

Influence of hydrological regime on the wetland ecosystem

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Abstract

In this paper are analyzed, defining the wetlands, main characteristics of their, the influence of anthropogenic factors being an important parameter. They are given in detail the role of the flooding and drainage in determining the hydrological regime of the wetland (Lunca Dunării and Satchinez Swamp).

It is presented a conceptual model, accepted, establishing the hydrological regime on the ecosystem.

Biotic components have effects of the feedback on the hydrological regime. Researches from the wetlands permit, no doubt, the establishment the correlation of interdependence between hydrological and ecological factors and each other. This correlation is actually implementing the concept of ecohydrology.

Keywords: wetlands, hydrological regime, ecosystem

1. INTRODUCTION

The concept regarding sustainable development and water management policy must take into account of the importance and protection of existing wetlands. The importance of wetlands is mainly due to their ability to store of the large quantities of fresh water, to ensure a balance between flood control, supply layer underground water, retention of nutrients and sediment, mitigating the impact of drought for a zone overview as well as their biological productivity (for example, fish, wood, cane).

Wetlands are transitional in terms of spatial arrangement (figure 1). Wetlands form the aquatic boundary of the habitats of many terrestrial plants and animals; they also form the terrestrial edge for many aquatic plants and animals. Hence, small changes in hydrology can result in significant biotic changes. [W.J. Mitsch, J.G. Gooselink, 1987]

February 2 is declared “World Wetlands Day”, the date on which was signed the Convention on Wetlands of global importance from Ramsar (Iran). This international treaty has as the major objective the conservation of biodiversity and wetlands resource, and constitutes a real tool that promotes sustainable development on our planet.

By signing and ratifying the Convention, the parties have recognized the interdependence of man and his environment, and they took into account the fundamental ecological functions of wetlands, as

regulators of water regime, as habitats of the characteristic flora and fauna and especially of water birds.

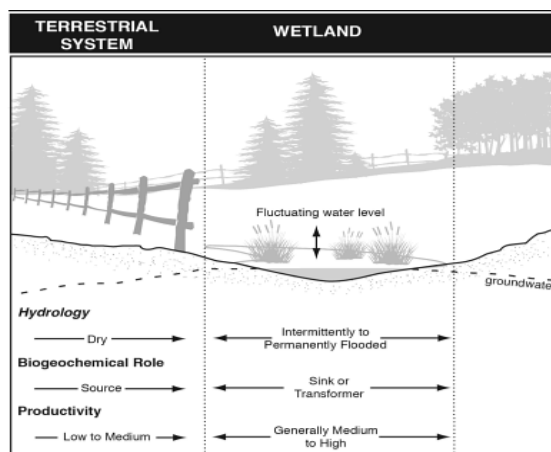


Figure 1. The area transitional

These wetlands represent habitats, which to be determined on the basis of their role from ecological, botanical, zoological, hydrological, limnology and hydrological point of view. Wetlands are particularly varied, being known under a variety of names: ponds, groves, lakes, etc.

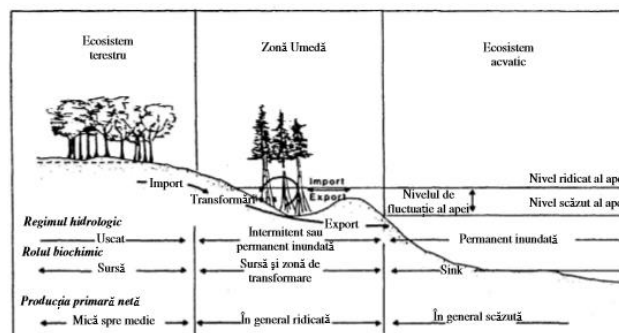


Figure 2. General wetland location [W.J. Mitsch, J.G. Gooselink, 1987]

After Junk and Welcome, floodplain is considered "a land area of low altitude, flooded with water flowing from rivers and lakes with which it is associated". The influence of the human factor is an important parameter in determining the change in structure ecosystems. In the past 50 years in Romania were destroyed over 400,000 hectares of wetlands, the most affected being the Danube Floodplain. [Smirca, 2008] Embankment rivers leads the continue increasing of anthropogenic pressures on water bodies, reaching in crisis situations to produce breaches leading to flooding with significant damage. An important example is the Danube floodplain from Romania. The initial natural environment of it consisted of flood

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channel, low-flow channel and floodplain, which contained wetlands, forests and grasslands. During the years 1960 and 1970, the embankment began on the river on Romanian side, reaching in the year 1987 to 75% of 1075 km, manages of Romania.

Soil loaded with nutrients offered possibility of agricultural areas and therefore authorities of the time decided transformation the plain into farmland by draining and longitudinal works. Drainage of wetlands and their inclusion in the set-aside increased the flooding risk, what has been observed many times in rainy seasons. Exceptional floods in years 1965, 1970, 1985, and 2005 and in recent years have produced significant damage to adjacent localities by breaking dykes, natural and controlled flooding in the adjacent premises. [I.Visinescu, M. Bularda, 2008]

A similar situation existed in catchments Timis - Bega, the longitudinal works narrowed Timis River, this being an important factor in producing floods of recent years. In the past, under Austrian domination Banat has swampland, but was transformed by intense drainage works and regularization of river bed. [F. Griselini, 1780].

Only areas of Timis County that keep the land characteristics before the draining are currently Satchinez marshes. Current conditions: groundwater less than 2 m deep, temperate climate and topography are considered adequate to assure existence of the wetlands.

2. CHARACTERISTICS OF WETLAND

In Romania at the moment there are 12 wetlands protected by the Ramsar Convention, of which in the hydrographic area Banat, is a Ramsar site, namely the Mures Floodplain.

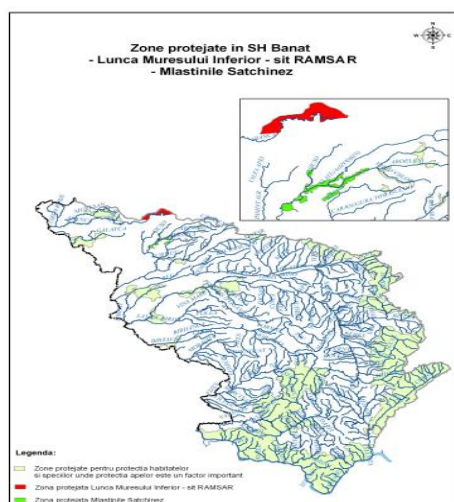


Figure 3. The area protected of hydrographic area Banat

Mures Floodplain has an area of 17 166 ha and is located within Arad (83%) and Timis (17%) county, extending downstream from Arad locality until the Hungarian border.

Mures Floodplain is a Ramsar site of great diversity, meeting important and rare habitats such as: muddy rivers, oligotrophic until to mesotrophic stationary waters, alluvial meadows, groves of willow and poplar; bird and mammal species as: egret, white

stork, black stork, hen harrier, stilt, black kite, otter, squirrel, etc.

Swamps Satchinez (Figure 4) from the space river basin Banat forms a nature reserve Ornithological, which spans on 242 hectares of Timiș County.

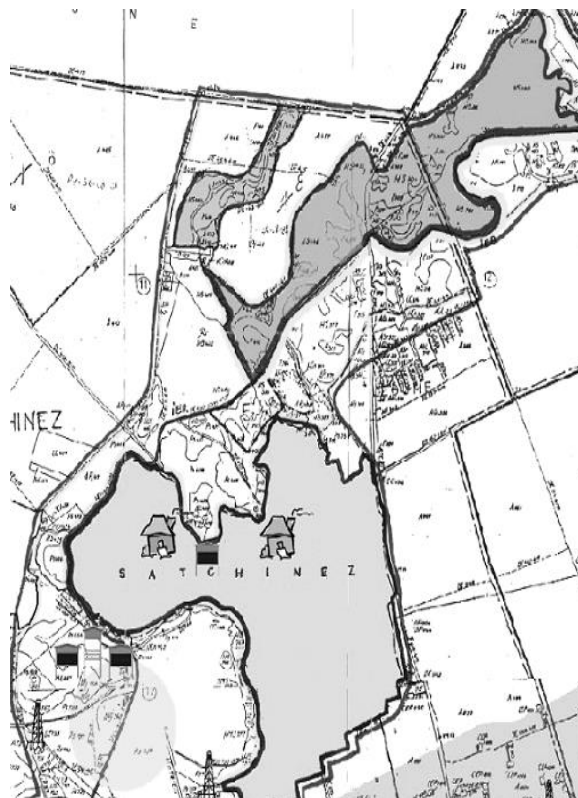


Figure 4. Swamps Satchinez – overview

This natural habitat is a reminiscent of ancient marshes which covered up to middle of the eighth century Banat lands. With more than two hundred years ago, the whole low plain of Banat was swamping due to periodic flooding and frequent changes of water courses. This environment, however, favorable of the aquatic birds (aquifauna), which due to the large number and diversity of species reign swamps, where not only food they found, but also protection for nesting.

Since the latter part of the 18th century, the need for agricultural land is becoming more acute and hydraulic structures have increased, limiting continuous range of the birds living area, to the brink of extinction.

By geomorphological point of view, Satchinez Marshes is located at the contact of three plain with different morphological characters: Vinga plain, Jimbolia Plain (Torontalului) and Timiș plain, which removes to a certain extent of the specific monotony of plain.

The nature reserve itself occupies Ier River floodplain (Apa Mare River) between Satchinez and Bărateaz settlements. In this sector, floodplain has widths between 400 and 2000 m, an average slope very low, only 0.4 degrees and an average height of 90 m. This floodplain, moreover that all the small rivers of the region is swampy and penetrate toward Northeast, within the Piedmont Plain Vinga, covered by loess

deposits of clay that reach to the North from Bărăteaz elevation 119 m. Meadow presents the same characters and to the South, which is characterized by the presence of extensive marshy areas, of the meanders and of the abandoned brook. The nature reserve itself occupies the Ier floodplain (Apa Mare River) between Satchinez and Bărăteaz settlements. In this sector, floodplain has widths between 400 and 2000 m, an average slope very low, only 0.4 degrees and an average height of 90 m. This floodplain, moreover that all the small rivers of the region is swampy and penetrate toward Northeast, the Piedmont Plain Vinga on inside, contrasting sharply with the wide river, covered by loess deposits of clay and its, that reach to the North from Bărăteaz, elevation 119 m.



Figure 5. Swamps Satchinez of Banat catchments

Besides the actual reserve, the area protected includes a buffer zone that it extends along the river Ier, up to east from Barateaz locality and southwest of Satchinez locality, until to Raul Mare and incorporating some of valley slope from Vinga and Jimbolia plains.

Construction of the dam on Sicsău Valley and achievements the storage Satchinez, have compensated to some extent the dewatering effects by appearance of 4 ha of water surface and of some important areas covered with reeds. Unfortunately, and here you can see the high degree of silting –up of the lakes, which raises questions regarding its future. Currently the lake represents an important nesting and feeding place for the water birds of sanctuary, but also an attraction for fishermen.

Currently, the sanctuary has a surface of 1194 ha and its structure is as follows: 122 ha- sanctuary itself; 1072 ha- the buffer area of mosaic kind, which includes: Satchinez reservoir (It has an area of 40 hectares); Bărăteaz Pond; Ratu Mare Pond (It has an area of 6 hectares); Verbuncu Pond (It is a remnant marshes that existed in the plains of the Banat. It has an area of 2 hectares)

The swamps Satchinez are dubbed “Delta of the Banat”, a paradise of the water birds, here are living over 40% of the bird species found in Romania.



Figure 6. Verbunca Pond

3. EFFECTS OF HYDROLOGICAL REGIME ON WETLANDS

Wetlands are found in regions where the rainfall is in excess towards the losses by evapotranspiration or overland flow.

Wetlands form the aquatic boundary of the habitats of many terrestrial plants and animals; they also form the terrestrial edge for many aquatic plants and animals. Hence, small changes in hydrology can result in significant biotic changes.

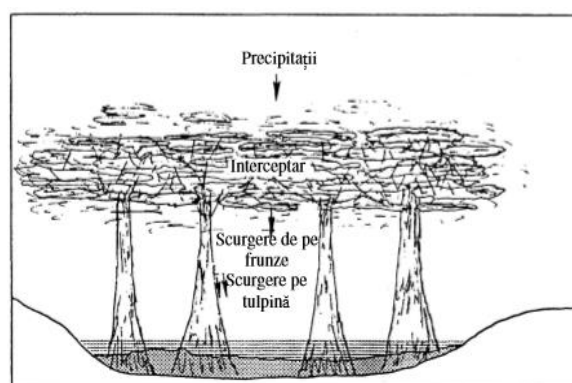


Figure 7. The route of water of precipitation in a forested wetland area

The starting point for the hydrology of a wetland is the climate and basin geomorphology. Effects of hydrological regime on the structure and functions of the wetlands can be described by a series of the cause-effect relationships.

A conceptual model showing the overall effects of the hydrological regime of wetland ecosystems is described in the figure below (figure 8)

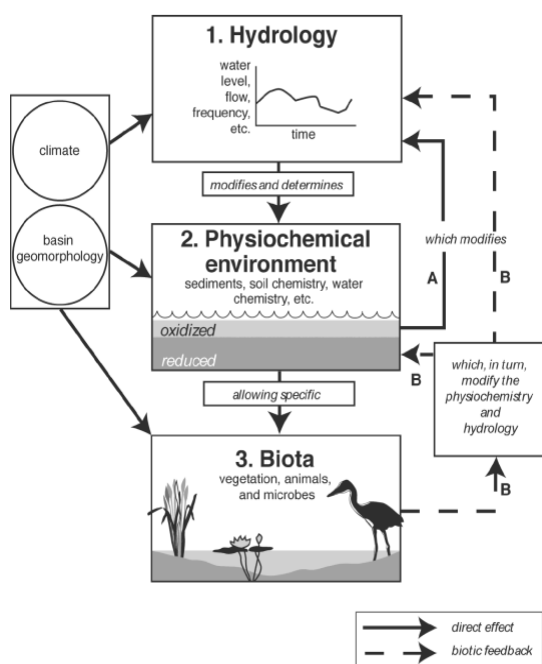


Figure 8. Diagram regarding the effect of hydrology on wetland function and the biotic feedback that affect wetland hydrology [W.J. Mitsch, J.G. Gooselink, 1987]

Initially the effects influence the physical and chemical issues of wetlands, which in turn affect the biotic components of the system. Biotic components have feedback effects on the hydrological regime. On the basis of studies were formulated some principles of importance on wetland hydrological regime, which has resulted:

Hydrological regime determines a unique composition of vegetation, but it can limit or enhance the richness.

Primary productivity of wetlands is enhanced by the flow conditions and reduced hydro periodic, and is often reduced of the stagnant water conditions

The accumulation of organic matter in wetlands is controlled by hydrological conditions that influence primary productivity, decomposition and export of particulate organic matter.

Wetlands are complex systems cu functions as: adjusting the flow regime, erosion protection, water quality improvement, habitat, and water storage. The characteristics and the current state of riparian wetlands are mainly influenced by the various hydrological factors like: the water regime and the flow situation. The vegetation plays an important part in calculating the storage capacity due to plant absorption and in decreasing the speed by providing a coefficient of roughness.

Promoting the new concept “living with floods” for flood risk mitigation can interfere once with discharge decrease and then with the flowing surface (S). This makes S the active floodplain which include the riparian wetland areas. The hydrograph shows part of the flood wave from the river bed being taken by wetland, used here as a side retention. The volume stored (V_w) is also influenced by vegetation and soil moisture at that point. H_1 represents the bank height, H_2 being the height of the flood wave.

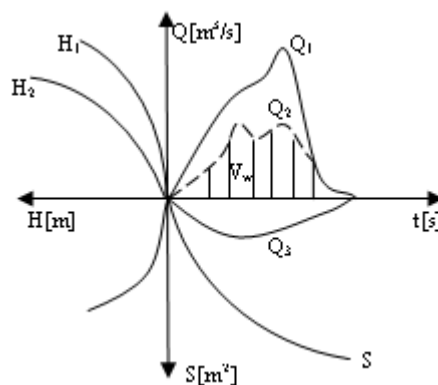


Figure 9. River hydrograph

Increasing the flowing surfaces can be done through the local defense dikes, the revitalization of wetlands, decreasing with predilection the pressure on the embankment that occurs in the current arrangement schemes.

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