



GEF/UNDP/OSCE Project “Enabling Transboundary Co-operation and Integrated Water Resources Management in the Dniester River Basin”

ASSESSMENT OF ECOSYSTEM SERVICES IN THE LOWER DNIESTER BASIN

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Introduction

The “Assessment of Ecosystem Services in the Lower Dniester Basin” study was conducted as a part of the preparation of the Transboundary Diagnostic Analysis of the GEF/UNDP/OSCE/UNECE project “Enabling transboundary co-operation and integrated water resources management in the Dniester River Basin”. The aim of the Project is to introduce mechanisms for integrated water resources management in the Dniester River Basin to ensure its sustainable development.

The purpose of this study is to identify ecosystems and evaluate their services using the methodology of the GEF Guidance Document on the Economic Assessment of Ecosystem Services using the example of the Lower Dniester wetlands. The paper uses the results of international studies on the assessment of ecosystem services, data on wetlands prepared by the Republic of Moldova and Ukraine within the framework of requirements of the Ramsar Convention, scientific articles, statistical information and data provided by the Lower Dniester National Natural Park. The work is based on the results of international research in the field of valuation of ecosystem services; data on wetlands prepared by the Republic of Moldova and Ukraine in the framework of the Convention on Wetlands of International Importance especially as Waterfowl Habitat (the Ramsar Convention), scientific articles. Reports prepared by the Ecological Society "Biotica" and NGO "Eco Contact" of the Republic of Moldova with the financial support of the Austrian Development Agency (ADA); and statistical information and data shared by the Lower Dniester National Nature Park (Ukraine) was also used in this paper – the GEF Dniester project would like to thank these organizations for cooperation.

The work was prepared under the guidance of Eduard Interwies, an international expert on the economic valuation of environmental services and co-author of the GEF guidance document on the economic valuation of ecosystem services (Germany).

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1. General approach and definitions

The main reason for the degradation of ecosystems is the underestimation of their real economic value, the value of natural resources and services in general. In cases where the financial resources necessary to solve serious economic problems are limited, payments for ecosystem services (PES) can provide additional resources for the improvement of environmentally friendly technologies that create incentives for investment and increase the involvement of business in environmental protection.

“Ecosystem services” are the many and varied benefits that people get for free from the natural environment and functioning ecosystems.

Development of the PES system includes:

- identification of ecosystem services,
- assessment of ecosystem services,
- identification of potential sellers and buyers,
- identification of compensation mechanisms,
- creation of markets for these services¹.

The first stage is the identification of services provided by ecosystems related to one of the four broad categories:

- providing (food, raw materials, water),
- regulatory (climate regulation, air quality regulation, water purification, pollination of plants),
- cultural services that directly affect people (educational, aesthetic, spiritual, cultural heritage, recreation),
- supporting services necessary for the preservation of other services (soil formation, photosynthesis)².

Ecosystem services can be also divided into "use values" and "non-use values", according to the concept of the "Total Economic Value" (TEV). (Total Economic Value - TEV). The TEV is a common approach in the field of environmental economics that aims to create a single monetary metric that combines all activities within an area and to express the levels of each activity in units of a common monetary measure, such as US dollars. It is a useful tool for exploring what types of values each ecosystem service provides. This helps in determining the valuation methods required to capture these values.³

Before the concept was introduced, economic values have quite narrowly been defined as "benefits". Values of ecosystems have been attributed only to raw materials and physical products that ecosystems generate for human production and consumption. These direct uses however represent only a small proportion of the total value of ecosystems, which generate economic benefits far in excess of just physical or marketed products. Instead of focusing only on direct commercial values the TEV also encompasses the subsistence and non-market values, ecological functions and non-use benefits. Broadly defined, the TEV includes:

Use Values:

¹ <http://www.unece.org/fileadmin/DAM/env/water/publications/documents/ece-mp-wat-22-Rus-final.pdf>

² <https://iwlearn.net/documents/28544>

³ DEFRA (2007) Securing a Healthy Natural Environment: An Action Plan for Embedding an Ecosystems Approach

Direct use value: Individuals make use of a resource in either a consumptive way (e.g. the fishing industry and agriculture) or a non-consumptive way (e.g. cooling water).

Indirect use value: Individuals benefit from ecosystem services supported by a resource rather than actually using it (e.g. watershed protection for flood mitigation, cycling processes for agriculture or carbon sequestration).

Non-Use Values are associated with benefits derived simply from the knowledge that the natural environment is maintained. By definition, non-use values are not associated with any use of the resource or tangible benefit derived from it, although users of a resource might also attribute a non-use value to it. Non-use value can be split into three basic components:

Altruistic value: Derived from knowing that contemporaries can enjoy the goods and services the natural environment provides.

Bequest value: Associated with the knowledge that the natural environment will be passed on to future generations.

Existence value: Derived simply from the satisfaction of knowing that ecosystems continue to exist, regardless of use made of them by oneself or others now or in future (also associated with "intrinsic value").

In general/globally, the existing projects for the introduction of a payment system for ecosystem services are still not enough despite the available positive examples of the development of markets for ecosystem services in individual countries. This applies even more to Republic of Moldova and Ukraine. Causes:

- ecological inadequacy of traditional models of the economy,
- lack of institutional infrastructure,
- imperfection of regulatory, legal, and methodological framework in the field,
- lack of systematic education among stakeholders.

Ukraine acceded to the Ramsar Convention in 1991, the Republic of Moldova in 1999. It's an intergovernmental agreement, the purpose of which is "the preservation and rational use of all water wetlands through local, regional and national action and international cooperation, as a contribution to achieving sustainable development worldwide. "The main message of the Strategic Plan for 2016–2024 of the Ramsar Convention states: "Wetlands are preserved, used wisely, restored and their benefits are recognized and valued by all". Therefore, it is necessary that a mechanism for identification, recording and evaluation of ecosystem services is created in the Republic of Moldova and Ukraine, using existing methodologies and experience of other countries.

The overall economic value of a wetland mainly consists of two aggregate components: **use value and non-use value.**

The total economic value of a wetland consists of:

- Direct value: fishing, recreational activities, the use of individual (rare) plant and animal species (aesthetic and scientific),
- Indirect value: prevention of droughts, fires, floods, preservation of biodiversity, spawning grounds, improvement of the population,
- The cost of non-use (willingness to pay). These studies are based on sociological surveys of the population to determine the economic value of unique natural objects, the potential willingness of the population to pay for their existence.

Economic approaches to assessing the value of wetlands and their ecosystem services are based on:

- market valuation,
- rent,
- cost approach,
- alternative cost,
- total economic value⁴.

Not all proposed approaches are well developed, they contain contradictory issues, however, based on them, it is possible, at least in the very first approximation, to assess the economic value of wetlands.

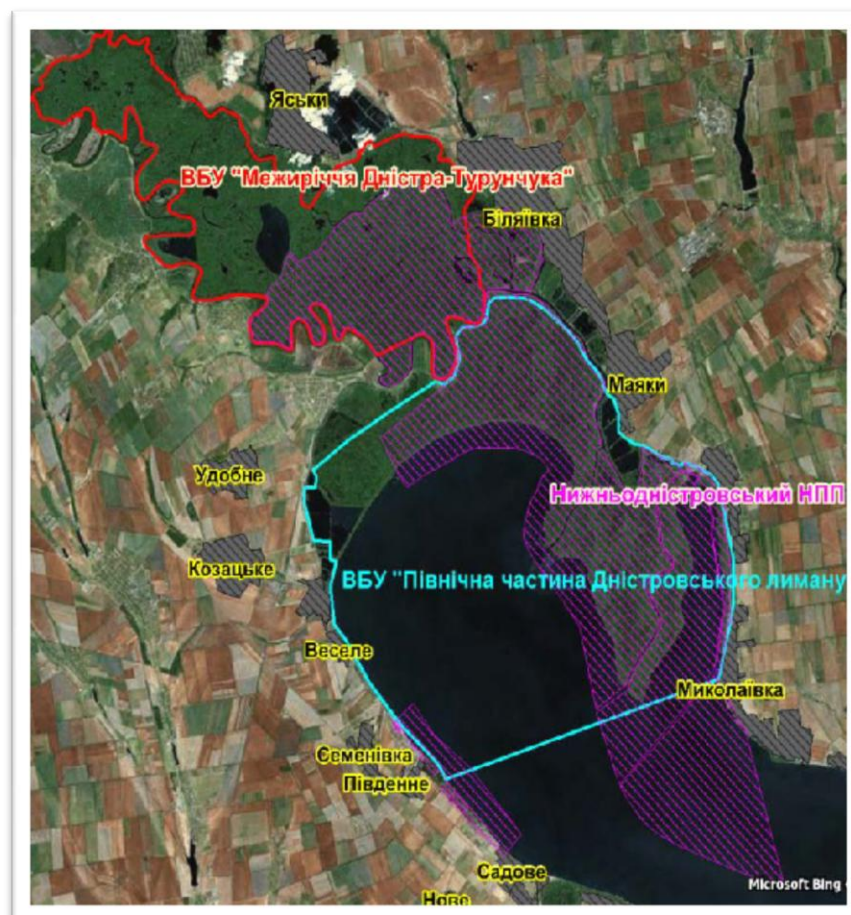
Specific officially approved methodologies and regular statistical reports are required to implement all of these approaches. Unfortunately, these procedures are absent in Republic of Moldova and Ukraine, as well as official methods of performing economic assessment of most natural goods and services, environmental damage, etc.

⁴ <https://iwlearn.net/documents/28544>

2. Description of Lower Dniester wetlands

The ecosystem services provided by wetlands located in the Lower Dniester have been researched within the framework of the Project "Enabling transboundary co-operation and integrated water resources management in the Dniester River Basin" as a part of Transboundary Diagnostic Analysis. There are three wetlands of international importance "The Lower Dniester" (Republic of Moldova), "Dniester-Turunchuk Crossrivers Area" and "Northern part of the Dniester Liman" (Ukraine) in the delta of the Dniester, which are protected by the Ramsar Convention.

The Lower Dniester National Natural Park was established in 2008 by Decree of the President of Ukraine dated November 13, 2008, area 21,311.1 hectares. Two RAMSAR-sites do not fully – but mostly – correspond to the extent of the Dniester NNP. This territory is also included in the list of key territories of the Azov-Black Sea natural corridor ecological network, and the riverbed meadows of the Dniester delta are important for the conservation of the species diversity and quantitative riches of birds included in the EU Directives on the protection of wild birds and the protection of natural habitats and wildlife Flora (Important Bird Area (IBA) UA091). The creation of the Lower Dniester National Park in the Republic of Moldova is under discussion.



Picture 1. Map of Wetlands on the territory of Ukraine: red color – border of Ramsar wetland **Dniester-Turunchuk Crossrivers Area**, blue color – border of Ramsar wetland **Northern part of the Dniester liman**, purple color – the border of **Lower Dniester NNP**

2.1. Dniester-Turunchuk Crossrivers Area wetland

(46°28' N, 30°36' E; altitude: 0.4-0.9 M).

Location. Northwest Black Sea Coast. Comprises the area between the rivers Dniester and Turunchuk and is located on the border with the Republic of Moldova near the city of Bilyaivka - the district center of the Odesa region. The nearest Ramsar site is the "Northern part of the Dniester estuary". Area 76 000 ha.

Wetlands characteristics. The area is characterized by the Dniester River delta with two courses (the main one is the Dniester River, the secondary one is the Turunchuk River) and flood plains. The area has a great value as a place of habitat for wetlands (nesting, wintering and staying during seasonal migrations).

As a Ramsar site it meets the following criteria:

- plays a large hydrological, biological and ecological role in the natural functioning of the river basin and coastal ecosystems,
- has value as a place of residence of more than 15,000 wetland bird pairs and 50,000 wintering birds,
- There are more than 20,000 birds regularly living in the area,
- 2-3% of the herrings of the large white *Egretta alba* and about 9% of glossy ibis *Plegadis falcinellis* nest in this area.

Physical and geographical characteristics. The Dniester together with Turunchuk forms a marshy plain. The Turunchuk canal is twisted, has the width of 34-240 m, 60-75 m on average - and a depth of 2-13 m. The flow rate is 0,5-1,0 m / sec. Within the wetlands, the Dniester river is 100-200 m wide (maximum - 600 m). Depths in the breeding grounds are 16-25 cm, and 4,0-8,0 m in deep parts, sometimes - 12 m. The flow rate is 0,2-0,4 m / sec. The average monthly water temperature in the cold season is about 0° C, and in July - 18-20° C. The maximum temperature (up to + 33° C) was recorded in the second and third decades of July. From the end of July the water temperature begins to drop. The ice regime is unstable. Some years see the Dniester freeze over. The spring ice is observed in early March and continues on for an average of 5 days. After separating Turunchuk from the Dniester, the flow rate in the main channel has decreased, while in Turunchuk, on the contrary, it has increased. In the current century, more than 50% of the annual flow is carried out by the latter, and this indicator increases every year. There are many sandy strata, deep floodplain lakes, floating islands, and higher aquatic and shallow vegetation, with islands of floodplain forest, and shallow islands of willow.

Hydrological characteristic. The lower reaches of Dniester are in a zone of insufficient humidification. It is a mixed-power river (mainly snow, as well as rain), and its water regime depends on weather conditions. Characteristic of it is the pronounced spring flood and the presence of several floods associated with the rainfall in the Carpathians, common throughout the year, except for one to three winter months. The water level in the Dniester rises fast, and falls slowly. The presence of drought in the summer is usually due to the lack of spring flood. In the lower reaches of the Dniester, the flow rate is small and is only 0.2-0.3 m/s. Strong winds blowing from the Dniester estuary can change the direction of the current to the opposite. At the mouth of the Dniester, the average volume of the flow is m³ / sec. Its main volume usually comes in spring, but in the presence of strong rains, increased volume of runoff can be observed in summer and autumn. Winter flow has an average of 15-20% per annum. Water

resources are used for agricultural, industrial and transport purposes. The Dniester river is a main source of drinking water for the inhabitants of Odesa and adjoining territories.

Flora. Within the area, water-loving vegetation predominates: There are several species from the Red Book of Ukraine (waterwheel plant *Aldrovanda vesiculosa*, *Epipactis palustris* marsh helleborine, summer snowflake *Leucojum aestivum*, marsh orchid *Orchis palustris*, floating fern *Salvinia natans*, water caltrop *Trapa natans*).

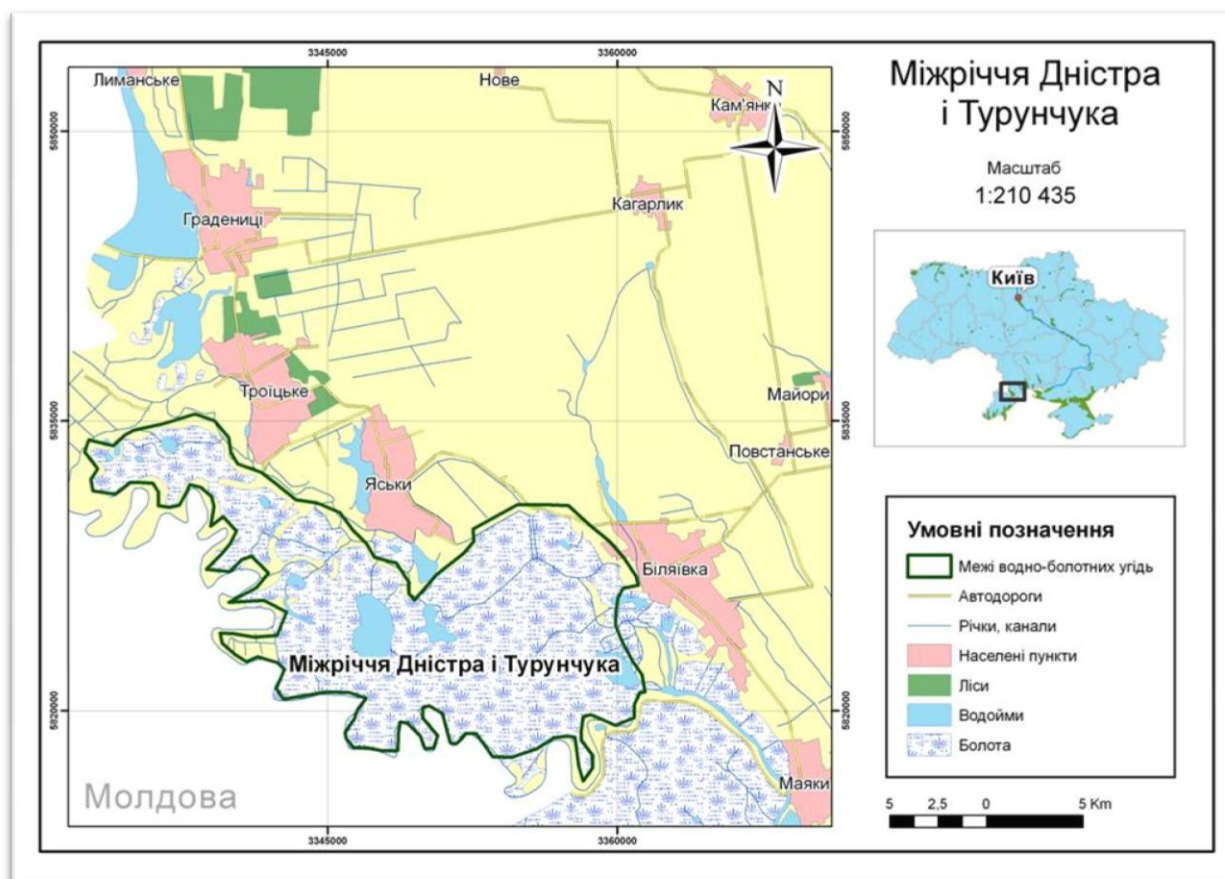
Fauna. Smoothly flowing Lower Dniester is a refuge for many species of animals and plants that need protection. In particular, there are 35 species of birds recorded in the Red Data Book of Ukraine. Altogether, there are almost 340 species of birds in the wetland, of which about 100 nest here. The total number of birds that nest here is about 15,000 pairs, and the main places of their nesting are thickets of reeds, floodplain forests and open water areas with islands of floating vegetation, as well as reed-shrub thickets in the northern part of the Dniester estuary. Seasonal clusters of water-loving birds of up to 20,000 individuals are observed on large floodplain islands, open water areas, shallow estuaries and surrounding agro-cenosis. The Lower Dniester is an important spawning site for a number of valuable fish species. In general, there are about 70 species of fish belonging to 20 families. Among the animals listed in the Red Data Book of Ukraine, of note are mollusks – *Turricaspia lincta*; fish – sterlet *Acipenser ruthenus*, Black Sea sturgeon *Huso huso ponticus*, european mudminnow *Umbra krameri*, common zingel *Zingel zingel*; and birds – glossy ibis *Plegadis falcinellus* (1 300 pairs), eurasian spoonbill *Platalea leucorodia* (20 pairs) and others. In the wilderness there nest up to 200 large white heron pairs.

Socio-cultural value. The site has a great scientific, ecological, educational and recreational significance. This is a traditional fishing and recreation place for local residents and residents of Odesa. The Dniester is a source of drinking water for the big region and serves as an important transport artery connecting Ust-Dunaisky with other ports of Ukraine and the countries of the Danube.

Land use. The site is under state and collective ownership. The hunting, fishing, fish farming, recreation, water use for water supply of settlements and agricultural needs are limited, and the use of natural resources is controlled. In the surrounding territories, there is state, collectively and privately owned land. The above-mentioned forms of natural resource management, as well as traditional farming (grazing livestock, viticulture, irrigation, etc.) apply.

Measures for the protection and preservation of wetlands. Limitations and control over the use of natural resources are introduced within the site. Currently, the project of creating a national natural park "Nizhny-Dnistrovsky" is being developed, which should improve the situation with the protection of natural complexes of the site.

Public authorities responsible for maintaining of the wetlands. Landowners, land users and local authorities are responsible for protecting the site. State control in the field of environmental protection is carried out by the State Ecological Department of Odesa Oblast.



Picture 2. Map of Dniester-Turunchuk Crossrivers Area wetland

2.2. Northern part of Dniester Liman wetland

(46°22' N, 30°12' E; altitude: 0,4-0,6 m).

Location. Northwest black sea coast. The site is part of the Dniester estuary and is located in the Odesa region on the border with Moldova. The closest Ramsar site is the "interconnection of the Dniester and Turunchuk". Area 20000 ha.

Wetlands characteristics. The area includes the delta of the Dniester with its rivers, floodplain lakes, peninsulas, complexes of floating plants and the northern part of the Dniester estuary. The area has a great value as a place of habitat for wetlands (nesting, wintering, staying during seasonal migrations).

As a Ramsar site it meets the following criteria:

- it is a typical Black Sea estuary in the mouth of a large river,
- it has the necessary conditions for nesting of various wetland birds and stopover during migrations as well as wintering of the representatives of *Anseriformes*, *Gruiformes* and *Pelecaniformes*,
- throughout the year, more than 20,000 wetland birds regularly settle there,
- site is the place of residence for representatives of the *Anseriformes*, *Charadriiformes*, *Ciconiiformes*, which serve as indicator groups for assessment of the ecological status of the environment.

Physical and geographical characteristics. The Dniester Liman is an estuary of the Dniester River. Its western and eastern shores are laced with declining lakes. The northern coast is low,

here alluvial peninsulas with reed thickets and marsh vegetation are widespread. Lyman has a catchment area of 75,200 km² and a volume of 673-733 million m³. It has a length of 42.5 km, the largest width of 12 km, average depth of 1.8 m, and maximum depth of 2.7 m. The surface area is 360-408 km².

The climate is temperate continental with short warm winters and long, hot summers. The annual precipitation is 300-400 mm, and the evaporation is 800-900 mm. In some winters, the estuary may freeze over, but no longer than for a month.

Hydrological characteristics. The Dniester Liman belongs to the semi-open-type estuaries. Its water reserves are used to supply water to agricultural lands and to provide drinking water to the city of Odesa. Water transport plays an important role.

Flora. The main type of vegetation within the site, especially in the upper estuary, is wetland vegetation. The plants from the Red Data Book of Ukraine, such as waterwheel plant *Aldrovanda vesiculosa*, summer snowflake *Leucjum aestivum*, floating fern *Salvinia natans* and water caltrop *Trapa natans*, grow there.

Fauna. The total numbers of breeding ornithocomplex in the site reach 3,000 pairs. The main nesting areas in the wetlands are thickets of cannabis, islands of floodplain forest, areas with floating aquatic vegetation and shrub and reed thickets in the northern part of the estuary. Seasonal clusters, in which there are as many as 20,000 individuals, are observed mainly on estuaries, large flood lakes and adjacent agrocenosis. Among nesting species the *Fulica atra* (700 pairs), the *Podiceps cristatus* (300 pairs), the *Anas platyrhyncha* (200 pairs), and black-headed gull *Larus ridibundus* (120 pairs) are predominant. Of note are great egret *Egretta alba* (80 pairs) and mute swan *Cygnus olor* (60 pairs).

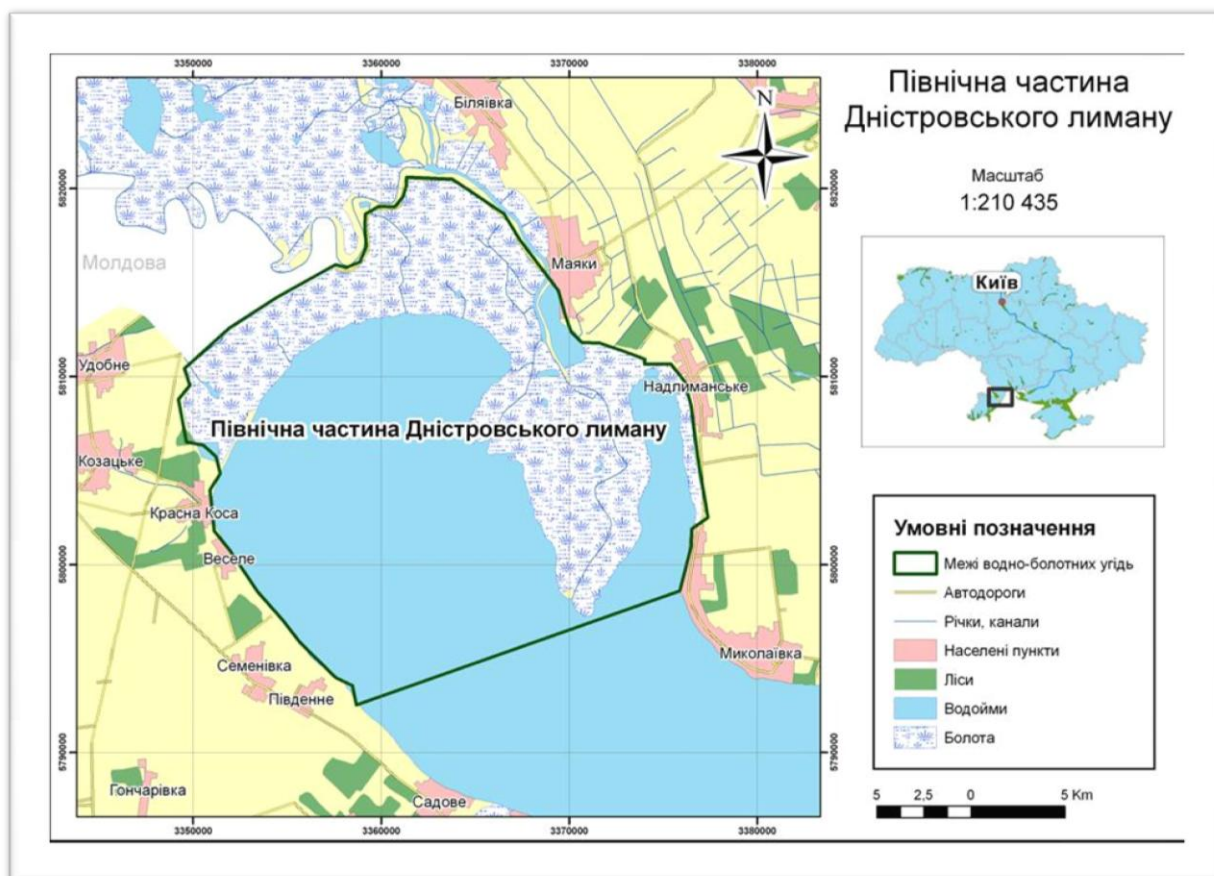
Species from the Red Data Book of Ukraine: *Turricaspia lincta*, sterlet *Acipenser ruthenus*, Black Sea sturgeon *Huso huso ponticus*, European mudminnow *Umbra krameri*, common zingel *Zingel zingel*, Dalmatian pelican *Pelecanus crispus* (800), great white pelican *Pelecanus onocrotalus* (500)

Socio-cultural value. The area is important for environmental education, recreation and scientific research. This is a traditional fishing place, as well as an important transport route linking the city of Ust-Dunaisky with the ports of Ukraine and the countries of the Danube region. This is a favorite place for people living in Odesa and other settlements of the region.

Land use. The site is under state and collective ownership. The use of natural resources (hunting, fishing, recreation, water supply for agricultural and domestic needs, etc.) is limited here and is under control. In the areas adjacent to the site, under the state, collective and private ownership, the above mentioned natural resources are used, in conjunction with traditional farming (grazing, viticulture, irrigation, etc.).

Measures for the protection and preservation of wetlands. The use of natural resources within the wetlands is limited and controlled. Part of the estuary is the wildlife sanctuary of the Military Society of Hunters and Fishermen.

Public authorities responsible for maintaining wetlands. Landowners, environmental users and local authorities are responsible for protecting the site. The State Ecological Department of Odesa Oblast carries out state control in the field of environmental protection.



Picture 3. Northern part of the Dniester Liman wetland

2.3. Lower Dniester wetland

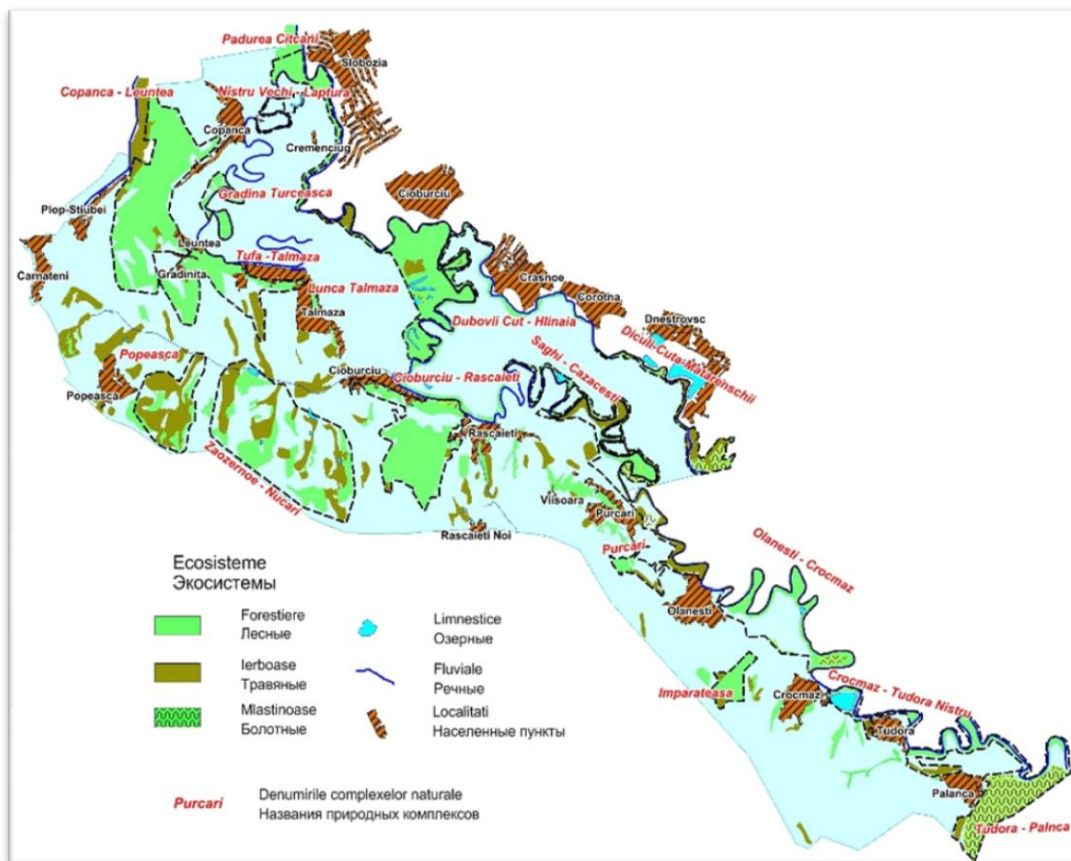
The Republic of Moldova currently has three sites designated as Wetlands of International Importance (Ramsar Sites), with a surface area of 94,705 hectares. One of them is “Lower Dniester” (was included in Ramsar List no.1316), Causeni and Stefan Voda Districts, Territorial administrative unit Transnistria with areas 60000 hectares (46°34'N 29°49'E) (pic. 4). The status of this wetland contributes to the preservation of the entire ecosystem of the Dniester delta, along with two downstream Ramsar sites in Ukraine.

Varieties of terrestrial and aquatic biotopes, including the Natura 2000 biotopes, have been identified on the wetland territory. Land biotopes include 15 natural types: floodplain forests (4 biotopes), upland forests (5 biotopes), meadows and steppes (6 biotopes). Aquatic biotopes include 7 types: the Dniester River, valley permanent and temporary lakes, the Old Dniester biotope, the canal - standing water ecosystem interacting with the river, freshwater drainage systems and ponds, brackish-water canals, stream ecosystems.

Natural ecosystems are either absent in almost half of the wetlands or occupy less than 10%, and only 4% of their share exceeds 60%. The main core of the site is the “Talmaz plains” tract with an area of 1686 hectares, including forests with numerous glades, a lake, a bayou, permanent flooded and drying channels, swampy depressions, meadows and areas of abandoned farmland.

The alternation of agricultural and natural land creates natural conditions for nesting and feeding of various birds, including endangered and vulnerable predatory birds and birds of the

wetland complex, including corncrake (*Crex crex*) and pygmy cormorant (*Phalacrocorax pygmaeus*), which nest here, others are stopping here during the migration. Red-breasted goose (*Branta ruficollis*), white-eyed pochard (*Aythya nyroca*), pallid harrier (*Circus macrourus*), white-tailed eagle (*Haliaeetus albicilla*), Dalmatian pelican (*Pelecanus crispus*) are regular visitors. In general, the number of bird species reaches 228, comprising 127 nesting and 101 migratory species. Freshwater migratory fish such as Danube salmon (*Hucho hucho*), European mudminnow (*Umbra krameri*) and various sturgeon species are found in the Dniester⁵.



Picture 4. Ecosystem of "Lower Dniester" wetland

⁵ <http://www.biotica-moldova.org/library/Brosura%20GEF-ADA-rusa.pdf>

3. Identification and assessment of ecosystem services of the Lower Dniester wetlands

The GEF Guidance Document on the Economic Assessment of Ecosystem Services proposes a methodology for assessing ecosystem services in international water projects (<https://iwlearn.net/documents/28544>)⁶.

The methodology includes:

- identification of ecosystems whose services will be assessed,
- determining the size of the territory in which these ecosystems are located,
- definition of ecosystem services potentially supplied by these territories,
- search for reliable information about the volume of services supplied and their possible assessment (the most difficult stage),
- identification of which ecosystem services can be assessed directly via (local) market prices, and which need a benefit transfer,
- assess the values of provisioning services via local market prices,
- assess the values of other ecosystem services using the simplified Benefit Function Transfer approach.

For the study undertaken, the ecosystem services proposed by the GEF Guidelines were reviewed. However, the Ministry of Ecology and Natural Resources of Ukraine proposed to pay attention to the recommendations of the 13th meeting of the parties on the Ramsar Convention in 2018. It identified needs to integrate the benefits of wetlands into national policies for managing of natural resource potential. Managers of wetlands at all levels must clearly understand the importance of their functioning and services provided. They must include all these advantages in own political decisions and operational activities. Therefore this study tried to estimate the key ecosystem services of international wetlands proposed by 13th meeting (Table 1).

Table 1. Ecosystem services in Lower Dniester Ramsar sites

Ecosystem services	Ramsar sites:					
	«Dniester-Turunchuk Crossrivers Area», Ukraine (76 000 ha)	«North part of Dniestr Liman», Ukraine (20 000 ha)	«Lower Dniester», Republic of Moldova 60 000 ha			
			Forest ecosystem	Meadow ecosystem	Water ecosystem	Inland wetlands, floodplains
Fish/Fisheries	+	+				
Medicinal plants	+	+				
Fiber, timber, fuel	+	+	+	+		
Water (drinking, irrigation)	+	+			+	
Climate regulation	+	+	+			+
Maintenance of life cycles of migratory	+	+				

⁶ GEF Guidance Documents to Economic Valuation of Ecosystem Services in IW Projects (2017)

Ecosystem services	Ramsar sites:					
	«Dniester-Turunchuk Crossrivers Area», Ukraine (76 000 ha)	«North part of Dniestr Liman», Ukraine (20 000 ha)	«Lower Dniester», Republic of Moldova 60 000 ha			
			Forest ecosystem	Meadow ecosystem	Water ecosystem	Inland wetlands, floodplains
species						
Opportunities for Tourism/Recreation	+	+	+	+	+	+
Aesthetic Information, Inspiration, Spiritual Experience, Education	+	+	+	+	+	+
Water treatment						+
Air quality regulation			+			
Maintenance of genetic diversity	+	+	+	+	+	+

3.1. Market prices methodology for assessment of ecosystem services

While most ecosystem services are not traded on markets, there are some that are, i.e. products that are derived directly from the ecosystem (food, raw materials etc.), and some other services (e.g. tourism). As these products are directly traded on markets, or in a certain way replace products usually obtained in a (local) market or store (e.g. in case of building materials), their value is best assessed using the local **market prices** that would need to be paid for the replaced product.

The Lower Dniester ecosystems provide a number of provisioning ecosystem services that can be valued at market prices. However, the lack of data on ecosystems such as area, quantity of products received and their price do not allow to fully assess the ecosystem services. Only some of them (water, reeds, recreation) have been identified and estimated (Table 2).

The drinking water supply ecosystem service was valued by the volume of water supplied to the population of the Odesa region from the Belyaevsky water intake on the Dniester river (Infoxvodokanal branch of Infox LLC) and cold water rates for consumers (0,14 Euro/m³). Water consumption in 2016 amounted to 83760 thousand cubic meters. Accordingly, **the value of the ecosystem service for the economy of the Odesa region amounted to 13,800 million euros**. The ecosystem service "water supply for irrigation" was estimated by the volume of water supplied for irrigation in the Lower Dniester irrigation system of the Odesa region. In 2017, 11.3 million cubic meters of agricultural land was supplied for irrigation in the Odesa region. One cubic meter of water cost 0.153 euros. Therefore, **the ecosystem service of irrigation water supply was valued at 1.730 million euros**.

The ecosystem service "tourism and recreation" was valued as a service provided by Lower Dniester NPP to amateur fishermen. Service for tourists visiting the park for amateur fishing, costs 10 euros a day per person. In 2018, 10500 people visited the park for this purpose.

Therefore, the ecosystem service "tourism and recreation" is valued at 0.145 million euros in 2018.

The ecosystem service "building materials, reed" was valued taking into account the size of the territory where the reed is harvested and its price on the European markets per ton. In 2018, 3133 tons of reeds were harvested in both sites. The market value of 1 ton of reed is about 0.22 euros. Therefore, **the ecosystem service for the supply of reeds was 6,893 mln euros.**

3.2. Benefit transfer methodology for assessment of ecosystem services

To value ecosystem services not traded on local markets, one can use a customized benefit function transfer methodology according to the GEF Guidance mentioned above. In cases where such knowledge and resources are limited, the "**benefit transfer**" method is often used to estimate economic values for ecosystem services that cannot be valued otherwise, by transferring available information from detailed original studies already completed in another location and/or context. For this, a number of conditions described in the methodology should be observed, but the main ones are similar economic, geographical and natural-ecological conditions, as well as areas occupied by ecosystems. GEF guidance document for economic valuation (<https://iwlearn.net/valuation/the-repository-of-economic-valuation-studies>) proposes to use the Repository of Economic Valuation Studies containing information on studies considered directly usable for benefit transfers, i.e. studies with values/benefit information that can be transferred to another area - our project area, in this case. It is the result of an extensive search, screening hundreds of valuation studies and selecting the few that are directly usable. The repository is structured in such a way as to allow one to easily identify the studies available for the transfer to project area, to select the most appropriate ones, and to have all information at hand to perform any adjustments to the values cited that might be necessary (picture 1).

The results of the research carried out by Garcia – Llorente/Martin – Lopez/Diaz/ Montes 2011 "Can ecosystem properties be fully translated into service values? An economic valuation of aquatic plant services" were used for valuation of climate regulation ecosystem service using benefit transfer methodology (picture 1). Some similar conditions exist in research territory of Lower Dniester such as freshwater ecosystem, estuary, rural area, low population density, highly visited. That's why value of climate regulation EURO 56,4 /ha/year was transferred to the wetlands of Lower Dniester.

The results of the research carried out by Martin – Lopez/ Garcia – Llorente/ Diaz/ Montes/Palomo 2011 "The conservation against development paradigm in protected areas: valuation of ecosystem services in the Donanna social-ecological system" were used for valuation of water treatment ecosystem service. Value of water treatment EURO 104,6 /ha/year was transferred to the wetlands of Lower Dniester.

Search the repository

Broad ecosystem type (B): Freshwater
 Specific ecosystem (C): inland wetland
 Services (E): - All
 Valuation methods (F): - All

Monetary unit (H): - All
 Socio-economic characteristic - GDP/capita (J): - All
 Socio-Economic characteristic: area (K): - All
 Warm or cold-water (N): - All

6 items found - Reset

1 Authors/name of the study/year	2 Marine or freshwater ecosystems	3 Specific ecosystems covered	4 Ecosystem and study area characteristics	5 Ecosystem services covered	6 Valuation Method(s) used	7 Values per area (i.e. per hectare) most used (H)	8 Monetary unit used, and which year	9 Socio-economic characteristics: population density of the area (low/medium/high)	10 Socio-economic characteristics: per capita income (national level 2015)	11 Socio-economic characteristic: urban/urban catchment/rural area	12 Socio-Economic characteristic: area is economically (agriculture, fishery etc.) used Y/N	13 Socio-Economic characteristic: density of use by tourists/visitors (highly visited/medium/rarely visited).	14 Warm or cold-water ecosystem
García-Llorente/ Martín-López/ Díaz/ Montes (2011). CAN ECOSYSTEM PROPERTIES BE FULLY TRANSLATED INTO SERVICE VALUES? AN ECONOMIC VALUATION OF AQUATIC PLANT SERVICES	Marine Freshwater	Estuaries/ marshes Other inland wetlands Salt ponds/lagoons	220.070 ha of valuable ecosystems of the Donana region.	Climate regulation (micro-climatic regulation)	Climate regulation/Contingent valuation	Climate regulation: EUR 56.4/ha/yr	EUR, 2011	Low	Spain: 34.861 Int5	Rural	Yes	Highly visited	Cold
Martín-López/ García-Llorente/ Díaz/ Montes/ Palomo (2011). THE CONSERVATION AGAINST DEVELOPMENT PARADIGM IN PROTECTED AREAS: VALUATION OF ECOSYSTEM SERVICES IN THE DONANA SOCIAL-ECOLOGICAL SYSTEM	Marine Freshwater	Estuaries/marshes Other inland wetlands Salt ponds/lagoons	220.070 ha of valuable ecosystems of the Donana region.	Water treatment/Climate Regulation/Erosion prevention/Opportunities for tourism/recreation/Spiritual Experience/Aesthetic information, inspiration (existence value)	Water treatment/Contingent valuation/Climate regulation/Contingent valuation/Opportunities for tourism/recreation/Travel cost/Spiritual experience/Travel cost/Aesthetic information, inspiration/Contingent valuation	Water treatment: EUR 164.8/ha/yr Air quality: EUR 168/ha/yr Erosion prevention: EUR 38.9/ha/yr Hydrological regulation: EUR 26.1/ha/yr Opportunities for tourism/recreation: EUR 198.7/ha/yr Beach tourism: EUR 1680/ha/yr Spiritual experience: EUR 904.5/ha/yr Aesthetic information, inspiration: EUR 485.8/ha/yr	EUR, 2008	Low	Spain: 34.861 Int5	Rural	Yes	Highly visited	Cold

Picture 1. Screenshot of the Repository of Economic Valuation Studies

Table 2. Ecosystem Services of freshwater ecosystems in Ukraine and the methodology for economic valuation

Ecosystem	Area, ha	Ecosystem services	Methodology used: market prices (MP) or benefit transfer (BT)	Value determined per unit of product and source of information on the received price	Overall value of ecosystem service per year
«Dniester-Turunchuk Crossrivers Area» (Ukraine)					
<i>The beds of the Dniester and Turunchuk, lakes</i>	4 000	Water (drinking)	MP	EURO 0,14 /m ³ "Branch" Infoxvodokanal "LLC" Infox "	EURO 13,8 mln 83076000 m ³ /year (2016)
		Water (irrigation)	MP	EURO 0,153 /m ³ Odesa Regional Administration of Water Resources of the State Agency of Water Resources of Ukraine	EURO 1,730 mln 11,3 mln.m ³ /year (2017)
		Opportunities for tourism/recreation	MP	EURO 10 /day/man Lower Dniester NNP	EURO 15 000 / year (2018)
		Maintenance of Life Cycles of migratory Species		information is absent	
		Maintenance of genetic diversity		information is absent	
		Fish/fisheries		information is absent	
<i>Wetlands, sandy islands and coastal areas</i>	72 060	Fiber, timber, fuel (reed)	MP	EURO 0,22/t Lower Dniester NNP	EURO 355,74 /1617 t/year (2018)
		Climate regulation	BT	EURO 56,4 /ha/year García-Llorente/ Martín-López/ Díaz/ Montes	EURO 4 064 184 /year (2011)
		Aesthetic, information, inspiration, spiritual experience, education	BT	information is absent	
«North part of Dniester Liman» (Ukraine)					

Ecosystem	Area, ha	Ecosystem services	Methodology used: market prices (MP) or benefit transfer (BT)	Value determined per unit of product and source of information on the received price	Overall value of ecosystem service per year
<i>Delta of the Dniester, floodplain lakes and Dniester Delta, wetlands</i>	12 000	Fish/Fisheries		information is absent	
		Fiber, timber, fuel (reed)	MP	EURO 0,22 /t Lower Dniester NNP	EURO 333,5 /1516 t/year (2018)
		Climate regulation	BT	EURO 56,4 /ha/year Garcia-Llorente/ Martín-López/ Diaz/ Montes	EURO 676 800 /year (2011)
		Opportunities for tourism/recreation	MP	EURO 14 /day Lower Dniester NNP	EURO 126 000 /year (2018)
		Water treatment	BT	EURO 104,6 /ha/year Garcia-Llorente/ Martín-López/ Diaz/ Montes	EURO 1 255 200 / year (2011)
		Maintenance of life cycles of migratory species		information is absent	
		Maintenance of genetic diversity		information is absent	
<i>Coastal sandy areas</i>		Aesthetic information, inspiration, spiritual experience, education		information is absent	
		Medicinal plants		information is absent	
		Maintenance of life cycles of migratory species		information is absent	
TOTAL				?	?

3.3. Total value of the ecosystem services in Lower Dniester in Ukraine

The total value of the ecosystem services selected in Ukraine including water supply and irrigation, tourism and recreation, reed, climate control and water purification (ref. table 2) amounts to 29 million EURO per year. This is only an extremely insignificant percentage of the benefits provided by the ecosystems of Lower Dniester and can be seen only as an initial valuation at the very lower end. Valuation the remaining ecosystem services, including those presented in the table, will require considerable effort.

For comparison, the cost of all water protection measures carried out in the Dniester basin in Ukraine in 2017 was 3.7 million Euros.⁷

A global study conducted by Robert Costanza for inland wetlands allows a very rough estimate of the value of the wetland ecosystem services of the Dniester sites, using a benefit transfer

⁷ TDA of Dniester basin. GEF/UNDP/OSCE Project “Enabling transboundary co-operation and integrated water resources management in the Dniester River Basin”

method. The total value of ecosystem services presented in Constanta research is US\$16,500 per hectare per year.⁸ **The value of all ecosystem services of the three sites in the Lower Dniester can be roughly estimated 2.2 billion EUR per year.**

The main challenges of the current study were:

- methods may be time consuming to carry out;
- estimates generated for one site cannot usually be extrapolated to, or compared with, other areas;
- information collection is focused more on broad-based consultation with users and beneficiaries than on using surveys or models to generate and analyse quantitative and biophysical data, which are usually absent.

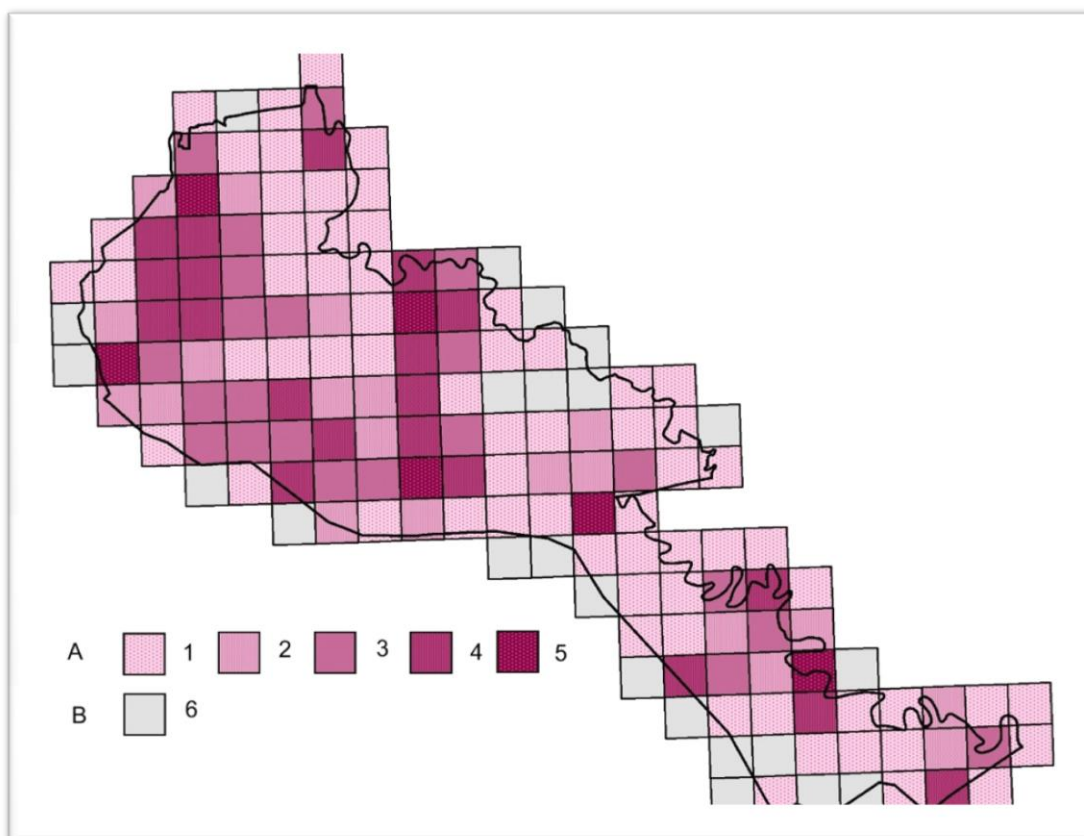
3.4. Assessment of ecosystem services of Lower Dniester Ramsar site in Republic of Moldova

The assessment of the biodiversity of the lower reaches of the Dniester River in the Republic of Moldova was carried out within the framework of the project "Sustainable Development of Aquatic Ecosystems on the Ramsar Convention site" and carried out by the Ecological Society "Biotica" and NGO "EcoContact" with the financial support of the Austrian Development Agency. Ecosystem services were assessed according to the methodology of Alexei Andreev, a leading researcher at the Institute of Zoology of the Academy of Sciences of the Republic of Moldova. The methodological approach to estimate the cost of biodiversity conservation services for wetlands was based on a reference estimation of value (derived from indirect data on the cost of a biodiversity conservation service in order to calculate the average value taken as a reference value per specific area), estimates of biodiversity and areas of its supporting territories.

GIS technologies were used for spatial evaluation. Sheets of topographic maps with the scale of 1: 5000, with a size of one sheet square of 5.51-5.55 km², with an average of side 2.3x2.4 km and a perimeter about 9.4 km was applied as a mapping unit. The territory of the wetland includes 157 such units, of which 98 were fully included and 59 partially.

The essence of the method is that the determination of the capital valuation of biological diversity as an ecological resource is the capitalized value of the current (annual) cost of the service for the conservation of biological diversity. Estimation of the average cost of a biodiversity conservation service, taken as a reference value for a specific area, was made on the basis of an analysis of literature data from the results of studies of areas especially valuable for biodiversity and the calculation of minimum and maximum estimates of its value. For the Lower Dniester wetland, the biodiversity cost estimate was calculated using two options: based on the average minimum (3133 Euro) and average maximum (5967 Euro) of the value of biodiversity per ha.

⁸ <https://community-wealth.org/sites/clone.community-wealth.org/files/downloads/article-costanza-et-al.pdf>



Picture 5. Territorial differentiation of the assessment of the value of the wetlands biodiversity service of Lower Dniester:

A - cost of the services of biodiversity of the territories-cores: 1 - less than 1 thousand US dollars; 2 - 1-5 thousand US dollars; 3 - 5-15 thousand US dollars; 4 - 15-25 thousand dollars; 5 - 25-40 thousand dollars; 6 - more than 40 thousand US dollars;
B - other territories.

46% of the ecosystem services are so called providing, 28% are regulating, 12% - biodiversity conservation, 14% are touristic.

The total value of the estimated ecosystem services of the wetlands of the Lower Dniester on the territory of the Republic of Moldova is 10.2 million euros^{9,10}.

⁹ 0.9 euros for 1 dollar

¹⁰ http://eco-tiras.org/books/conferinta_tiraspol_2018.pdf

Conclusions and Recommendations

The attempt in this study to identify and assess the ecosystem services of wetlands as unique natural formations indicates that the understanding of their value and attention to their conservation and restoration is inadequate in both countries. Negotiations on the establishment of the Lower Dniester National Park in the Republic of Moldova, which has been going on for years, and the lack of adequate information on the resources that should be preserved in the Lower Dniester NPP in Ukraine, confirm this. The reasons are as follows:

- environmental inadequacy of traditional economic models,
- Inadequate institutional infrastructure,
- imperfection of the legal, regulatory and methodological framework in this area,
- lack of systematic educational work among stakeholders.

Ecosystem services provided by two wetlands in Ukraine amount to 29 million Euros per year, in Moldova - 10.2 million Euros.

Not all of the proposed approaches to valuation of ecosystem services are well developed and some contain controversies, but they can be used as a basis for at least a first approximation to assess the economic value of wetlands.

At the national level, it is necessary to:

- integrate application of the ecosystem approach at the legislative level,
- develop a methodology to assess the value of ecosystem services,
- extend the application of the ecosystem approach to territorial communities, especially the economic valuation of ecosystem services, for example, financial benefits to specific farmers from tourism development or "non-construction" in the inundation zone,
- introduce best practices in ecosystem restoration,
- systematically examine the natural processes that need to be maintained when restoring ecosystems.

In addition, the Ramsar Convention recommends the following:

- to carry out inventory, assessment and monitoring of the site, scientific research and training of specialists for effective management of the Ramsar Site, availability of adequate knowledge about its functioning,
- to create models for site inventory and data management, including the use of remote data collection technologies,
- to use inexpensive and user-friendly geographic information systems.