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MORPHOLOGICAL AND MORPHOMETRIC ANALYSIS OF THE PREAJBA VALLEY LAKES (DOLJ COUNTY, ROMANIA)

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Abstract

The Preajba Valley lacustrine complex is located in the South-East of Craiova city (6 km) and it is currently represented by 9 reservoirs. The research aims at elaborating the cross-valley profile along the dams of the Preajba Valley lakes based on the field measurements with GPS Rover - GNSS Smart S 82-T. The analysis of the morphological features of the Preajba Valley lakes is based on the processed data obtained during the field trips conducted in the spring of 2014. Another important objective of this research is to analyze the morphometric elements of the eight lakes of the Preajba Valley (Lakes I, II, III, IVI V, VI, VII, VIII and IX), i.e. surface, perimeter, length, medium width, maximum width and quotient of sinuosity. In comparison with the measurements from the cartographic support using GIS tools, there is observed a reduction of the lake surface (Lake VII and Lake VIII), a change of the appearance of the banks (Lake II) and the appearance of hydrophilic vegetation (Lake V). The lacustrine complex called the Preajba Valley is included on the list of protected areas from Dolj County due to its ecological features and this study could be useful for improving the management of the lakes by the local and regional authorities.

Keywords: GPS data, GIS tools, morphological features, morphometrical parameters, lacustrine complex, Preajba Valley

1. INTRODUCTION

1.1. Background of the research

The morphologic features, the morphometric parameters, the trophic state, the catchment's size, the groundwater interactions, the climatic

conditions, the flow input are the main factors which generate and influence the existence of lacustrine units. International important contributions regarding the way how the size, form and depth of the lake can influence the lake's structure can be found in some researches written by: Welch (1948), Hutchinson (1957), Håkanson (1981), Ambrosetti&Barbanti (2002), Nõges (2009) and Moses et al. (2011).

In Romania, the genesis and classification of the lacustrine depression in correlation with the hydrological regime have been established by Gâștescu (1963, 1971).

Recent researches of the Romanian natural and anthropic lakes approach in terms of multidisciplinary: morphometrical and hydrological features of the lakes (Gâștescu & Brețcan, 2003), landscape dynamics (Rădoane, 2004), physico-chemical features and ecological characteristics (Romanescu, 2008); genesis and evolution (Sorocovschi&Șerban, 2010); morphobathymetric features (Horvath et al., 2010); the morphology and the morphometry elements (Șerban et al., 2012); morphometrical and dynamical features (Telteu & Zaharia, 2012); ecological reconstruction (Dimache et al., 2012); fish migration (Voicu et al., 2013).

1.2.Study area

The Preajba-Făcăi lacustrine complex is a group of reservoirs along the Preajba River. This intervention on the Preajba riverbed dates from the Communist era, since the years 1976-1979.

The purpose of this complex was the creation of a recreational area for the inhabitants of Craiova city, located in its proximity, where the beauty of the natural environment was augmented by practicing some water sports or fishing. These lakes have been equipped with dams (with the role of separating the lacustrine depressions) and with surface discharging systems.

The main water course is Preajba River whose sources are located in the vicinity of the Cârcea settlement. The river joins the Craiovita channel at 1,200 meters before the confluence with the Jiu river, managing to cross on the East-West direction the terraces of the Jiu River on the left side (Fig. 1).

The Preajba catchment area is located in Dolj county within the administrative limits of the following settlements: Preajba (Malu Mare), Făcăi and Cârcea (Craiova). The Preajba river length is 6 km and the catchment area is 15 sqkm (Water Cadastre Atlas of Romania, 1992), the altitudinal difference between the springs and the junction with the Craiovita channel is approximately 121.11 meters (data processed after SRTM at 90 m, CGIAR-CSI).

An important factor for the physical-geographic structuration of the area is represented by the presence of the temporary springs that supply small rivulets which are a representative factor for the existence of the entire Preajba Valley lacustrine complex.

The Preajba river flow is a permanent and constant one, especially since the lakes communicate between them, on the principle of communicating vessels, using the discharging systems located in the body of the dam.

The previous researches of the Preajba Valley Lakes have reported a different number of lakes, their numbering being made all the time from the upstream towards downstream.

Pânzaru (1969) identified 14 lakes, which were then grouped according to their genesis and territorial repartition into two distinct sectors.

Thirteen lacustrine units where identified by Cioboiu & Brezeanu (2002) along the Preajba river and two of its tributaries on the right side.

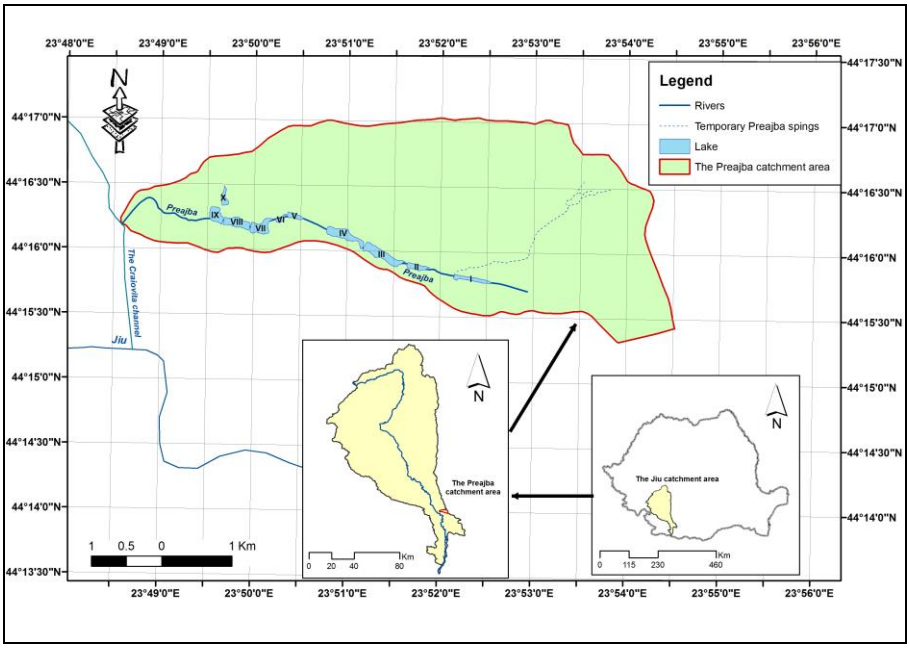

Figure 1. Framing the Preajba catchment area at national and regional level
(processed after the topographic map 1:50,000 and the Water Cadastre Atlas of Romania, 1992)

Currently, following the field investigations during the spring of 2014, 2 of 11 lakes, previously identified in the literature, are devoid of water (their positioning being upstream and downstream of the Lake I).

Keeping the numbering from the springs towards the confluence with the Craiovita Channel, we have identified 9 Lakes along the Preajba River and one Lake along one of its tributaries, the Bătrâna river, which at present is dried up (fig. 2).

a

b

Figure 2. The lake (a) and the dry water course (b) along the Bătrâna Valley *(Photos by Goga, 2014)*

Most of the lakes are invaded by paludous and aquatic macrophites (Fig. 3), which is a feature of the eutrophic ecosystems; but the phytoplankton does not have proper development conditions here (Goga, 2009).

From the surface water quality point of view, the small basins from the Preajba Valley can be used for pisciculture, as well as for tourist and entertainment purposes (Cioboiu, 1999, 2002; Cioboiu & Brezeanu, 2002).

The Preajba-Făcăi Lacustrine complex (with a surface of 28 ha) has obtained the status according to the legislation of international and national community: protected natural area of national interest SITE CODE -2394; aquatic protected area "Preajba-Făcăi Lacustrine Complex" under law 5/2000; protected area declared in accordance with the Resolution of the Dolj County Council No. 26/1994.

The educational-ecological measures and dissemination of information about protected areas on the Preajba-Făcăi Lacustrine Complex is a research project completed in 2011 and aims to study the 5 Lakes of the protected natural area " Preajba-Făcăi Lacustrine Complex " (http://www.arealprotejat.ro).


I


I


II


III


IV


V


VI


VII


VIII


IX

Figure 3. The Preajba Valley lakes

(Photos by Ionuș and Avram, March-May 2014)

By identifying the Preajba River lakes, a total of 8 Lakes resulted, being the most close result to the numbering of this research, the difference is at the Lake II and III level which have been analyzed as a whole.

According to the results of the above mentioned project, in the Preajba-Făcăi Lacustrine complex are delineated three protected areas, each of them with certain permitted activities (The current state of preservation. Measures to achieve a favorable conservation status, 2011).

The Integral protection zone (surface - 17.44 ha) integrates most of the natural area Preajba-Făcăi and it overlaps the wet area of the standard form in accordance with APM Dolj.

The sustainable development zone (surface 4.17 ha) it is characterized by ongoing right of investment/development activities, in particular those of touristic interest, but with "respect for the principle of sustainable use of natural resources and to prevent any significant negative effects on biodiversity."

The sustainable management zone (surface 6.38 ha) is individualized through the following permitted activities: educational and scientific activities; rational use of grasslands for grazing and/or mowing in a given period, so as not to affect the present flora and fauna species; programs and ways of ecotourism.

2.DATA AND METHODS

The element of novelty brought by this research on the Preajba Valley Lakes, lies in the use of new data obtained through the own measurements carried out in the period March-May 2014 with GPS South S82-T. The latest technical endowment made by the Geography Department of the University of Craiova facilitated the development of some faster and accuracy measurements campaigns.

The morphometric features of the Preajba Valley lakes have been determined using the detailed topometric maps (1:25,000 and 1:50,000), ANCPI satellite images (ortophotos - 2009), GPS data and digital databases.

The field observations have been conducted in order to provide new data or to reveal details that were not observable on the maps.

3.RESULTS AND DISCUSSIONS

The Preajba Valley has a length of about 9 Km (GIS measurement after 2009 ortophotos). GPS technique used in the valley morphology

measurements have facilitated the obtaining of some information and leaded to the Preajba lacustrine complex (Fig. 4).

The cross-valley profiles along the dams of the Preajba Valley lakes (Fig. 5) were done based on the left bank of the valley, and the distances between points are about 5 meters and depict the morphological aspects of the Valley by two elements:

- the symmetry of the two slopes of the Lake I and Lake III, and the asymmetry in the case of the other lakes, due to the phenomenon of increasingly anthropogenic pressure on the left slope through the expansion of new households in the Preajba village;
- the difference in altitude of the dams (maximum-110.7 m, in the case of the Lake I and minimum-79.5 m, in the case of Lake IX) which ensures the flow of the Preajba river and the upstream-downstream circulation at the discharging systems level of the all 11 lakes.
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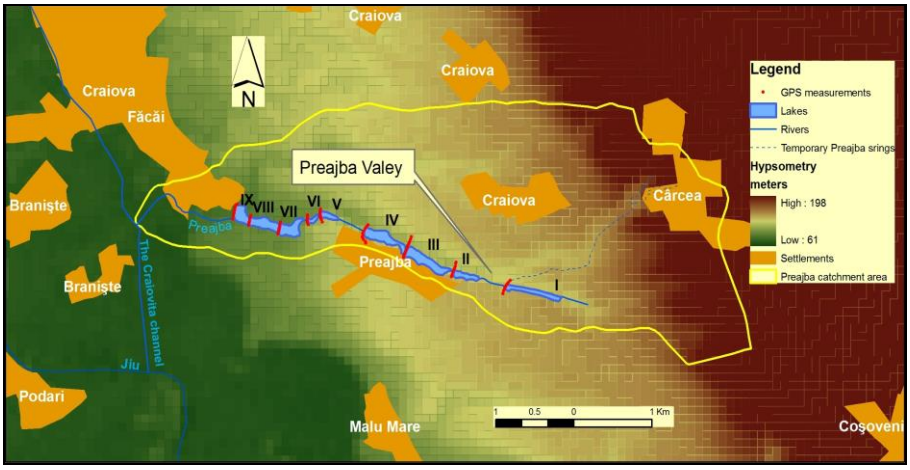

Figure 4. The Location of the GPS measurement points along the dams of the Preajba Valley lakes *(processed after the SRTM at 90m and after the topographic map 1:25,000)*

Comparing the two slopes of the valley there is observed the steep left slope in the case of Lakes I and III, with differences in elevation between the ridge and the dam of about 4 m (111.2 m-107.5 m, Lake I) and 5 m (107.6 m-102.8 m, Lake III).

The high human pressure on the left slope is felt at the level of the cross-valley profiles of the Lakes V, VII and VIII, a fact highlighted by the little difference in altitude (less than a meter) of this slope.

The right slope, beyond which lies the agriculture lands between Preajba settlement and Craiova city (Fig. 6), shows the high altitude between the ridge and the dam itself, having a steep aspect, in the case of Lake I (111.2 – 110.7 m), Lake III (107.6 – 102.8 m), Lake IV (105.5 – 97.5 m) and Lake V (91.0 – 90.1 m).

Regarding the differences in altitude along the dams (highlighted by the brown colour of the cross-valley profiles), the inflections of the altitude between the left and right slope, have been influenced due to the human pressure exerted by crossing them with transport vehicles (including tractors) and carts corroborated with some unfavourable features (dams made by mud and without grass on the canopy).

This fact is due on the one hand to the locals who want to arrive faster at neighboring localities (Preajba, Cârcea and Craiova) by shortening the distance, and on the other hand to the tourists who come for leisure or fishing and cross subconsciously the dams in order to remain on the right bank of the Lakes.

Due to the position along the valley and through the low degree of accessibility, the lakes I, II, III and VI are spared from the circulation along the dam. At the opposite pole, i.e. the most popular dams are those of Lakes II (for locals), Lake IV and Lake VII (for tourists).

The biggest differences in altitude at the dams' level are in the case of Lake VIII (0.86 m) and Lake IX (0.51 m), the lowest value being roughly in the median position and are due to the human pressure presented above.

The measurements through GIS techniques based on processing the cartographic support (2014 ortophotos, ANCPI) reveal that the biggest lacustrine area is that of the Lake III, 6.4 hectares (tab. 1).

At the opposite pole, the Lake VI has only 0.8 ha, the explanation for both values refer to the position of each lake within the complex, as well as to the communication that exists between the neighboring waters through the surface discharging systems.

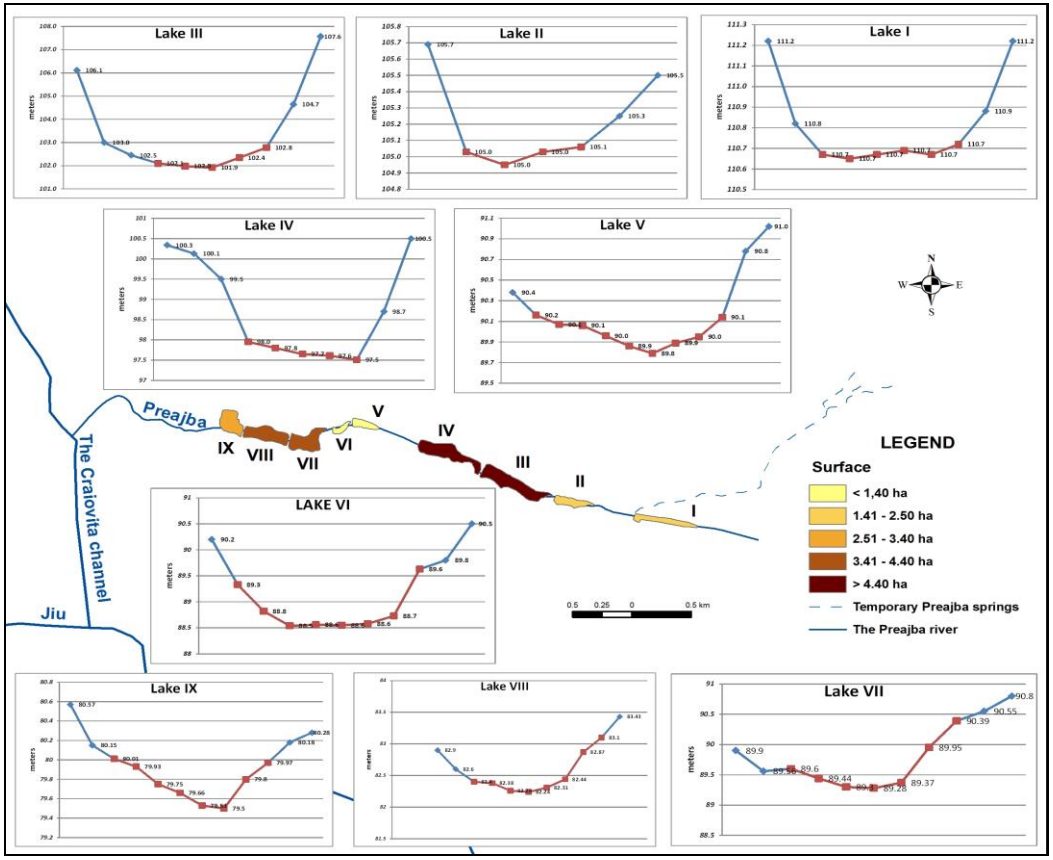

Figure 5. Cross-valley profiles along the dams of the Preajba Valley lakes

a

b

Figure 6. The Preajba Valley *(view on the left side of Lake II (a - March 2014, b - May 2014; Photos by Ionuș)*

Table 1. The main morphometric parameters of the Preajba Valley lakes
(processed data after the 2009 orthophotos)

Number of lake	Surface (S, ha)	Perimeter (P, km)	Length (L, m)	Maximum width (lmax, m)	Medium width (lmin, m)	Quotient of sinuosity
I	3.8	1.56	706	72	53.82	2.26
II	2.0	0.77	330	83	60.61	1.54
III	6.4	1.51	657	137	97.41	1.68
IV	5.6	1.42	619	130	90.47	1.69
V	1.4	0.56	241	72	58.09	1.34
VI	0.8	0.45	185	80	43.24	1.42

VII	4.0	0.99	360	167	111.11	1.40
VIII	4.2	0.98	382	143	109.95	1.35
IX	3.4	0.75	284	176	119.72	1.14

The total area of the lacustrine complex is about 31.6 hectares being in a continuous decrease due to the warping and to the extension of vegetation.

In terms of perimeter, the Lake III is still on the first place (1,510 m), and the Lake VI (450 m) is on the last place; this ranking proves a direct proportionality relationship between the two parameters of the lakes - the perimeter and the surface.

The maximum length is recorded by the Lake I, 706 m, while the minimum value, 43.24 m, is recorded by Lake VI (Tab. 1). Although it has the minimum values both as surface, perimeter and length, the Lake IV has a typical form of a lake (fits best in a circle) within all the lakes of this complex.

The maximum width is 176 m and is recorded by Lake IX, as well as the highest value of the average width (119.7 m).

The smallest distance between bakns, 72 m, is recorded by the Lakes I and Lake V. The maximum quotient of sinuosity is recorded by the Lake I (2.26) and minimum value is recorded by the Lake IX (1.14) (Fig. 5 and Table 1).

4.CONCLUSIONS

The Preaja-Făcăi Lacustrine complex in terms of location, the morphological and morphometrical features has a special geo-ecological and especially agrotouristic potential, but it has a high degree of fragility, so that the human pressure has a destructive effect on the ecosystem both aquatic and terrestrial.

Although the status of protected area controls the human pressure within the Preajba Valley, however there are many breakings of these directives, either through fishing in the prohibition period, either by destroying the habitat of species with garbage dumps located on the left slope of the valley.

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