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Some approaches to the economic valuation of the wetlands biodiversity in Moldova

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The article presents principal results of the first experience of economic valuation of wetlands biodiversity in Moldova. The country's largest Ramsar site "Lower Dniester" served as a case study. This wetland, located in the Dniester River basin, occupies 60,638 ha and includes 18 natural complexes. The initial material for the study was extracted from available sources; GIS technologies provided spatial analysis. The long-time intensive anthropogenic pressure has led to the transformation, fragmentation and reduction of this wetland's biological diversity. In almost half of its area, natural ecosystems are either absent or occupy less than 10%; only in 4% their share exceeds 60%. Another factor determining the economic value of this wetland is its fragmentation, the level of which was assessed through coefficient of fragmentation (CF), calculated as a ratio of a natural object's perimeter to its area: the higher the CF, the more pronounced the level of fragmentation. CF of large forests was significantly lower (about 3.0) than its values for grass (6.7), marsh (6.90) and water (8.9) ecosystems. For the economic valuation of the wetland biodiversity, a "reference value" was found through averaging numerous literature data on the value of the rich, particularly in relation to their biodiversity territories, and two reference values: the average minimum ($3,520) and the average maximum ($6,705), both per hectare, were identified. Using these indicators, the economic value of the "Lower Dniester" key territories, or territories–cores of the national ecological network due to their rich biological diversity, were assessed both in market and spatial terms.

Key words: Ramsar site, ecosystem, biological diversity.

INTRODUCTION

Different conservation organizations, governments, and donor agencies make intensive efforts to save life on earth. The accomplishment of this urgent task is consistent with another main mission — conservation of biodiversity. The third edition of the Global Biodiversity Outlook (SCBD, 2010) insisted that urgent actions must be taken during this decade and the next to reduce biodiversity loss and prevent reaching tipping points. However, despite many actions, biodiversity continues to be lost, ecosystems are degrading, and the consequent decline in ecosystem services threatens to undermine human well-being. Such conclusion was supported by the later assessment (IPBES, 2018, p. 2): " … nature's contributions to people are critically important for a good quality of life, but are not evenly experienced by people and communities, and are under threat due to the strong ongoing decline of biodiversity".

In this context, in October 2010, the tenth Conference of the Parties to the Convention on Biological Diversity (COP-10) held in Aichi-Nagoya, Japan, adopted the Strategic Plan for Biodiversity 2011-2020, including 20 "Aichi Biodiversity Targets" (Available online: https://www.cbd.int/sp/targets/). The establishment of the corresponding national targets and their integration into updated national biodiversity strategies and action plans (NBSAPs) are a key to implementing this strategic plan.

In particular, according to Target 11 of Strategic Goal C: “Improving the status of biodiversity by safeguarding ecosystems, species and genetic diversity”, by 2020, at least 17% of terrestrial and inland waters, especially of extraordinary importance for biodiversity and ecosystem services, should be conserved through ecologically representative and well-connected systems of protected areas and other effective area-based conservation measures. The freshwater ecosystems hold a special place in this activity. On the one hand, while the earth’s rivers, lakes, and wetlands contain a mere 0.01% of the world’s water resources, their ecosystems occupy a disproportionately large fraction of the earth’s biodiversity. On the other hand, worldwide freshwater biodiversity is more threatened than terrestrial, as it is being subjected to an array of threats operating over a range of scales (Abell et al., 2002).

In recent decades, a new dimension of impacts on biodiversity has been introduced by climate change and its consequences (Elmhagen et al., 2015). The possible biodiversity losses due to this factor may modify the structure and function of ecosystems, thus affecting ecosystem services delivery. In the biotic environment, species can respond to change either through evolution, adapting to new conditions, or by tracking suitable conditions through dispersal. Furthermore, the impact of climate change on biodiversity differs, depending on the status of certain species in an ecosystem. To meet such challenges, additional researches are needed at the landscape to regional scales because the response strategies rely on the quality of available information and the capacity to make informed decisions.

Ecosystem loss and fragmentation are considered as the greatest worldwide threat to biodiversity and the primary cause of species extinction. Moreover, these processes are as much an issue for biodiversity in aquatic environments as it is for terrestrial ones (Laverty and Gibbs, 2007). For example, river systems and wetlands are being fragmented by natural forces such as bottom topography, river flows, floods, as well as human activities such as drainage, extraction of groundwater, dams (DSU, 2017; Zaimes et al., 2019), sedimentation, etc. Concerning wetlands, they were drastically reduced in area and number in many regions of the world due to intensive drainage and human use. Thus, according to Laverty and Gibbs (2007), in the continental United States, where study of wetlands has been more extensive, they have declined by more than half (from 89 to 42 million ha) between 1780 and 1980, and the rate of loss is speeding up. In Europe and Central Asia, the extent of wetlands has declined by 50% since 1970 (IPBES, 2018).

In this study, we used for wetlands their common definition: the transitional lands between terrestrial and aquatic systems, where the water table is usually at or near the surface, or the land is covered by shallow water. Some of them are linked to rivers, because in floodplains, it is sometimes very difficult to distinguish between terrestrial and aquatic species and habitats, given the dynamic nature of ecosystems. The ecosystem services that relate to freshwater resources encompass the benefits to people that can be estimated in economic terms (Reya et al., 2018). Likewise, damage to ecosystems and their biodiversity should also be evaluated economically.

Thus, the idea of a special study dedicated to the economic valuation of wetland biodiversity was driven by the following principal scientific and practical reasons:

(1) There is an urgent need to conserve wetlands as unique ecosystems that are among the world’s most productive environments with a wide array of benefits. Wetlands are cradles of biological diversity, providing with water and primary productivity, upon which countless species of plants and animals, including wildlife resources, depend on survival, being also important storehouses of plant genetic material. Many of the wetlands are ‘biodiversity hotspots’ and the numerous threats they face, along with the many ecosystem services they offer, have led to their protection status by the Ramsar Convention (Ramsar, 2009) and the Natura 2000 Network (European Commission, 2007); their conservation or re-establishment, especially in human-modified environments, has become a worldwide priority (Abell et al., 2002).

(2) Wetlands not only have zoogeographic relevance, but also serve as the most appropriate units for the conservation of freshwater biodiversity. The quality of wetlands habitat at any location is a function of all upstream and upland activities, and sometimes downstream activities too. Many of the threats to wetlands systems are the result of land-use practices or hydropower development (Vejnovic, 2017), which occur within their surroundings, and thus must be addressed (Abell et al., 2002).

(3) During the past century, many wetlands have been lost and degraded. Sometimes, labeled as wastelands and treated as ‘dustbins’ for wastewaters and solid wastes, they receive no worthy attention in the development plans (Gopal, 2015). Therefore, protecting wetlands biodiversity, their specific biophysical characteristics and benefits (ecosystem goods and services) requires a major change in national policies. The multiple roles and value of wetland ecosystems have been increasingly understood and documented, resulting in large expenditures to restore their lost or degraded hydrological and biological functions, including in Moldova (Andreev, 2008, 2017; Andreev et al., 2013; Rubel, 2007, 2009). But this is not enough, and there is a need to improve practices on different scales in the attempt to cope with the accelerating water crisis.

(4) Wetlands degradation and their loss are more rapid than those of other ecosystems and are continuing at an alarming rate (Jiménez Cisneros et al., 2014), primarily

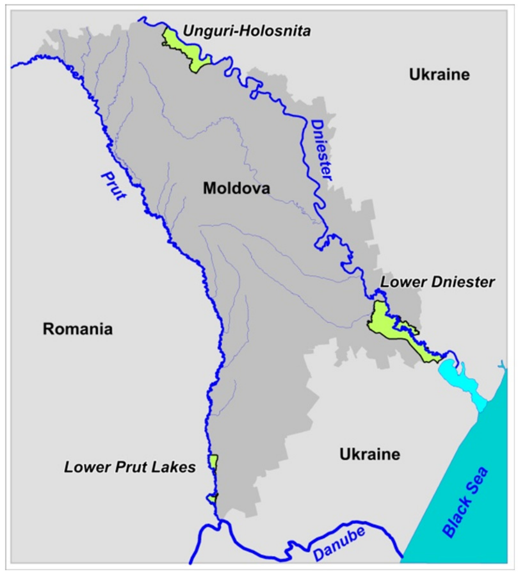

Figure 1. Moldova on the map of Europe and its wetlands of international importance (in green).

due to infrastructure development, land conversion, water withdrawal, eutrophication and pollution, the introduction of invasive alien species, etc. (MEA, 2005). Somewhere, the occupation of wetlands and adjacent floodplain areas for the intensive urban and agricultural land-use has led many of them to functional disconnection with their rivers. For instance, because of water shortage and mismanagement, in the last 50 years, half of the Mediterranean wetlands have disappeared. Pollution from cities and agriculture, especially nutrient loading, results in declines in water quality and the loss of essential ecosystem services (Settele et al., 2014), including the species groups from the IUCN Red List (http://www.iucnredlist.org/). It is very likely that these stressors for wetlands ecosystems will continue to dominate as the human demand for water resources grows, accompanied by increased urbanization, ongoing hydropower construction on rivers (Smith et al, 2007) and expansion of irrigated agriculture.

Considering an economic valuation as a prerequisite for making optimal choices regarding the protection and conservation of wetlands biodiversity, this paper aims, on the example of one wetland, to demonstrate some approaches and provide a set of tools for making an informed decision on this kind of problem.

MATERIALS AND METHODS

Study area

Following the Global Environmental Facility (GEF) methodology (GEF IW:LEARN, 2018), the first step in the economic valuation of ecosystem services is “Setting the scene”, including the determination of the spatial boundaries of the area to be studied and identification of ecosystems and their services to be assessed.

The Republic of Moldova (Moldova) is one of the states of the Former Soviet Union, located in south-eastern Europe, close to the geographical center of this continent, bordering with Romania in the west and Ukraine in the north, east and south. At its southern end, on the 430-meter strip, Moldova has access to the Danube River that provides it with potential access to the Black Sea. The country’s three large wetlands are tied to its two main rivers: Dniester and Prut (Figure 1). They all are included in the List of Ramsar wetlands of international importance.

Case study area

The wetland in the Dniester River basin, which was selected for this study (Figure 2), currently occupies 60,638 ha and includes 18 natural complexes. Due to the international natural and ecological importance, in 2003 this territory was designated to be under the Ramsar Convention (Ramsar, 2009) and received the official status of the international zone Nr. 1316 (3MD003): Ramsar Site “Lower Dniester” (hereafter, Lower Dniester wetland). For a long time, this territory was exposed to an intensive anthropogenic pressure that has led to its transformation, fragmentation of their natural complexes, and reduction of biological diversity and ecological stability. Therefore, in order to support its natural

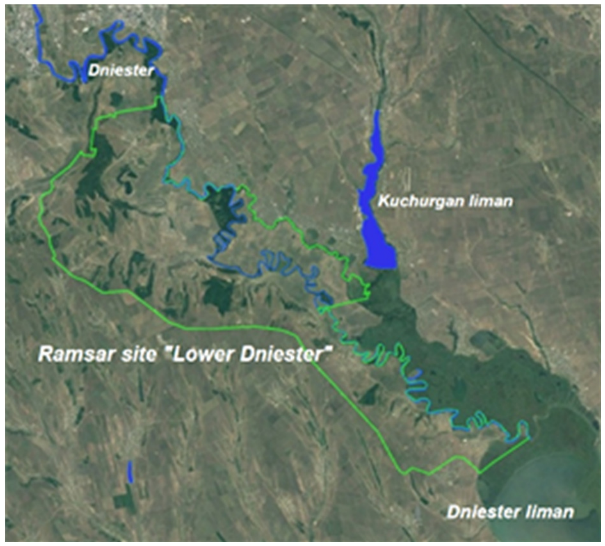

Figure 2. Location (centre: 46º34′N; 29º49’E), borders and space image of the case study area.

functional organization, the conservation of the natural systems of this wetland from further anthropogenic loading is a very practical problem for this territory.

Methods

Although ecosystem loss and ecosystem fragmentation are related processes and typically occur simultaneously, these two processes are distinct. According to Fahrig (2003), ecosystem loss refers to the disappearance of an ecosystem or an assemblage of organisms and the physical environment in which they exchange energy and matter. Fragmentation is usually a product of ecosystem loss and is best understood as the subdivision of a formerly contiguous landscape into smaller units, thus reducing its continuity and interfering with species dispersal and migration, isolating populations and disrupting the flow of individual plants and their genetic material across a landscape.

Economic valuation (EV) is a common approach from the field of environmental economics (Plottu and Plottu, 2007) to create a single monetary metric, which combines all activities within an area and expresses the level of each activity in a common monetary measure, such as the US dollar. This is a useful tool for exploring what types of values each ecosystem service provides and, accordingly, helps in determining the cost required to conserve these values (DEFRA, 2007).

The differences in the problems under study require differentiation of approaches to their solution. The specific methods used in this work will be described in the course of presentation and discussion of the results.

The initial information for the study was extracted from different digital and printed sources (Andreev et al., 2012, 2013) and has been formed into relevant databases. GIS technologies were used for spatial analysis. As a mapping unit, the topographical maps of scale 1:5000 were used. One map sheet corresponded to an area of 5.51-5.55 km^2 on the ground, with an average side of 2.3 x 2.4 km and a perimeter of about 9.4 km. As a result, the territory of Ramsar Site “Lower Dniester” was represented by 157 such units, including 98 units included fully and 59 – partially.

RESULTS AND DISCUSSION

Distribution of natural ecosystems

Exposure of the territory of the Lower Dniester wetland to a long-term impact of anthropogenic load has resulted in the transformation and fragmentation of its natural complexes, reducing their biological diversity and the ecological stability as a whole. At the moment, this territory includes 18 natural complexes (Figure 3), the largest among which are Copanca-Leuntea (2,400 ha), Lunca Talmaza (1,600 ha), Zaozernoe–Nucari (1,540 ha), Cioburciu–Răscăeți (1,230 ha) and Olănești–Crocmaz (1,480 ha). The morphometric characteristics of the natural ecosystems of this wetland are presented in Table 1.

The peculiarity of the ecosystems territorial distribution within these natural complexes is its unevenness. Thus, large forest ecosystems are confined to slopes and partly to floodplain areas, and the largest lakes are located in the southeastern part of the wetland. At the same time, it should be noted that all complexes are also characterized

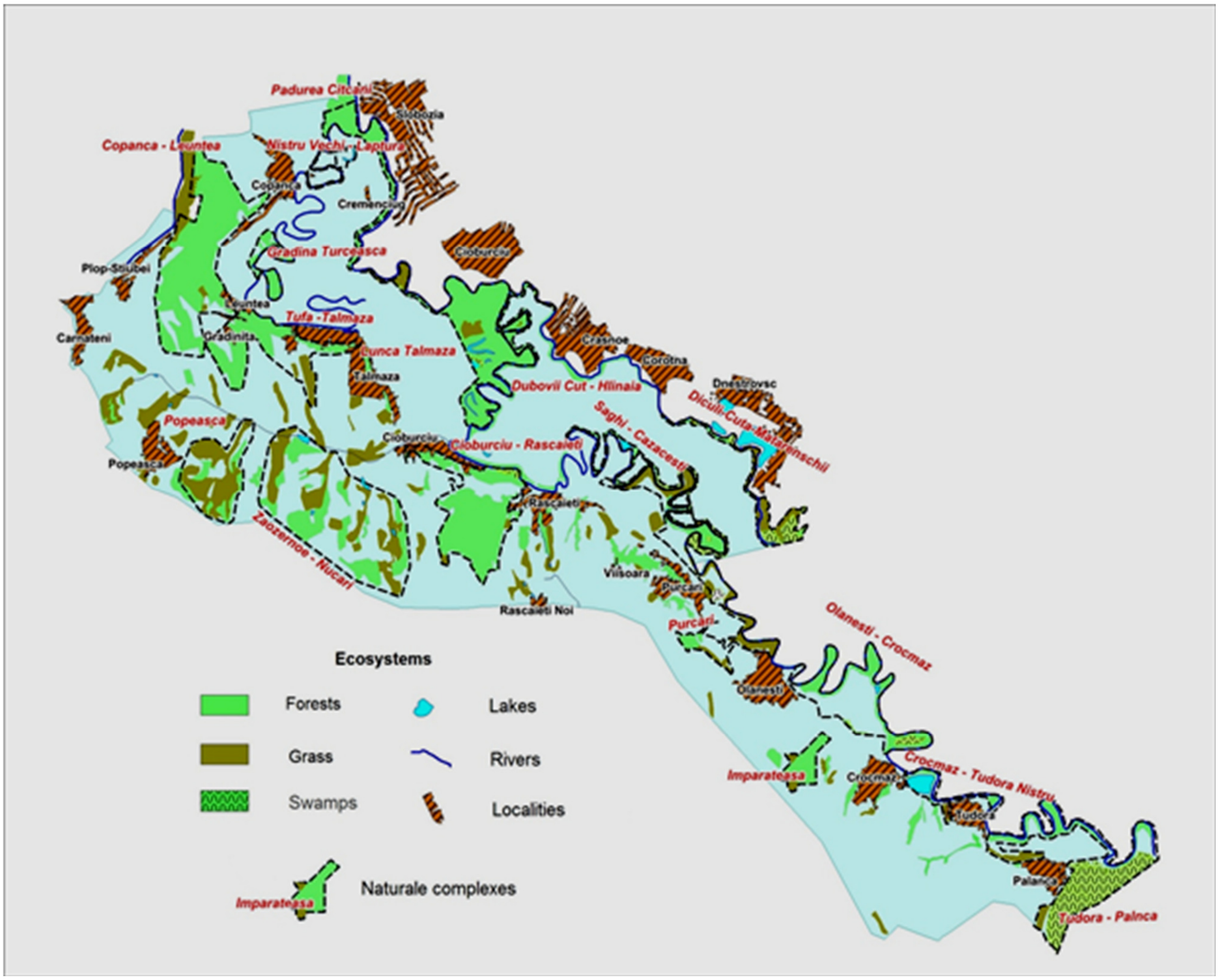

Figure 3. Natural complexes of the Ramsar site "Lower Dniester".

Table 1. Morphometric characteristics of natural ecosystems of the Ramsar Site “Lower Dniester”.

Natural ecosystems	Number	Mean area (km^2)	Mean perimeter (km)
Forests	40	2.296	11.493
Grass plots	78	0.544	3.647
Water objects	25	0.251	2.248
Swamps	24	0.506	3.491

by a combination of ecosystems, most clearly expressed on the Talmaza overflow lands.

To assess the unevenness of ecosystems distribution, as an indicator, the number of mapping units with different shares of individual ecosystems (percentage) was used (Figure 4). In almost half of the territory, the natural ecosystems are either absent or occupy less than 10%, and only in 4% of the territory their share exceeds 60%.

Fragmentation

In the economic valuation of the ecosystems conservation, the extremely important element is the assessment of their fragmentation that identifies areas in need of protection and restoration. Already, terrestrial and riverine habitats are becoming increasingly fragmented, which threatens the viability of the species and their ability to adapt, for example, to climate change

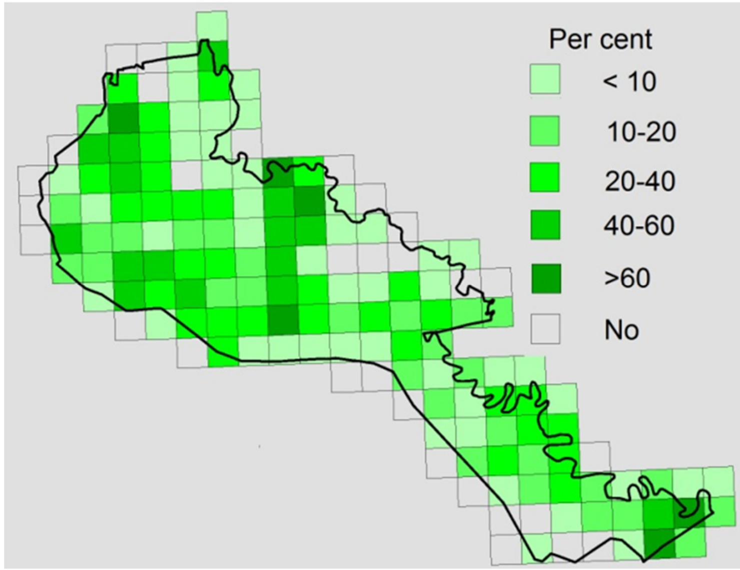

Figure 4. Distribution of natural ecosystems in the Ramsar site "Lower Dniester".

Table 2. Morphometric characteristics of large (>1,200 ha) forest areas.

Forest natural complex	Mean area (km^2)	Mean perimeter (km)	Fragmentation coefficient
Lunca Talmaza	16.93	43.38	2.56
Valea Stanei	25.30	91.20	3.60

(SCBD, 2010). Moldova lies in the zone of likely large-scale extinction of species under unfavorable conditions for adaptation: the excessive fragmentation of natural ecosystems and the deformed hydrological regime of its main rivers, first of all Dniester, against the background of general flow instability (Corobov et al., 2014). The fragmentation of ecosystems, combined with an increase in the area of disturbed lands, weakens the material-energy bonds between individual landscapes.

However, assessing fragmentation is not only the assessment of the ecosystems loss and vulnerability. It is also assessing the territorial distribution of all services provided by ecosystems. Quantitatively, the degree of fragmentation is estimated using various indices (McGarigal and Marks, 1994). In this study, as a quite informative index, the coefficient of fragmentation (CF), calculated as a ratio of an ecosystem's perimeter to its area, was used: the higher this ratio is, the more pronounced the fragmentation. Concurrently, the ecosystems' average area and their number were also used.

As an example, the results of the "Lower Dniester" forest and grass ecosystems' fragmentation assessment are discussed in more or less detail as follows.

Fragmentation of forest ecosystems

The total area of forests in the Lower Dniester wetland is about 9.2 thousand hectares, with a forest coverage rate of its territory at 15.3%, and a total number of woodlands of 40. The average area of woodlands is 2.3 km^2 (from 0.053 to 25.3 km^2) and the average perimeter is 11.5 km (Figure 5). Based on these values, here the forests average CF equals 5.1 (against 5.5 on average in Moldova), but changes significantly (from 2.67 to 68.54). Such a range indicates a high degree of forest ecosystems fragmentation and its territorial differentiation across the wetland. Moreover, such CF value is high for the Ramsar sites, thus requiring a system of measures to reduce it.

The available studies of the dependence of higher plant species richness in the area of their growth (Andreev et al., 2017) indicate that in Moldova there is a gentle trend of growth in the number of species in small areas and the beginning of its steep rise approximately at the level of 1,200 ha. In this regard, the analysis of the distribution of large forest areas (more than 1,200 ha) over the territory of the Lower Dniester was carried out. Table 2 presents the characteristics of two such areas.

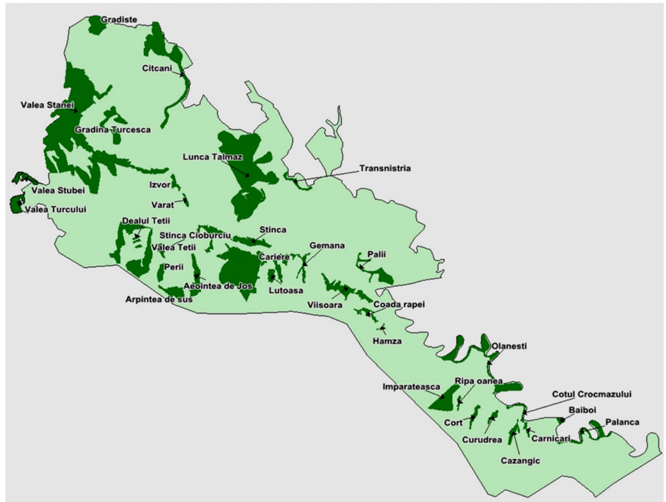

Figure 5. Territorial distribution of forest ecosystems in the Lower Dniester.

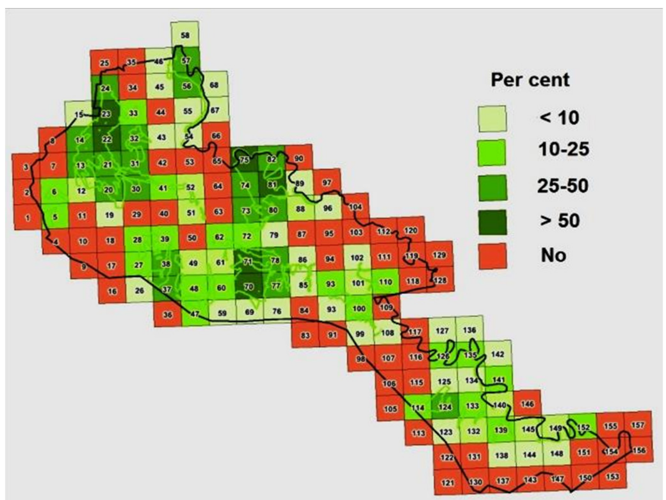

Figure 6. Percentage of forests covers in mapping units of the Lower Dniester wetland.

It is easy to see that CFs of large woodlands is significantly lower than their average for this wetland (5.1). At the same time, in 43% of the mapping units, forests are completely absent, and in 27% their share does not exceed 10% (Figure 6).

Fragmentation of grass ecosystems

Quantitatively, a degree of the sparseness of grass ecosystems (Figure 7) was also estimated, using the fragmentation coefficient. In addition, fragmentation of grass ecosystems was estimated by the number of grass plots and their average area.

On the whole, there are 78 grass plots in the Lower Dniester wetland. Its average area is about 0.54 km^2, significantly differing for individual plots: from 0.06 to 3.81 km^2, the mean perimeter of 3.65 km, and the resulting CF of 6.7, which is far exceeding the forest area. The assessment of grass ecosystems fragmentation through mapping units of the regular network is shown in Figure 7.

Fragmentation of water and swamp ecosystems

The total area of water bodies in the Lower Dniester

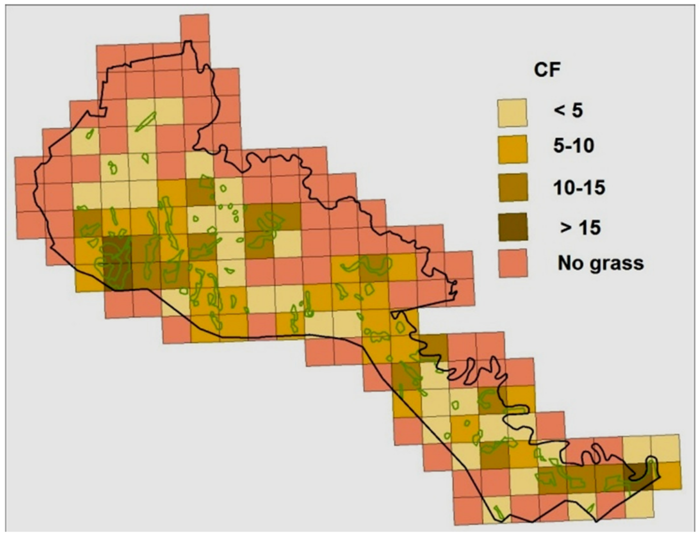

Figure 7. Fragmentation of grass ecosystems in the Lower Dniester in percentage.

Table 3. Morphometric characteristics of the water and swamp ecosystems in the Ramsar site "Lower Dniester".

Ecosystem	Number of objects	Mean area (km^2)	Mean perimeter (km)	Coefficient fragmentation
Water	25	0.251	2.248	8.95
Swamp	24	0.506	3.491	6.90

wetland accounts for about 0.63 thousand hectares (~6.3 km^2), or 1.1% of its territory; their average area is about 0.251 km^2, significantly differing for individual objects – from 0.01 to 1.93 km^2. The total area of swamp ecosystems is about 1.2 thousand hectares (~12 km^2), or 2% of the territory; their average area here is about 0.506 km^2, also significantly differing (from 0.003 to 6.87 km^2).

The morphometric characteristics of the water and swamp ecosystems, required for the assessment of their fragmentation, are given in Table 3. As can be seen in this table, the water ecosystems are more fragmented than those of the swamps.

Thus, as a result of the comprehensive review of all types of ecosystems in the Lower Dniester wetland, its total fragmentation decreases compared to the fragmentation of individual ecosystems, primarily due to the cumulative effect, as well as to their spatial discrepancy in the distribution over the territory of the site. Moreover, 20% of the territory is not provided with the considered types of natural ecosystems, and the level of provision with the natural environment stabilizing complexes can be considered satisfactory only for one-third of the territory. The highest natural diversity is characteristic of the Copanca-Leuntea, Lunca Talmaza and Tudora-Palanca complexes, mainly due to its swamps.

Economic valuation

The economic valuation (EV) of ecosystem services is a prerequisite to make optimal choices regarding their protection, conservation and sustainable use; EV also provides a set of tools for informed decision making. Through EV, the ecosystem goods and services can be comparable with other investments in economic activity, and as such they allow including properly the natural values in economic calculations. Highlighting how many ecosystems contribute to society, a valuation study helps to understand the benefits and costs of any intervention for their modification, while the lack of prices for such services leads to economic insecurity. Prices, which don't take into account the environmental component, give distorted signals about the importance of ecosystem services for society (GEF IW:LEARN, 2018; DEFRA, 2007).

The value of an ecosystem service in monetary terms depends on who is the potential payer, as well as on a number of other factors, including whether it will be possible to use this service on a sustainable basis in the

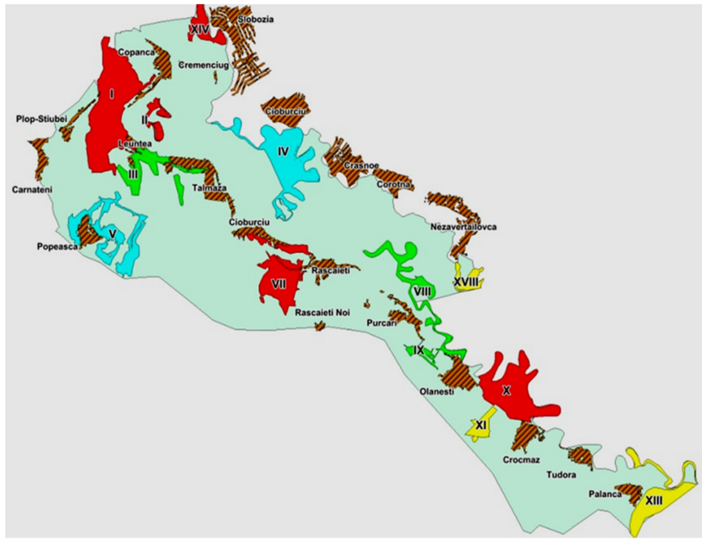

Figure 8. Key territories of the Ramsar site "Lower Dniester". Key territories: red, international; blue, national; yellow, local importance.

long term. Within any scheme involving the application of market mechanisms to ecosystem services, one of the main tasks is to determine their "true" value. There is no universal method for this, and in practice a number of approaches are used. Specific information on the various valuation methods is contained in different documents (GEF IW:LEARN; SCBD, 2007; TEEB, 2010).

The valuation of biological diversity as an ecological resource is conditionally accepted as a capitalized value of the current cost of services for its conservation. The methodological approach to estimating the costs of biodiversity conservation of the Ramsar site "Lower Dniester" was based on the approach that uses a so-called "reference value". The application of this unit of measure is due to the requirement to ensure that the uniformity of any economic valuation should be provided by the identity of units used for measurement. The reference value is usually (as well as in this work) obtained on the basis of available information on the cost of the biodiversity conservation services, by calculating the average cost per unit area. According to its idea, this approach is close to the *"benefit transfer"* method that is used in situations where significant expert knowledge and resources cannot be provided. In such cases, an economic valuation is conducted by transferring available information from the studies already completed in another location and context (GEF, 2018). Within the scope of the cited Guidance, this approach is referred as a ***"tier 1"*** project.

In particular, one of the latest global reviews of global estimates of the value of ecosystems and their services (De Groot et al., 2012) was conducted for 10 biomes and 22 types of ecosystem services. From the 320 publications with 1,350 estimates, these authors selected 650 comparable estimates for the analysis, and their average, minimum and maximum values were calculated. However, these estimates fluctuated significantly for all ecosystems services, sometimes by several orders of magnitude due to the fact that, as was shown, for example by Costanza et al. (1997), the value of ecosystem services was not valued directly by the market. Sometimes, the importance and corresponding values are driven mainly by the attitude towards them. In particular, the great attention paid to wetlands has led to a kind of paradox when the total value of their services was estimated at $25,682/ha per year, far exceeding the services of tropical and moderate forest biomes (5,264 and 3,013 $/ha per year, respectively, or grasslands – $2,871/ha per year).

In this study, the value of biodiversity, accepted as a "reference value", was found by averaging the literature information on the assessed values of the particularly rich in relation to their biodiversity territories. As a result, two indicators: the average minimum ($3,520) and the average maximum ($6,705), both per hectare, were identified as the reference values for economic valuation of such "key territories" in the Lower Dniester wetland (Figure 8). Also, an additional coefficient was introduced that took into account the quality and productivity of ecosystems *(Estimating coefficient),* based on the above estimates of their fragmentation. The sufficiently large areas of this Ramsar site, which are mainly found in the balance of local authorities and are occupied by low-quality tree vegetation, have also been taken into account in the conducted economic evaluations, but with a reduction factor of 0.1.

The results of the economic valuation of the biological diversity in the key territories of Lower Dniester are

Table 4. Economic values of the biodiversity of key territories of the “Lower Dniester”.

Code of key territory	Key territory	Area (ha)	Estimating coefficient	Value (millions of US dollars)	
				by minimum reference value	by maximum reference value
I, III	*Copanca-Leuntea, Tufa-Talmaza*	3,306	3	34.9	66.5
II	*Grădina Turcească*	251.0	3	2.7	5.0
IV	*Lunca Talmaza (Bălţile Talmaziene)*	1,686	5	29.7	56.5
V	*Popeasca*	1,188	4	16.7	31.9
VII	*Cioburciu-Răscăeţi*	1,192	4	16.8	32.0
VIII	*Răscăeţi -Olăneşti*	884	2	6.2	11.9
IX	*Purcari*	115	1	0.4	0.8
X	*Olăneşti -Crocmaz*	1,614	2	11.4	21.6
XI	*Impărăteasa*	267	1	0.9	1.8
XIII	*Tudora-Palanca*	894	3	9.4	18.0
XIV	*Pădurea Chitcani*	398	2	2.8	5.3
XVIII	*Diculi-Cuţa*	266	3	2.8	5.4
Forests under local authorities		2,558	0.1	0.9	1.7
	Total			***135.6***	***258.4***

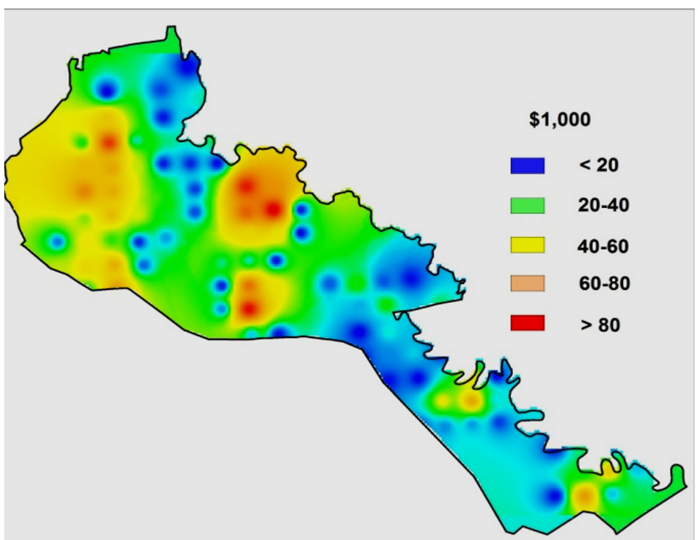

Figure 9. Economic value of biodiversity of the Ramsar site “Lower Dniester “.

shown in Table 4. These areas also serve as territory-cores of the national ecological network of Moldova (Andreev et al., 2012). The spatial interpolation of biodiversity values in the mapping units (Figure 9) demonstrates the pronounced territorial differences in the economic value of the ecosystems of this wetland.

Conclusion

An analysis of the wetland ecosystems of Moldova, based on the example of the largest of them, showed that a main feature of their spatial distribution is a very high fragmentation. The fragmentation adversely affects the level of biodiversity in wetlands and, consequently, the economic value of their ecosystem services. Despite the fact that the fragmentation of wetlands and their biodiversity is generally higher than that of other natural complexes in the country, greater conservation and improvement of their environmental sustainability remains a pressing economic task.

Therefore, the study carried out is of practical interest, firstly from the viewpoint of approaches to the definition of areas of first priority protection and restoration, which constitute a basis for the determination of priorities in the sequence of measures for their biodiversity conservation. The main problem in this issue is the lack or insufficient effectiveness of economic mechanisms, oriented directly towards such problem solving. There is also no doubt that economic evaluation is resource-intensive and its implementation requires significant expert knowledge. Countries like Moldova, where the necessary knowledge and resources are limited, usually use the experience of other countries in which such studies have already been completed, although in another location and context. Improving approaches and methods of economic valuation of biodiversity conservation services is an important direction for further research here.

From this point of view, the conducted research makes a certain contribution to the search for ways to solve these problems, since it demonstrates the national experience of a small developing country in the scientific substantiation of an economic assessment of biodiversity conservation based on a detailed quantitative study of the composition of ecosystems and the state of important natural complexes such as wetlands.

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The authors consider it their duty to note the now deceased Dr. Alexei Andreev, who was at the beginning of the research on this issue in Moldova.

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