NATURAL PROTECTED AREAS FROM ROMANIA. A CASE STUDY OF DANUBE DELTA

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Abstract: *The Danube Delta is recognition as natural international capital in Romania. In 1991 it was designated as Ramsar site and World Natural Heritage Site for a surface of 50% of its area. Also, in 1992 it is recognized as a Biosphere Reserve. The Danube Delta is a large protected area at international level, but at national level certain areas of the Danube Delta are only natural reserves. The Danube Delta is recognized as a Natural Biosphere Reserve by Government Decision 248/1994. In 1994, a GEF (Global Environment Facility) project was set and Park Administration implements the management plan. The Danube Delta has so far been the only protected area with its own administration. At national level, will be provided support for the establishment and strengthening of the necessary institutional framework, for the adoption of the laws on protected areas and strengthening legislative framework. Also, for preparation human resource which is a public participation component of popularization the idea of nature conservation and protected areas. The purpose of this article consisted of choosing Danube Delta area where the possible floods occur due to different weather phenomenon. To do this using ArcMap 10.5 programs were conducted a simulation map of flooding in the area under study.*

Keywords: *Convention, Danube Delta, Habitat, Protected Area, Maps.*

1. INTRODUCTION

The first modern, world-wide intergovernmental treaty on the conservation and sustainable use of natural resources is the „International Convention of Importance Wetlands Particularly as a Water bird's Habitat" signed on February 2, 1971 in the Iranian city of Ramsar, on the coast sea Caspian.

The Convention on Wetlands of International Importance, in particular as a habitat for aquatic birds, signed at Ramsar, Iran, in 1971, established February 2 as World Wetlands Day. Romania is a contracting party to the „RAMSAR" Convention as of September 21, 1991 (through the adoption of Law no. 5 of January 25, 1991). The declared objective of the Convention was to conserve the wetlands, fauna and flora that serve as aquatic bird habitat and which constitute the most important resources of economic, natural, scientific and recreational value. The choice of these areas, according to the Convention, is based on the international role from ecological, botanical, zoological, limnological, hydrological, taking into account their importance for aquatic birds in all seasons. First of all, The Convention establishes for the States Parties, the requirement to develop and implement the management plans, so as to favour the conservation of these areas by creating reservations and rational use of their reserves.

The wetland as a Ramsar site represents a recognition of the importance and proper management of areas worldwide. [11]

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The concept of Wetlands includes a wide variety of ecosystems that have the following common aspect: the presence of both land and water for most of the year. According to the definition given by RAMSAR, the wetlands are extremely diverse. The Convention defines wetlands as stretches of ponds, marshes, natural or artificial waters, permanent or temporary, where the water is standing or flowing, sweet or salty, including stretches of seawater whose depth at ebb does not exceed six meters. Regardless of the types of wetlands, they are characterized by the fact that they share a fundamental feature, namely: the complex interaction of their basic components - soil, water, animals and plants, elements that, in conjunction, perform numerous functions and provide multiple products that have supported people over time.

In the broad sense, nature protection has as its main objective the unaltered preservation of the natural ecosystems (eco - background) and the genetic background at global and regional level, in order to ensure the balance between the natural components of the environment, and between them and the human society.

In the present conditions, when in the extended territories the pressures exerted by the different ways of using the lands on the natural patrimony of the planet have reached critical values, the protection and the conservation of the nature occupy a priority place in the field of the concerns of the specialists in the field. [7].

Anthropic pressure had the greatest impact on the flora and fauna biodiversity, the plants and animals being the most vulnerable natural elements of the environment, in relation to human activities; their existence is inextricably linked to the quality of the other components of the landscape. Between 2013-2015, Romania held the Presidency of the Standing Committee of the RAMSAR Convention. For the period 2015 - 2018 Romania was a member of the Ramsar Standing Committee. This year (2019) World Wetlands Day was celebrated on February 2.

From a historical point of view, the Danube is mentioned in documents from the Greek and Romanian eras. If the Greeks called the Danube – Danubius - the Romans used the name Danubius for the upper course and Istros for the lower. Herodot, who between 454-447 BC. has visited the shores of the Black Sea reaching the river Nistru, describes Istros as being the largest of the rivers seen so far, and mentions that the river flows into the sea through five arms. Ptolemeu, in the Antonin Itinerary, gives the coordinates of all the points described by him at the mouths of the Danube River. Polybius (201¬120 BC), Strabo (58 BC - 25 AD), Ovidius (43 BC - 17 AD), Plinus the Elder (23¬79 AD; Naturalis Historia), and Flavius Arrianus (~ 95¬175 AD; Periplus Ponti Euxini) in their writings bring information about the Danube Delta, from which the following can be synthesized: formation of the delta already started, the Danube flowed into the sea through a greater number of arms than today, the delta front was located much to the west of the current position, in front of the mouths of the river were six islands, the largest being known as Peuce (Pomponius Mela, 1st century AD).

The Danube Delta is the most representative delta in Europe and one of the most complexes in the world and is the best-preserved delta in Europe. It is also considered to be the third area of ecological importance in the world. This represents a major attraction by the presence within it of a variety of vegetation and fauna - fish and ornithological. Here there is the richest and most varied ornithological fauna in Europe, namely over 300 species of birds, some of them declared nature monuments and are protected by law.

In 1991 it was included in the UNESCO World Heritage List as a biosphere reserve.

2. GENERAL PRESENTATION

The „Danube Delta" Biosphere Reserve has a total area of 580,000 hectares and includes morphologically and genetically units distinct physical and geographical, by point of view: the Danube Delta itself, the Razim-Sinoie lake complex, the maritime Danube up to the Cotul Pisicii, the Isaccea-Tulcea sector with the flood zone, the Sărături Murighiol lake and the Black Sea coast from the Chilia arm to Cape Midia, including the territorial sea up to the 20 m isobath.

The position of the reservation is defined by the following geographical coordinates: 28°10'50" (Cotul Pisicii) and 29°42'45" (Sulina) East longitude; 45°27' (Chilia arm, at km 43) and 44°20'40' (Cape Midia) North latitude. Of the total area of the reserve, more than half (312,440 ha) is represented by the aquatic and terrestrial natural ecosystems included in the list of areas with universal heritage value (the Convention of Universal Natural Heritage) as well as those destined for ecological reconstruction, areas that constitute the public domain of national interest. The rest of the areas include embanked for fish farming, agriculture area and forestry (about 80,000 hectares). These areas are provided in Law 18/1991, including private land or public property of local interest within the localities or territories of the communes (about 29,000 hectares) as well as a marine buffer zone of about 103,000 hectares.

The Danube Delta climate is temperate continental with Pontic influences, some areas have semi-arid climate. Precipitations are low, around 360 mm/year, and cloudiness is the lowest in Romania. The multiannual temperature average is 11 degrees Celsius. Summers are warm with minimal rainfall; winters are relatively mild with minimal snow cover which is kept only in harsh winters for short periods.

In Patlageanca, the Danube has a flow of 6400m³/s (on average), and is divided into two arms, in North Chilia and in South Tulcea. The Tulcea arm near the Cetatea Ismail is divided into two arms: Sulina and Sf. Gheorghe.

- The Chilia arm transports 60% of the Danube's waters and alluvium. Along the arm are located settlements, Periprava and Chilia Veche.
- Sulina branch is located in the middle of the Delta, has 71 km length and transports 18% of the Danube water volume.
- Sf. Gheorghe arm carries 22% of the flow. At discharge point, the Sacalin Islands are considered to be a beginning of the secondary delta

The territory of the Delta is par excellence a land of waters. The dozens of lakes, canals, streams and marshes that are part of it are the main elements of the Danube Delta biosphere's hydrographic system, of course along with the main arms of the Danube.

The most important lakes are: Roşu, Puiu, Puiuleţ, Lumina, Tătaru, Merhei, Matiţa, Fortuna, Gorgova, Trei Ozere, Erenciuc. Channels are the main circulation system in the Danube Delta. The canals provide from the lakes fresh water and water transport support. The largest channels are: Dunavăţ, Cordon Litoral, Litcov, Dranov, Caraorman, Crasnico. And the most important streams are: Păpădia, Litcov, Lopatna, Şontea.

3. FORMATION OF THE DANUBE DELTA

The Danube Delta was formed in an old Black Sea bay, Tulcea Bay. It has been filled with alluvium since the Quaternary period. The filling was done in several phases, being favoured by the low tide of the Black Sea.

The first phase consisted of the formation of a coastal cordon that partially is blocked by the Tulcea Bay.

In the second phase, the bay is completely closed and becomes a lagoon. In the next phase, the third, lagoon is filled with alluvium and in the newly formed marsh area the Sfântu Gheorghe arm - the oldest arm of the Danube - is formed. Also, in this phase the Babadag bay is closed, forming the lagoon complex Razim Sinoe.

In the fourth phase, the initial coastal cordon is pierced on the alignment of the present Crişan locality by a new arm of the Danube - Sulina, which is rapidly advancing towards the sea due to the large amount of alluvium.

In the fifth phase, the coastline is crossed again this time by the Chilia arm, near the future locality Periprava. Currently this arm carries the largest amount of water and alluvium, contributing to the formation of new territories of the Danube Delta.

The Danube Delta is a relief unit of Romania located in the East, being the newest of the country, a plain in the training stage. The flooding process is carried out by the Danube, which spills significant amounts of alluvium every year, in the Black Sea, thus contributing to the growth of the Delta. [3]

From a geomorphologic point of view, the Danube Delta is an alluvial plain in formation, where the marshy areas are covered by reef and abundant vegetation and a large number of lakes and canals. The Danube Delta looks like a large equilateral triangle with sides of about 75-80 km. The average altitude is 0.52 m, most of the territory is below one meter and 20% of the Danube Delta is below sea level.

The dunes and the shales are the largest formations in the delta, and they are also the highest areas of this water's paradise (Letea Grind - 12.4 m, Caraorman Grind - 7 m). The most important dunes in the Danube Delta are: river dunes (Chilia, Caraorman, Pardina, Stipoc), river-maritime dunes (Letea, Sărăturile, Crasnicol) and smaller dunes Zăton Buhaz, Crucea, Creţu, C.A. Rosetti.

The most important types of soils encountered in the territory of the Danube Delta are: alluvial soils, limnosoils, psamosoil and white soils. [8]

The territory of the Danube Delta can be divided into two geographical sub-regions: the Danube Delta itself (located between the arms of the river) and the Razim Sinoe lagoon complex, located south of the Sfântu Gheorghe arm. Delimitation is practiced, also between the river delta and the maritime delta. [3]

4. MATERIAL AND METHODES

The digital elevation model (DEM) was used for hypsometric map that can be found free of charge on CGIAR-CSI geo-portal in WGS84 geographical projection [CIAT, site accessed in Sept, 2019]. [10].

A Digital Elevation Model (DEM) is a grid or a raster of square cells whose cell value is the land surface elevation in the centre of cell. The DEM has a spatial resolution of 30 m. Digital Elevation Model (DEM) is the digital representation of the land surface elevation with respect to any reference datum. DEM is frequently used to refer to any digital representation of a topographic surface. DEM is the simplest form of digital representation of topography. DEMs are used to determine terrain attributes such as elevation at any point, slope and aspect. Today, GIS applications depend mainly on DEMs. [9]

The program used to create maps for this study case is ArcGIS 10.5. It has WGS84 projection and was transformed in Stereographic 1970 projection. (Figure 1).

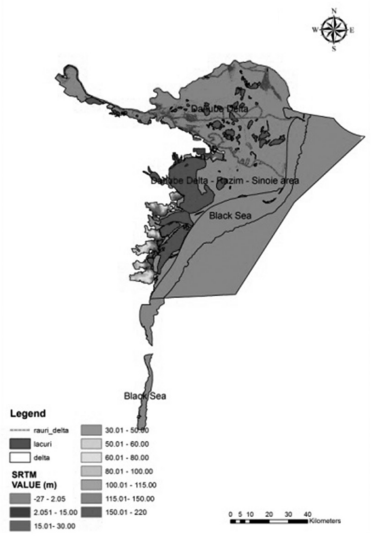

Figure 1. The map of the study area – Danube Delta

The map of the study is a hypsometric map and has 10 altitudinal classes. The altitudinal values are between: - 27.00 – 200.00 m

The studied area includes positive and negative relief forms:

- The deltaic area is represented by the positive relief representing 13% of the delta surface and is formed by dunes;
- The negative relief (0 m level) is represented by the depressions in which the waters of the Danube were installed, through the main and secondary arms, streams, marshes;

In the southern part, the Danube Delta continues with a large lagoon - Razim - Sinoie, formed by blocking an old bay with a sand ridge;

On the edge of the Razim - Sinoie lagoon is a narrow coastal plain called the Razim - Sinoie lagoon coastal plain. [2] [3]

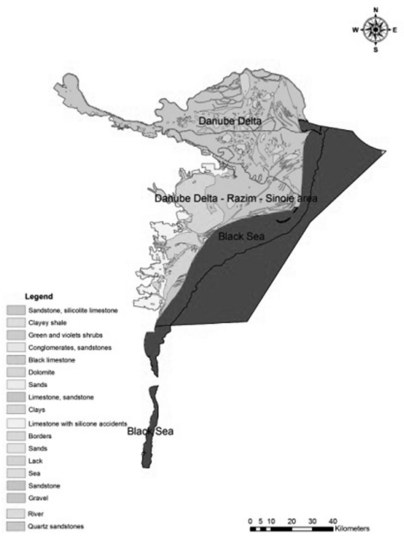

Figure 2. The geological map of the study area

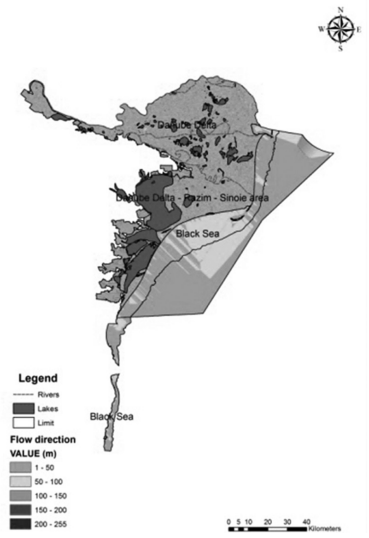

Figure 3 The flow direction of the study area

The geological structure of the Danube Delta is made up of a crystalline foundation over which a sedimentary cover is represented transgressive by a succession of Paleozoic, Triassic, Jurassic, Cretaceous, Neogene and Quaternary deposits, determined by deep and small drilling in the area. (Figure 2) [2] [4] [5] [6]

Flow accumulation was performed using Flow Accumulation tool in ArcMap. (Figure 3)
GIS functions as spatial analysis is capable to produce new information based on analysis of data stored in the system. [1]

GIS is a tool for planners to analyze the planning region. Results of the determination of flood-prone areas are expected to be a consideration for decision makers so as not to focus settlement construction in areas prone to flooding. In addition, the need for flood mitigation efforts in this area such as the construction of dikes, dredging to increase the capacity of the river as well as perform other businesses from upstream to downstream to prevent flooding.

5. CONCLUSION

The vision for the Danube Delta region (2030) is: „An attractive area - with valuable biodiversity and dynamic business environment, with low/medium economic level in both traditional and modern fields - where people live in harmony with nature, integrating economic activities in the tourism, agriculture and fisheries sectors, with adequate support provided by urban service centres."

The economic, social and ecological price paid for disturbing the functions of the wetlands is enormous. This resulted in numerous expenditures to restore the lost and degraded hydrological and biological functions of the wetlands.

Plants and soils in wetlands play an important role in water purification, removing high levels of nitrogen and phosphorus, and in some cases even toxic chemicals. This role is important in preventing eutrophication, a process that leads to rapid growth of algal mass, which means that the surface of the water is completely covered by plants. Thus, in the water mass, light and

therefore photosynthesis are greatly reduced, which is why there is not enough oxygen, although the demand is increasing through the multiplication of organisms.

Wetlands often play a crucial role in flood prevention. By storing water in the soil or by retaining it on the surface of lakes or marshes, wetlands reduce the need for expensive construction. Wetlands contribute to the recharge of underground aquifers.

Wetlands acts as purifying drinking water systems; it protects the lands from floods and are considered the most productive ecosystems in the world. Their structure and functions are determined by the hydrology of the area. This category of ecosystems is about ten times more productive than ordinary ecosystems. Because, in addition to the solar energy contribution, they receive an additional energy represented by the entrances of the areas with which they are in permanent contact, water and land. Thus, the circulation of water is crucial for ensuring their productivity. Organic matter excess (biomass) can be stored or exported to neighbouring ecosystems.

Wet areas tend to slow down the force of water, encouraging the storage of sediments that will reach the water. Nutrients are often associated with sediments and can be stored at the same time. These nutrients, especially nitrogen and phosphorus from agricultural sources, but also from industrial discharges, can accumulate in the basement and can be transformed by chemical and biological processes or taken by the wetland vegetation, and can then be effectively removed from system.

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