Fenomene şi procese hidrice de risc

HYDROLOGICAL FEATURES OF THE LOWER PRUT FLOODPAIN

GINA RADU

ABSTRACT. - Hydrological features of the lower Prut floodpain . In the lower Prut floodplain, between 1981 and 1985, the most important transformations of the natural ecosystems and hydrological regime have been generated by the dams and embankment works. These were undertaken in order to increase the surface of land used for agriculture or fisheries. Consequently, during long periods of drought, some wetlands are dry every year, and the periods on drought are followed by irregular flooding periods. The liquid flow of the River Prut is influenced by the rainfall and the functioning of the Stânca Costeşti Reservoir. Statistical processing of the data from Oancea Hydrological Station resulted in the average water flow during 1979 - 2006, which is 96.39 m^3/s, with the variation is between 26.1 m^3/s and 381 m3/s.

Key words: lower Prut floodplain, average water flow, floods, embankment works,

Prut River, one of the major tributaries of the Danube River is a border river with a length of 953 km. It originates on the eastern slope of Mount Hoverla, in the Carpathian Mountains in Ukraine. It flows South-East to join the Danube River near Reni, East of Galați, at a distance of about 150 km, before the Danube junction with the Black Sea. Prut River basin (with an area of 28,680 km^2) is limited to the border with Ukraine in the North, the Danube River in the South, Siret River basin in the west and the Republic of Moldova in the East (Fig.1). Reception area basin in Romania is approximately 10,990 km^2 .

Fig. 1. Location Prut River hydrographic basin

Prut river basin has the appearance of a feather, stretching from North-West to South-East. On a

distance of 39.4 km it acts as the Romanian-Ukrainian border, and a distance of 715 km (of which 73.9 km are composed of the Stânca- Costeşti Reservoir) marks the border between Romania and Moldova.

The relief of the territory, on the surface which are captured the waters of the Prut river, is irregular. According to physical and geographical characteristics, the river basin is divided into three sectors:

- ✓ *higher* (mountains) – from the springs to Rădăuți-Prut,
- ✓ *medium* (hill area) - from Rădăuți Prut to up of the downstream confluence with Jijia,
- ✓ *lower* (plain area) - begins downstream of the confluence with Jijia and ends at the junction with the Danube River downstream of Galati.

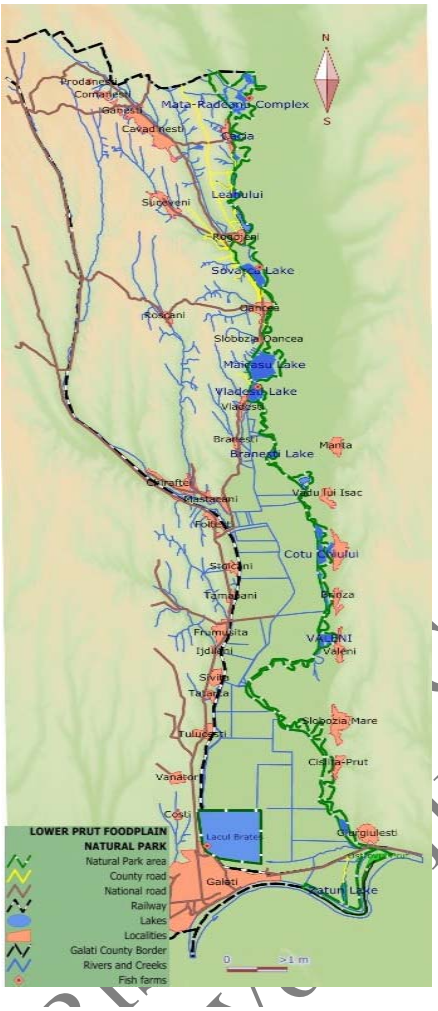

Fig. 2. Map territory examined

Relief space in this paper analyzed the contact zone between Moldova Plateau and Romanian Plain. Have been taken into account the proximity of the Valley lower Prut, which includes a protected Lower Prut Floodplain Natural Park (Fig. 2). Lower Prut floodplain tends to widen to downstream (Vlădeşti 7 km, Brăneşti 6.5 km, Frumuşiţa 7.5 km, Tulucești 8 km), except for area near Oancea locality (5 km).

The Prut floodplain includes many reliefs' microforms (current minor river bed, old, abandoned, isolated courses and abandoned meanders, lake depressions, longitudinal sand banks, the dejection cones, etc.). The actual minor river bed presents meanders and has low height sides (1.5-2.5 m), except for the Oancea area where the floodplain is in contact with the valley declivity. A longitudinal sand bank is found along the minor river bed, 2-3 m high and few tenths of meters wide. It currently supports the dam along the Prut.

The hydrographic network of the analysed area consists of the Prut River and its tributaries (Elan, Horincea, Oancea Seaca, Stoenească, Brăneşti) and Chineja (flows into the Brateş Lake). The Prut River is the most important water

body crossing the region, being the main factor modelling the Lower Prut Floodplain Natural Park area.

Stoeneasa flows into the Prut north of Vlădeşti with a catchment area of only 7 km^2 and the declivity is 18 ‰.

Horincea has a catchment area of 253 km^2, a length of 32 km and a flow of 0.13 m^3/s. This influent of the Prut River receives nearby stream the Oarba Creek, which arises from the center of Suceveni.

Oancea has a catchment area of 18 km^2 and a length of 5 km. The junction with the Prut River is located near the Oancea locality.

Chineja is the most important water body in the sector after the Prut River, with a catchment area of 780 km^2. It is channeled on the lower sector and flows into the Prut near Folteşti locality with a yearly discharge of 0.49 m^3/s.

In terms of water supply they receive, the water bodies within the area under study can be categorized as it follows: rain-melting (85-90% of the total annual flow) and underground moderate (10-15%). The rainwater is 50-60% rain and 40-50% snows. In dry summers the water supply of the rivers becomes dominant rain-melting. For groundwater, their importance is not the volume of water that supply the surface water, but the fact that they ensure the permanence of some creeks (Chineja, Horincea, etc.).The liquid flow of the River Prut is influenced by the rainfall and the functioning of the hydrotechnical works of Stânca Costesti Reservoir.

In order to assess the regime hydrometric data from Oancea Hydrological Station (HS Oancea) were considered, data collected between 1979 and 2006.

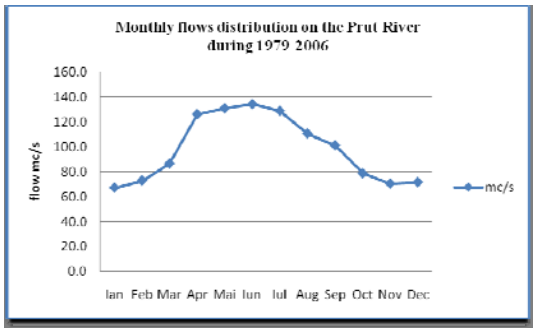

Fig. 3. – Monthly flows distribution on the river Prut during 1979-2006 (HS Oancea)

For the river Prut, the multiannual average flow to station Oancea is 96.4 m^3/s, with significant variations from one year to another (from 38.4 m^3/s in 1990 and 147.9 m^3 /s in 1998). The highest flows were recorded in May-June (134.4 m^3/s) and lowest in winter months (70.5 m^3/s). Thus, during the months of spring and summer, the outflow represents 60% of volumes of water on the river Prut. The lowest values are typical for cold season when the highest average recorded is of 17.7%. Low rates of outflow are in autumn (21.2%), while intake of low rainfall decreased significantly influences the flows (table 1, Fig. 3 and 4).

Table 1. Monthly flow dynamics (mc/s) to Hydrotechnics Station (HS) Oancea during 1976-2006.

Month	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
Oancea	67.1	72.9	86.5	126.3	131	134.4	129	110.7	101.3	78.6	70.5	71.6

Maximum flow rate usually occurs in the May-July period, very rare cases being registered outside this period. Maximum rate during 1979-2006 at SH Oancea was of 757 m^3/s (24 April 1979) in the overlapping period of thaw with the high rainfall.

Characteristic are the high flows recorded in the years 2005, 2006 and 2008, when the flood apex exceeded 690 m^3/s. Period and duration of the events were different (August-October 2005, May 2006, June-July 2006 and May, August-September 2008), but all of them were accompanied by floods.

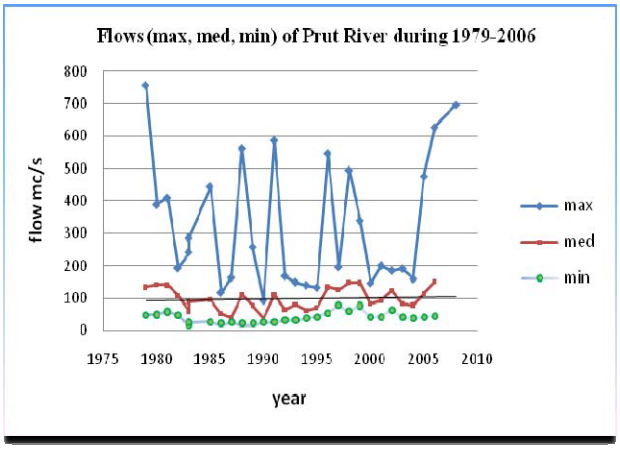

Fig. 4. Annual flows distribution during 1979-2006 (HS Oancea)

The floods, which are characterrized by flow values higher than annual average, raise problems for the stability of natural ecosystems where they are present for a long period of time and the flow values are very high.

They might be accompanied by flooding, affecting the stability of riparian ecosystems.Characteristic are the high flows recorded in the years 2005, 2006 and 2008, when the flood apex exceeded 690 m^3/s. Period and duration of the events were different (August-October 2005, May 2006, June-July 2006 and May, August-September 2008), but all of them were accompanied by floods.

In all cases, duration and high decrease time draw attention, together with the impressive volume of transited water. Nevertheless, the maximum flow values recorded are associated with increases in water level and subsequently with floods. (table 2).

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Table 2. Characteristics of the floods on the Prut river in the years 2005, 2006 and 2008 – Oancea section

Parameters (mc/s)	Flood 2005 Aug. – Oct.	Flood 2006 May	Flood 2006 June	Flood 2008 Aug.- Sept.
Q minimum	73.4	61.6	193	163
Q maximum	476	495	627	693

Minimum flow usually occurs in the winter months, with the highest frequency in January (10 cases), based on the phenomenon of frost event. Minimum annual flows with high frequency recorded in the months December and February (5 cases). The minimum flow in absolute value was in 24.02.1983, HS Oancea (table 3).

Table 3. Monthly flows extremes recorded during 1979-2006 (HS Oancea), (mc/s)

Month	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
Maximum	263	224	340	757	578	563	479	587	476	248	200	263
Minimum	22.6	17.4	26.2	23.6	25.3	13.3	32.4	27.4	26.5	27.3	26.7	19.6

By statistical processing of the flows recorded at HS Oancea was calculated average during 1979 - 2006, which is 96.39 m^3/s, and the variation is between 26.1 m^3/s and 381 m^3/s. Median is 84.2 m^3/s and the module is 102 m^3/s. Most of the values fall within 90-102.8 m^3/s, flow with insurance of 1% is 27.8 m^3/s, and the insurance with 90% of 157 m^3/s.

It should be noticed that, until the year of 1980, the floodplain area of the lower Prut river basin included natural lakes and swamps. During 1981 and 1985, works of arrangement for fisheries and agriculture were imposed in the whole lower Prut basin where the natural lakes and swamps were subject to complex hydrotechnical works, which led to the disappearance of free regime of flooding. Liquid flows of the River Prut are influenced by the rainfall and the operation of the Stânca Costești Reservoir.

Today, the lower Prut floodplain includes several ponds and shallow lakes (Pochina, Vlascuța, Mața-Rădeanu, Cacia, Teleajen, Broscarului, Leahului, Brateş Lake), used especially for pisciculture and Prut flow control.

Considering the dimensions, the ecological and social-economical functions the most important hydrotechnical arrangements are Brateş Lake (2400 ha, established in the 40's, on a much higher surface) and the bogs Mața-Rădeanu-Cârja-Vădeni (1081 ha, from which an important percentage develops naturally).

The most important transformations in the natural ecosystems have been generated by the dams and the embankment works. These are designed to reduce

the risk of flooding, to increase the surface of land used for agriculture and to delimit the fisheries facilities. Dams' construction resulted in significant changes in the Lower Prut floodplain by changing the hydrological regime. Consequently, during long periods of drought, some wetlands dry every year, and periods of drought followed by periods of irregular floods.

Currently, there are areas in the hydrographic basin which require ecological reconstruction works, in order to restore specific functions of wetlands (water storage / retention of flood wave, retention and recycling of nutrients, the reservoir of biodiversity, habitats for plants and animals), for restoration ecological and hydrological balance.

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