Biodiversity protection actions in lower Prut basin

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***Abstract*—**This paper summarizes a large amount of information which constitutes the basis of documenting a report aimed at arranging a pilot wetlands area to protect biodiversity in the southern basin of Prut river.

The issue of environmental protection and biodiversity conservation in the catchment of Prut river has both environmental and geopolitical implications due to the geographic position.

Premises are represented by the natural elements that support the development of sub-basin Horincea as pilot wetland basin in the Lower Prut sector (the conditions of relief, climate and hydrological features, flora and fauna composition, focusing on ichtyofauna). The advantages and threats regarding the development of these wetlands are presented based on legislative criteria as well as from the point of view of the exploitation of natural resources in this basin.

There are presented both tehnical and institutional solutions. The institutional decision makers are identified as the two relevant ministries (Ministry of Agriculture and Rural Development, Ministry of Environment and Forests), two national companies (Romanian Waters National Company and Romsilva National Company) and entities within the general jurisdiction of the local authorities. The responsibilities of each of the above and the types of action required to fulfil the objective are presented further in this paper.

***Keywords*—**environment protection, biodiversity, wetlands, Horincea basin, Prut river.

I. Introduction

Saying nature protection we understand preserving representative natural entities (species, natural environments) of special scientific and landscape value whose existence is in danger. Preserving nature is a complementary action to the one of protecting the environment thus facilitating to the next generations a patrimony that otherwise might be lost.

Analyzing the system and the competencies of public local and central there can be identified the bodies and institutions which are bound to prepare priority programmes of reclaiming, using, protecting and developing these areas. Two ministries are involved directly in this process: (Ministry of Agriculture and Rural Development, Ministry of Environment and Forests), two national companies (Romanian Waters National Company and Romsilva National Company) and entities within the general jurisdiction of the local authorities.

II. General Data

Prut basin is located in the eastern part of Romania, is falling between the Moldova Plateau in western part and Podolia Plateau, in Republic of Moldova in the eastern part. The overall direction of the river collector is North-South. Basin is located entirely in the historical province called Moldova and spreading Săveni Hills, Moldavian Plain, Fălciu Hills and Covurluiului Plain.

Evolution and geography are linked to the Moldavian Plateau. The Prut basin encompasses parts of Maramures, Suceava, Botosani, Iasi, Vaslui, Galati counties and neighbors first order basins of Tisza and Siret. Is tributary to Danube (see Fig. 1).

Prut river has its springs in the Woody Carpathians in Ukraine, but through the spring of Izvorul Catelei, tributary of White Ceremus it comes from north part of Romania.

The Prut river in Romania is 742 km, to the mouth of Danube and only from right bank has river system codified totaling 248 rivers sections and 4,551 km total lengh, ie 1.9% of total network length encoded in the country, with a density of 0.41 km/km^2, over country average, wich is 0.33 km/km^2 [1].

The surface of the basin in Romania is 10,970 km^2 (4.6% of the country), and together with related areas in Ukraine and Republic of Moldova is 28,396 km^2. The forest covers an area of 1,085 km^2 (9.9% of its catchment area and 1.7% of the country's forest area) [2].

III. Biodiversity Protection Problem in Lower Prut Basin

III.1 Background of developing the sub-basin Horincea as the pilot wetland area in the Lower Prut River Basin

Horincea hydrographical basin, in the county of Galati, is included in the geomorphologic unit of the Moldavian Plateau, with its sector Covurlui Plateau, which is broken down into Covurluiului hills and Covurluiului plain. The hydrographical basin crosses two major structural units: Barladului Platform and Covurlui Platform [3].

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Horincea river, an affluent of Prut river, is located in the south and has a total length of 35 km and the surface of the basin area of 253 square kilometres (see Fig. 2).

The morphometric elements of the river system and basin surfaces are presented in Table 1. Thus, the main parameters of the river system (river Horincea collector and its affluents: Zoiţeana, Lişcov and Oarba - column 1) are calculated in column 2 and the parameters of the main river basin and the three affluents are summarized in column 3. In addition, there have been calculated the form coefficients of the basins (in column 4) *form factor* (*Ff*), the *form report* (*Rf*), *circularity ratio* (*Rc*) and the *sinuosity coefficient of the watershed* (*Ks*) [4].

Form factor ($Ff = F/L^2$); *Form report* ($Rf=F/(P/4)^2$); *Circularity ratio* ($Rc = F/Fc$); *Rate of development of watershed* ($K_s=P/L_c=0,282P/\sqrt{F}$), where *F* represents the area of the hydrographical basin (in km^2) and *P* is the perimeter of the hydrographical basin (in km) (for details see APPENDIX).

Ff and *Rc* are subunit coefficients, with values becoming smaller as the degree of elongation of the basin increases. According to the form report (*Rf*) there are three categories of basins: elongated ($Rf < 1$), square ($Rf = 1$) and round ($1< Rf < 1,274$). Between this report and the Circularity Report (*Rc*) there is the relation $Rf = 1,274Rc$ [3].

The main types of relief within the basin are plateaus, valleys and meadows at the confluence with the Prut River [5].

The main classes and soil types in the study area are the following: zone/ local soils of the chernozem type and non-zone/non-local zone and soil type alluvial soils and hydromorphic soils. The temperate continental dry climate with hot summers and dry and harsh winters is characteristic for the area fitting in the continental climate, the land of plain climate, steppe district.

The average annual temperature is 10 °C at the meteorological station Galati and 9.8 °C at the meteorological station Barlad. Lowest temperatures are recorded in January: -3.1 °C and the highest temperatures are recorded in July: 22.6 °C. The continental character is expressed by the amplitude of monthly average temperature that is of 25.7 °C, fact explained that the whole territory is under the influence of air masses from the North East. The highest amplitudes are recorded in winter, indicating the alternation between frosting and defrosting [6].

In the vegetation period 1st March- 31st October, the total sum of temperatures is 3827 °C and average temperature range is 15.7 °C. Monthly average temperatures, especially during the vegetative period, are appropriate for both fish farming and agriculture.

Across the basin, the average daily maxima, the frequency of days with maximum temperatures and average daily temperature of the air are within normal limits for fishing and agriculture.

Their variation affects the water temperature regime and intensity of ice phenomena on rivers in the basin [7].

The average amount of precipitation is 512 mm in the north and 462 mm in the south. The study of average seasonal rainfall distribution during the year indicates that the maximum is recorded during the spring and summer, which justifies the need for water accumulation in these seasons and its redistribution depending on the requirements.

The distribution of monthly and seasonal average quantities of rainfall recorded in the sub-basins do not correspond to the purpose and water retention basins are necessary for a new redistribution of precipitation, as needed.

Highest monthly amounts of precipitation are higher than average amounts appropriate to the season which determines that consideration of measures to combat soil erosion by washing and flood mitigation.

The lowest annual rainfall must be taken into account the multi-compensation hypothesis, at least for agro-fishery ponds. Average number of days with snowfall is 20. Snow may persist up to 44 days, highest frequencies being recorded in January and February.

Due to the complex local factors such as relief, slope, exposure, there appear different climatic nuances in this area that differ from one area to another outlining certain topoclimates namely interfluves and large watersheds, areas exposed to atmospheric circulation maximum sun light; sunny sheltered in SE-SSW, broad valleys (Prut, Elan, Horincea), which direct the cold winter air masses [8].

The total evapotranspiration is 494.4 mm and the multi-annual average evapotranspiration from the water surface is 939.5 mm over the entire vegetative period, thus exceeding the rainfall, aspect that requires proper management of water works.

A close correlation between the annual average flow and average annual rainfall is observed, especially for the Horincea river, throughout the year. The correlation is quite tight in the case of Prut river as well and in particular between the years 1983-1988 and 1991-1998 [9].

The coefficient of variation of the flow for the Prut river basin presents a low variability, $C_v=0,3$ and in the sub-basin Horincea the C_v value is 0.8, supporting the unevenness of the leak [10].

As far as the Prut river is concerned, the highest average flow is recorded in July. Values close to the maximum value are reported in June and August. The minimum average flow is recorded in January. The flow volume is high during the months of June and July.

The maximum average flow for the Horincea stream is recorded in July. Values close to those reported in this month are those of June, May and August. The minimum average flow is recorded in January. Monthly average flow has two maxima: in March, due to melting snow, and a summer maximum in June-July, caused by summer rains. Comparing the flow volume we note that the highest percentage is recorded in the spring.

Prut river has a significant potential, the annual volume of water circulated is 3.079 thousands m^3. Sub-basins come with an intake of 6,79 thousands m^3, representing a rate of 0.2% of its volume [11].

Seasonal flow regime is characterized by low variability, the coefficients of the flow ranging between 0.65 and 1.46 in the Prut river basin and between 0.05 and 0.26 in the Horincea sub-basin [12].

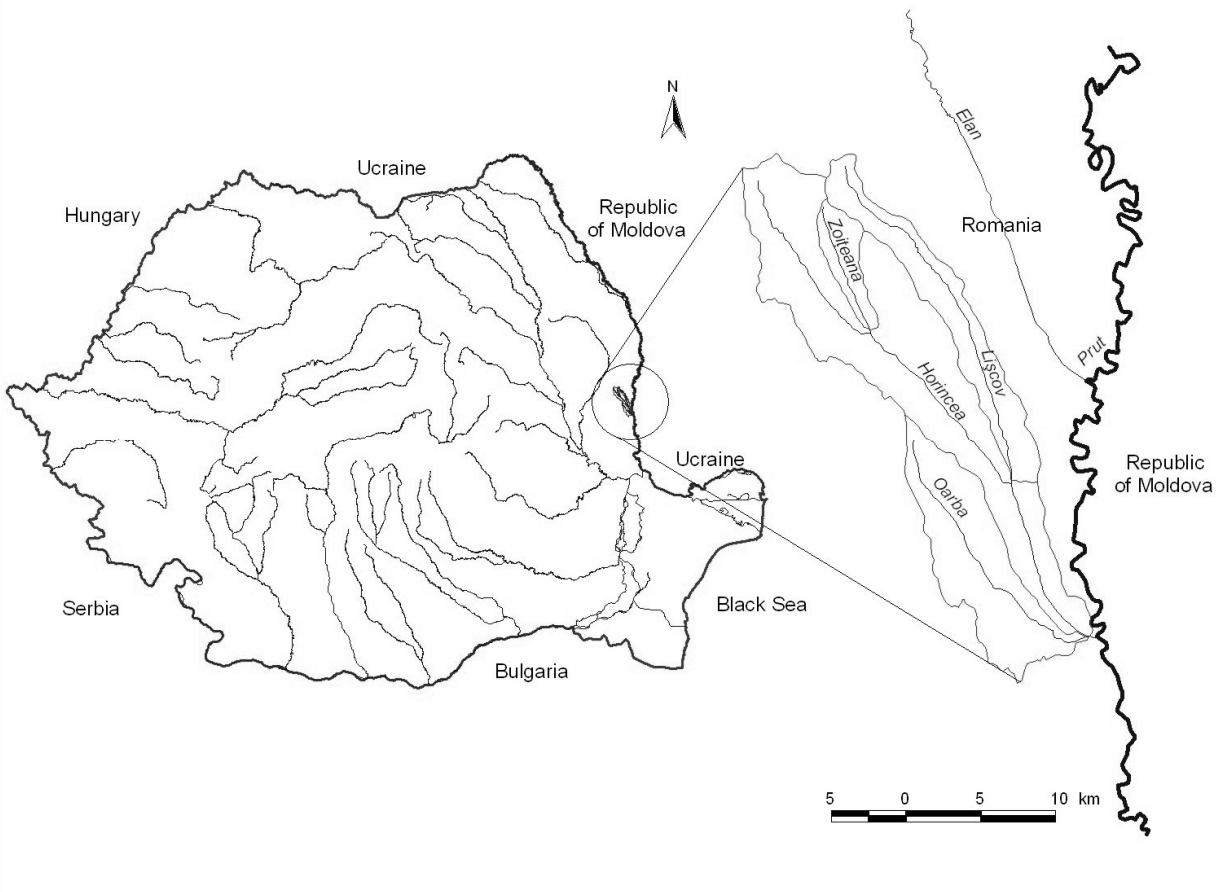

Fig. 2 The geographic position of Horincea sub-basin

Volume flow ranges between 17% to 23.9% from the annual flow volume in autumn and winter and between 26.4% to 32.7% from the annual flow volume in spring and summer for the Prut River and between 11.9% to 19% of the annual flow volume in autumn and winter and 38.2% to 30.9% in spring and summer for Horincea stream [13].

Maximum river flows of the basins of100-1000 ha are high, highlighting the torrential character of the flow and justifying flood mitigation works were carried out in the valleys. The volume of annual flow/debit of small basins justify the opportunity of building accumulations [14].

Tabel 1 The morphometric elements of the river system and basin surfaces

1	2			3				4			
River	Morphometric parameters of the hydrographical network			Morphometric parameters of the hydrographical basin				Form coffiecinets of river basins			
	Length (km)	Gradient (‰)	Ks	Surface (sqm)	Average altitude (m)	Perimeter (km)	Length (km)	Ff	Rf	Rc	Ks
Horincea	**35,0**	**6,0**	**1,1**	**253,0**	**150,0**	**93,5**	**29,8**	**0,3**	**0,5**	**0,6**	**1,7**
Zoiţeana	8,0	27,0	1,2	10,0	176,0	21,4	6,8	0,2	0,4	0,8	1,9
Lişcov	21,0	10,0	1,1	37,0	155,0	56,1	17,9	0,1	0,2	1,5	2,6
Oarba	17,0	12,0	1,1	48,0	149,0	45,4	14,5	0,2	0,4	0,7	1,8

The average volume of sediments in the Prut river basins is 4770 m^3. The lowest value is recorded in Oancea valley and the highest in Oarba Valley [15]. The minimum flow is recorded during winter, in January for Prut river and for Horincea stream in January and August [16].

In the lower basin of the Prut River there have been identified several sources of water, namely: the Prut groundwater layer, layer of the terrace groundwater, springs

arising from Prut river deposits, the Neogene aquifer complex (Pontian, Dacian).

Drinking water supply in the area can be done only from average depth aquifer Pontian – Dacian age complex. Obtained flow is 0,5 l/s, respectively 43,2 m^3/day. The water supply is ensured through a drilled well about 50 m deep which is dug using dry system in order to determine correctly the depth of aquifer layers. Chemical protection of the aquifer layer should be performed by cementing to about 20 m depth, but in the future, drinking water can be ensured by the Prut river and pumping and filtering stations an it will be distributed according to the requirements [17].

In terms of flora and fauna the territory falls under the South-eastern forest steppe zone- the district of South-eastern Barlad Plateau has small forest of thermophilic essences, mainly grey oak. Natural landscape of the steppe has suffered strong anthropogenic changes, over 80% of its territory became arable land, and the patches of forests and meadows that have been preserved are heavily modified in terms of spontaneous vegetation. Forests were cleared, only oak forests and acacia plantations remaining on limited areas. Prut floodplain vegetation is represented by natural vegetation formations and forest meadows, specific to alluvial which are periodically flooded and presenting excess groundwater moisture [18].

Forrest-steppe and steppe fauna are less diversified. Species diversity is conditioned by the structure of the vegetation in the subject area, the variety of habitats and anthropogenic factor. Aquatic species, more than other groups of birds have suffered from the improvement hydro-technical and hydrological works on both sides of the lower basin of the river) since 1970. Changing landscapes, habitats and favourable nesting refuge led to a marked decline in their numbers. Another limiting factor is human disturbance and the practice of uncontrolled bird hunting [19].

Ichthyofauna of the lower Prut river currently includes a variety of fish species. Assessments made showed that 77.2% of the investigated fish population is composed of non-prey species, out of which 46.7% are of economic value and 3.8% of prey species.

The latest studies carried out during 1993 - 1996 have shown that there are 35 species and subspecies of fish from six families. They are:

-*Cyprinidae* family comprises 24 species and subspecies;
-*Percidae* family comprises three - species;
-*Cobitidae* family includes 2 - species;
-*Gobicidae*-family contains one species;
-*Esocidae*-family contains one species;
-*Siluridae*-family comprises a single species.

For all listed species, 14 species and subspecies have economic interest, eight species have little economic value, and 13 species do not have economic value.

The ichthyofauna did not preserve the bleak which was found incidentally the Prut river and the sterlet, which migrated from the Danube. Regarding the current status of various species of fish present in the Prut River can be seen that the populations of these species have a relatively large spread is well represented with the exception of the species *Esox luckrs* which has an overall regression in terms of numbers[20].

As a general feature, all systematic units in the Prut river meadow can not be gravitationally supplied operated during periods of technological maximum. The average quotes of 309 cm, 355 cm, 352 cm, 315.9 cm recorded in May, June, July, August for the past twenty years, no longer supply these units. Only values higher than 400 cm of the Prut level can provide a gravitational supply but only as a small percentage. This creates additional costs reflected in the price of fish production [21].

Except Vladesti improvement works area, all works on Prut meadow have suffered strong degradation processes as a result of flood waves of the river Prut and lack of maintenance works. Natural marshes in the Prut river meadow were placed under protective measures imposed by the local County Council and are proposed to become natural reserves. Leahu and Cotu Mare marsh will retain the status of natural goods, entering the circuit of wetlands protected wetlands.

III.2 Advantages of development the pilot areas resulting from the environmental policy in the Prut southern basin

The Prut catchement its an important geopolitical area in this part of Europe. In the area of Prut basin there are a large number of natural reserves for the conservation of landscape or to protect the endemic species. There are several types of natural reserves in the Prut basin, most of them protecting forests and landscapes. A special type is represented by the paleonthological protected areas. A consistent percentage (when compared to other basins of the same size in Romania) is represented by aquatic surfaces established as natural reserves: parts of river, lakes, ponds, wetlands. The Natural Park called *Lunca Joasă a Prutului Inferior / Lower Prut Floodplain Natural Park* is the first unit of this type in the Prut basin and the most important protected area near the Danube Delta. In the future this will be included in *Danube Green Corridor* area as an europeean natural unit.

Declaring the Natural Park Lower Meadow of Lower Prut in the southern part of the Prut river Basin is the final result of the interaction in time between human activities and nature. This protected area was created as a distinct zone with significant landscape value and great biological diversity, through the maintenance of harmonious interaction between man and nature and protecting habitats and landscape diversity there are encouraged traditional use of land and some activities of the local population, also there id offered to the public the possibility for recreational activities and tourism and there can be carried out scientific, educational and cultural activities in this area [22].

III. 3 Environmental considerations

The Mata - Radeanu complex of lakes and ponds inside the Lower Prut Floodplain Reserve (at 2.414 number in Annex I of the Law 5/2000) is representative to establish an area into south sector of Prut basin, for special protection as Natural Park, as part of the Danube Green Corridor.

The complex of lakes and ponds in northern Lower Prut Floodplain Natural Park develops through arrangements made on an area exceeding 640 hectares. Initial usage category was: pond (360 ha), pasture (71ha), marshy grassland (50 ha) harmful (about 160 ha). The lake complex is located on the right bank of the Prut river, between Km no 113/terminal no 1255 and Km no 121 + 400 m/terminal no 1252, in Elan river confluence area, (close to terminal no 1253), the territory of Cavadineşti common - Vădeni village.

In their natural state, at maximum level of flood waters in natural regime, the ponds area exceeded 568 ha. Arrange fish (568 ha) and farming (78 ha) was executed in 1980. The land was divided into two separate bodies by Elan river.

The North sector (Mata Lake, on the border with Vaslui county) consists of two ponds (135 ha, representing the low marsh and 57 ha, the high marsh area) and southern sector (Radeanu Lake, representing 342 ha, water surface and 78 ha, agricultural area).

In Radeanu Lake case, in the south west of Elan creek (lower course), it features the natural integrity of the water surface area alternating with areas of reeds, low hollows, marshes, where bird colonies are present throughout the year. The area proposed as a Special Protection Bird Area (SPA) is 194 hectares.

Basically, as a result of improper operation of many hydraulic works, particularly due to lack of financial resources, are currently operational only 148 ha of fish ponds.

In conclusion, the existing habitat types accommodating a variety of fauna (including avifauna), both sedentary and migration, wetland Mata - Radeanu in the area of 386 hectares, closely resembles special conservation areas in the Danube Delta. We declare the same thing for other areas of the lower Prut basin (Pochina Lake, its area under the embankment between Vladesti village and Giurgiulesti Customs, Prut Island, Brates Lake).

The Natural Park area, as habitat type includes: natural eutrophic lakes with *Hydrocharition* or *Magnopotamion* vegetation type (*Natura 2000* habitat code: 3150) and lakes or ponds with gray water (dirty or blue-green), more or less cloudy, extremely rich in alkaline substances (regular pH greater than 7). On water surface is present *Hidrocharition* community type and in deep systems and open water areas, these *Hidrocharition* communities associated with submerged vegetation consists of large cormophytes (*Magnopotamion*). Typical flora of this habitat are water dandruff (*Lemna*, *Spirodella Wolffia*), *Hydrocharis morsus - ronae* (Grass frog), *Stratiotes aloides* (rizacul) otrățel species (*Utricularia australis*, *Utricularia*, etc.), *Aldrovanda vesiculosa* (*Aldrovanda*), ferns of *Azolla* genus, aquatic moss genus *Riccia* and *Ricciocarpus,* different submerged cormophytes such as broscariță species *Potamogeton lucens*, *Potamogeton praelongus*, *Potamogeton zizii, Potamogeton perfoliatus, etc.*

III.4 Threats deriving from the development the pilot areas resulting from the environmental policy in the Prut southern basin

There are several measures that may undermine the planning of pilot areas and they require special attention from central authorities and especially the local ones. Among those we present further the actions for preventing eutrophication, to upgrade the treatment plants at the sources of pollution and in general to maintain a sanogenesis state in the Horincea sub-basin.

Setting up anti-hail systems in order to avoid damages to soil, crops and human settlements.

In order to protect the soil and to avoid clogging the water reservoirs measures for increasing the forest areas, especially on the slopes.

The water supply from Prut river to be made solely by authorized units on the basis of measurements with special equipment within the approved limits.

The administration of nutrients for the fish farms to be made based solely on laboratory analysis of water from reservoirs and studies should be made on the limits to which fish populate a reservoir in order to prevent eutrophication and oxygen deficiency, especially during periods of air temperatures above 25 °C.

The need of programming the development and modernization of wastewater treatment plants at the sources of pollution which do not achieve the parameters required for wastewater discharge into the environment.

Establishing consolidated treatment, sludge dehydration and disposal of municipal sewage plants technologies as well as other content from the industrial wastewater treatment plants

Administrators dealing with the operation of the drainage channels facilities that are close to Prut river should prohibit the discharge of untreated waste. Also, the quality control of repressed waters out into the Prut River must be put in place, with a frequency imposed by the operating regime of the pumping stations.

Elaboration of a study on water quality in the Stânca-Costeşti with a special focus on the state of eutrophication, accumulation of heavy metals and radioactivity [23].

Achieving an agreement between the parties involved to adopt a common standard for the quality of surface water and groundwater.

Adoption of agreement of the best environmentally sound technologies for recycling of livestock waste. Realization of exchange of experience with field trips to the most important and effective wastewater treatment plants.

Administration of chemical fertilizers and pesticides in agriculture will be based on legal regulations, requiring a strict control on the transport, storage and use.

Installation of automatic radio detection devices located in the area upstream of intakes for water supply to populated areas.

IV. SOLUTION

Based on the analysis of the premises and conclusions that have emerged there can be extracted a series of proposals to solve the problem. The most important aspects are the technical (technical works for effective exploitation of water resources and the role improvement works combined with fish farming biotechnology) and organizational ones (decision-makers involved and the specific tasks).

IV.1 Technical aspects

Rivers crossing the plain area as is it is the case of Prut river are not adequate for the partitioning of the river bed of their basins, because of the hydrologic regime with large flow variations. They may however be used as power sources for the system units created as a result of improvement works on the former marshes or for natural marshes as well as for economic and social utilities. Water use in these two cases requires the installation of pumping stations in the Giurgiulesti Oancea-area location, water and wastewater treatment. Their location will be dictated by the

population exodus from town to village and the development of small rural industries.

The hydro potential of the sub-basins of this stream opens the door to elaborating an unified scheme in line with landscape features, hydrology and geology of the area.

In this respect a complex arrangement of Horincea sub-basin, Oancea, Bisericii and Stoenesei valleys which are located in an area of moisture deficit becomes essential.

To complete the sub-basin planning, they should be viewed as indivisible natural units.

Developing works on these basins should start from the watershed line and include all works required for combating and preserving soil erosion and the total elimination of the harmful effects of the flood water.

The accumulation of water thus created can store the flood waves and can also have a complex use: agro-fishery, water supply for livestock farms, for recreation. Regardless of the type of use, they must perform the following functions: to not allow the water flooding downstream, to ensure a guaranteed minimum flow during periods of low fluid potential and to ensure efficient use of water resources. Possible locations of accumulation for Horincea sub-basin can be completed in a subsequent step, with accumulations in its lower sector thereby ensuring effective control of the flow of the whole basin. The investment costs will be higher because of the fact that in this area Horincea stream has a riverbed requiring a dam of approximately 6 km.

Another future possibility would be that of transferring water from Prut although it would involve higher costs.

This option would be justified in case the population in this area will grow up and small industry would develop.

The entire range of hydrotehnical works in the sub-basin Horincea of Oancea, Bisericii and Stoenesei valleys aimed at regulating the water stream in order to to avoid negative effects of flooding must nevertheless respect the principles of ecological planning in order to avoid failures occurring after the completion of this type of works respectively: the disappearance of flooded area which increases the speed of the water drainage because of the fact that the river beds, after the improvement works are performed, they become channels, thus the riparians can only use the water for a short time; increasing speed also leads to a gradual deepening of the river causing a general lowering of groundwater in the area leading to depletion of water from wells and land dryness.

When considering the environmental planning, one should start from the principle that the streams in the Prut basin represent simultaneously ways of circulation, tanks and complex ecological zones which are in strict interaction with the surrounding areas.

Based on the data presented so far, respectively the abiotic and biotic components of the climatic, hydrologic regime, soil structure, vegetation, the intensity of erosion processes, profiles, the first steps that are recommended are: cutting the steep banks, which immediately reduces erosion, creating low gradient banks, stabilization of river's bottom current by adding of rocks and boulders and planting both grass and shrub vegetation on the banks in order to stabilize the soil.

Regarding fisheries ponds built on the old marshes that belonged to the lower basin of the Prut River - they need to be restructured to ensure the optimal application of new technologies that are characteristic to the competitive business environment specific and market economy.

The restructuring of fisheries facilities take the following general technical aspects:

-Sensible dimensioning of fishery farms to focus on technological activity on small areas of, easier to control and more effective;

-Use of hydraulic pressurized systems for the water supply of the units;

-Mechanization of the main technological phases for fishing, nutrition, maintenance - using recirculation systems for intensive fish farming.

The restructuring of fisheries facilities open the prospect of achieving some strategic objective of the sector, namely: the application intensive fish farming of the valuable species in demand on the internal and external markets, the application of biotechnology in acclimatised spaces, mechanization and automation of piscicultural technologies.

Regarding the natural marshes that can still be found in the Prut meadow the best solution would be that they preserve their current form and they should become natural reservations. Preserving these areas will lead to the conservation of the biological balance and biodiversity of the area. Moreover, under the present circumstances, opens the perspective towards a new approach: the Prut meadow would enter the international circuit of protection and development.

VI.2 Organisational issues

The central authorities that have specific responsibilities in environmental protection are the Ministry of Agriculture and Rural Development, Ministry of Environment and Forests and the two national companies - Romanian Waters National Company and National Company Romsilva).

Ministry of Environment and Forests has major responsibility for environmental protection in Romania, its main tasks being related to water management of river basin planning for the reclaim of new water sources, coordinates the preparation of plans and frameworks for developing the hydrographical basins, approves the water-related works, establishes forecast and information activities in the field of water management and hydrology, etc.

Ministry of Agriculture and Rural Development has specific responsibilities the field of protection of soil, terrestrial and aquatic ecosystems. Also, it elaborates and sets up priority programs for improvement of works and financing, preventing and combating animal diseases, plant protection and phyto-sanitary quarantine, quality control of seeds and seedlings.

This ministry approves land improvement, conservation and environmental protection programs and it elaborates regulations regarding agricultural systems, technologies of plant cultivation and animal husbandry, forest regeneration, harvesting, collection and transport, and soil quality standards in order to maintain and improve it, to remove the negative consequences on aquatic and terrestrial ecosystems to ensure conservation of specific functions, biodiversity and natural habitats, and communicates with the central environmental authorities.

Ministry of Agriculture and Rural Development keeps track of land rendered unfit for agricultural production and

provides upon the request of their owners specialized technical assistance for land improvement works.

Romanian Waters National Company manages water resources (surface and groundwater) and prepares and monitors the implementation of programs for meeting the water demands of the population and economy, exploitation of new water sources, rational use and protection against depletion and pollution, complex planning of water in accordance with current and future requirements. It is also the Romanian Waters National Company that correlates the water works with land reclamation works.

National Forest Company Romsilva is required to perform all the works of ecological restoration, regeneration, plantation and maintenance.

V. CONCLUSION

From an institutional point of view, the present system is satisfactory, still the legislative framework needs improvement. The above mentioned authorities must promote regional development programs in agreement with the national strategy while the Government supports the legislative initiatives It is necessary to continue observing the aquatic ecosystem of the Prut River and its direct affluents as per the Regulation agreed between Romania and Moldova. Ministry of Environment and Forests Ministry of Environment has the task of requiring the Republic of Ukraine to join the existing Regulation.

There must be a correlation in terms of legislative measures between the riparian parties to Prut river regarding the zones of sanitary protection of water sources and locating these areas upstream from the water supply for the population.

APPENDIX

Form factor, Ff:

$$Ff = F/L^2 \qquad (1)$$

where F is surface basin, in km^2 and L is lengh basin, in km. Was calculated by R.E. Horton, in 1932.

Form report, Rf:

$$Rf=F/(P/4)^2 \qquad (2)$$

where F is surface basin, in km^2 and P is lengh basin perimeter, in km. Was calculated by I. Zavoianu, in 1978.

Circularity ratio, Rc:

$$Rc = F/Fc \qquad (3)$$

where F is surface basin, in km^2 and Fc is the surface of one circle with the same lengh as basin perimeter itself, in km^2. Was calculated by V.C. Miller, in 1953.

Rate of development of watershed, K_s:

$$K_s=P/L_c=0,282P/\sqrt{F} \qquad (4)$$

where F represents the area of the hydrographical basin, in km^2 and P is the perimeter of the hydrographical basin, in km. Firstly was calculated by A.I. Cebotarev, in 1957, as ratio between lengh of watershed (it means Perimeter basin, *P*, in km) and lengh of circle with the same area as basin area itslef (L_c, in km).

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