; a high percentage belongs to xeromesophilous species, found in sunny and dry places. The nature of the two ecosystems induced a high percentage of hydrophilous species and less ultra-hydrophilous species.

With regard to temperature (T), a large number of mesotherm species and a small number of microtherm species were found in both areas, due to the cold climate here. Moreover, a large number of species, which tolerate both high and low temperatures, can be noticed.

With regard to soil (R), there is a high percentage of low acid-neutral and acid neutral species in the two areas, and a high percentage of *euryionics* species.

To conclude, from the point of view of bioforms, phytogeographic elements, ecological facts, and adaptation of species, Lacul Cuiejdel and Lacul Roşu have many resemblances, despite their different flora oldness and stage of development.

Phytocoenological study

Lacul Roşu has well developed phytocenoses, because of its age, whereas the vegetation of Lacul Cuiejdel, being newly formed, is evolving. Some of the plant associations from Lacul Roşu can be also found in Lacul Cuiejdel, but because the area is not geologically stable and due to the rainfalls, there are often high floods, large parts of the lake plugged and some phytocoenosis were covered with mud. Therefore is difficult to study floristic structures here.

The vegetation of Lacul Cuiejdel contains the following floristic structures: *Potamogetonetum pectinati, Eleocharidetum palustris, Typhetum angustifoliae, Typhetum latifoliae, Schoenoplectetum lacustris, Sparganietum erecti,*

Agrostetum stoloniferae, Trifolio repenti- Lolietum, Scirpetum sylvatici, Epilobio-Juncetum effusi, Deschampsietum caespitosae, Tussilaginetum farfarae, Eupatorietum cannabini, Juncetum inflexi.

Lacul Roşu has floristic structures as: *Telekio speciosae- Alnetum incanae, Lemnetum minoris, Batrachio trichophyllo- Callitrichetum polymorphae, Potametum natantis, Typhetum angustifoliae, Typhetum shuttleworthii, Glycerietum plicatae, Carici flavae- Cratoneuretum filicini, Scirpetum sylvatici, Angelico- Cirsietum oleracei, Festucetum pratensis, Deschampsietum caespitosae, Telekio - Petasitetum hybridi, Caricetum vesicariae, Equisetetum fluviatilis, Caricetum rostratae, Caricetum appropinquatae.*

CONCLUSIONS

Lacul Cuiejdel is an interesting ecosystem because of its biodiversity, geological and geomorphologic particularities, as well as a landscape, that is why it was declared a Natural Reserve. Lacu Roşu, valuable due to the same elements, is also *a witness* of the evolution of Lacul Cuiejdel and it is a significant part of the Hăşmaş-Cheile Bicazului National Park.

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