

# Recreational Ecosystem Services of Environmental Protected Areas of Ukraine: Prospects and Implementation Obstacles

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## Abstract

The aim of the work was to analyse the essence of recreational resources as a component of ecosystem services for the planning and development of recreation within the protected areas of Ukraine. This study highlights the features and essence of the ecosystem services concept. The classification, characteristics and possibilities of cultural ecosystem services usage of protected areas are assessed, and the location and importance of recreational services are emphasized. Theoretical and methodological approaches to the recreational ecosystem services assessment of protected areas were performed using GIS tools. The negative consequences of the Russian Federation military aggression on the protected areas of Ukraine and the ecosystem services decline are considered. The main advantages and obstacles of implementing the ecosystem services concept for planning the recreation development of the Ukrainian nature reserve fund are discussed.

## Keywords

biodiversity, ecosystem services, GIS, protected areas, recreation, Ukraine

## Introduction

The rapid pace of global economic development is accompanied by increasing anthropogenic pressures on ecosystems. This is largely attributed to unprecedented natural resource exploitation throughout human history, with increasing ecosystem disruption at various levels which, in turn, leads to reduced biodiversity and the inability of an ecosystem to independently recover. Combining the desire and need to consume natural resources with the need to preserve and sustain the environment for present and future generations is a great challenge that may only be achieved through proper management, rational usage and ecosystem protection.

The classical approach to environmental protection is based on the implementation of legal measures that serve to protect and promote plant and animal species conservation along with associated habitats. Current methods of conservation are focused on limiting the degrading impacts of humans. However, there are not convincing arguments that such approaches are correct and justified, as it is undetermined whether societal spending on environmental protection is adequate.

The global scientific community is mobilizing efforts to develop a variety of biodiversity conservation concepts on a worldwide scale, shifting the ideology from an ecocentric to an anthropocentric approach based on the concept of ecosystem services (ESs).

ES concepts have been actively developing over the last decade and are discussed at various levels of scientific conferences. The number of publications devoted to this issue is rapidly growing, and practical results are reflected in numerous projects supported by the European Union, such as Millennium Ecosystem Assessment (MEA), The Economics of Ecosystems and Biodiversity (TEEB), Emerald Network, Open Scholarly Communication in the European Research Area for Social Sciences and Humanities (OPERAs) and Mapping and Assessment of Ecosystems and their Services (MAES). In these projects, the essence of ES, the available evaluation tools and the

experience of their application are systematized. The introduction of ESs is especially relevant in the context of the new European Union Biodiversity Strategy, which extends until 2030.

In accordance with its European integration commitments, Ukraine has approved, at the legislative level, the intention to introduce an ecosystem approach to all areas of socio-economic development as a basis for achieving good environmental status. The Ukrainian state ecological policy strategy through 2030 envisages the institutional development of ecosystem services, which should ensure opportunities for sustainable society development. It is assumed that by 2030, the biological diversity of Ukraine should be preserved and restored by providing ESs (Gavrilyuk *et al.*, 2021).

Protected areas (PAs) are vital to the implementation of regional, national and international biodiversity conservation programs. PAs are landfills for research, environmental monitoring, education, recreation, tourism, and protection of unique natural and cultural sites, and, at the same time, they are key providers of a wide range of ecosystem services. PAs are key to providing cultural and recreational ESs. Millions of people in Ukraine use ecosystem recreational services, but currently, many are underestimated as they are based on the individual recreational resources assessment rather than services as a whole. Implementation of the ES concept in recreational activities of PAs is an urgent and time-sensitive task (Kulczyk *et al.* 2014). The ES concept considers certain aspects of PAs, which are particularly relevant in terms of the quality of life and well-being of people. A characteristic feature of this approach is nature interpretation as a resource or capital, which creates a flow of services that meet both the material needs of society and the requirements for a sustained environment in addition to recreation and health needs.

The purpose of the work is to analyse the essence of the recreational resource as part of ESs for the planning and development of recreation in PAs of Ukraine. To achieve this goal, the following tasks were identified: 1) analyse the essence of recreational services and their place in ESs, 2) highlight the importance of ESs of PAs for recreational and tourism development, 3) consider theoretical and methodological approaches in assessing recreational ESs of PAs and 4) reveal the main advantages and prospects of practical ecosystem approach implementation in PAs.

## Literature review

The new approach to conservation has aroused great interest and discussion in scientific communities. ESs are global research subjects of interest (Costanza *et al.*, 1997; Daily, 1997; MEA, 2005; Brown *et al.*, 2007; Solon, 2008; Haines-Young, 2018). R. Costanza is responsible for substantiating the essence of the term „ecosystem services” and determined that they consist of material flows, energy and information from natural capital stocks, which combine with manufactured and human capital services to produce human welfare (Costanza *et al.*, 1997).

In Ukraine, literature primarily regards the implementation challenges and economic evaluation of ESs (Degtyar, 2012; Lukavenko *et al.*, 2017; Gavrilenko, 2018). In recent years, scientific developments on the systematization, classification, inventory, management and degradation of ESs of PAs have been revealed, which are reflected in the literature (Fedorenko, 2017; Varivoda, 2017; Gavrilenko, 2018; Shishchenko, 2019). In these publications, researchers emphasized the need to inventory ESs usage for tourism and recreation (Solon, 2008; Kulczyk *et al.*, 2014; Kalamucka, 2015). Studies assessing the value of ESs for recreation (Clough, 2013; Hermes *et al.*, 2018) and the cartographic methods for evaluating the potential of ESs for recreation (Vallecillo *et al.*, 2019) are noteworthy.

The number of scientific publications related to ES research continually grows, which indicates the relevance, interdisciplinary nature and prospects of this scientific issue. Despite the significant quantity of publications, several questions regarding certain categories of ESs in PAs, including recreational areas, warrant further research.

## Formation and development of ES concepts

The concept of „ecosystem services” first appeared in the 1970s, but it gained widespread scientific use in the early 2000s. Different authors interpret the „ecosystem services” concept in unique ways (Table 1), but all hold the view that ESs are a set of ecosystem benefits that people receive to fulfil needs. In this study, the following definition is employed – ecosystem services are a set of products and functions of ecosystems that are useful to human society in meeting both tangible and intangible needs to ensure its well-being. Ecosystem products include tangible goods that are directly consumed by humans. Thus, useful ecosystem functions include the support of life functions (e.g., cleansing functions) and those which enhance its quality (e.g., aesthetic values and cultural or scientific assets).

ESs can be considered as flows derived from ecosystem assets. Such reserves are referred to as natural capital, describing natural resources, including soil, air, water, living organisms that exist as complex ecosystems and relevant ESs necessary for human society to survive and prosper (Gavrilyuk *et al.*, 2021).

Potentially, ESs are restorative, but they can degrade or be lost due to inefficient management. A common international classification of ESs, Common, has been developed to preserve and maintain ecosystem capital. International Classification of Ecosystem Services (CICES) has a five-level hierarchical structure (section – subdivision – group – class – class type). More detailed types of classes make the classification user-friendly and provide more clarification as to which ESs are included in each class.

Table 1. „Ecosystem services” definition from different authors

<i>Definition of the concept</i>	<i>Author</i>
Ecosystem services – flows of materials, energy and information from natural capital reserves, combined with services production, as well as human capital to ensure human well-being.	Costanza, 1997
Ecosystem services are the benefits that people receive from ecosystems.	Millennium Ecosystem Assessment, 2005
Ecosystem services – flows that are generated by the structure and processes of ecosystems that are beneficial for humankind and occur naturally.	Brown, Bergstrom, Loomis, 2007
Ecosystem services – a set of products and functions of ecosystems that are useful to humankind. Ecosystem products include tangible goods that are directly consumed by humans. Instead, useful ecosystem functions include support of life functions (e.g., cleansing functions) and those that enhance its quality (e.g., aesthetic values and cultural or scientific assets).	Solon, 2008
Ecosystem services – the contribution of ecosystem structure and functions – in combination with other sources – for human well-being.	Burkhard <i>et al.</i> , 2012
Ecosystem services – functions of ecosystems that provide economic benefits to users of these services and are based on the implementation of various regulatory functions of nature.	Tikhonova, 2012
Ecosystem services – are flows of economic benefits and values that economic and other entities receive from the usage of existing ecosystem functions, as well as those formed in a result of generating, restoring, maintaining, regulating ecosystem processes and formed by economic entities.	Mishenin and Degtyar, 2015

In CICES, ESs are divided into three main categories: *provision services*, which include the provision of food or timber production; *regulatory services*, including air and water filtration, pollination and climate regulation, protection against natural disasters such as floods, etc.; *cultural ecosystem services*, which include recreation and leisure, education, aesthetic and spiritual development.

PAs are essential in preserving the biological diversity of Ukraine and, at the same time, provide a wide range of environmental services that should be considered when planning territory development and resolving nature conflicts.

The main conflicts of nature management within the Ukrainian PAs are related to improper use of certain PAs, excessive recreational loads, accumulation of garbage and landfills, illegal logging and poaching and the intrusion of invasive species.

The biggest losses of ESs concern PAs located within large cities containing the highest anthropogenic pressures on the ecosystems. However, in recent months, due to the Russian Federation military aggression, losses of ESs in Ukraine are extremely high. According to the Ministry of Environmental Protection and Natural Resources of Ukraine, as of May 1, 2022, the aggressor was conducting hostilities on the territory of 900 objects of the nature reserve fund, with a total area of 12,406 km<sup>2</sup> (1.24 million hectares), which is approximately one third of the Ukrainian nature reserve fund. The reserve fund includes 26 national parks and 14 nature and biosphere reserves. Fourteen Ramsar sites with an area of 397.7 thousand hectares, 200 territories of the Emerald Network with an area of 2.9 million hectares and biosphere reserves are currently under threat of destruction in Ukraine. Every day there are fires, animals are perishing and habitats disappear. Damage to ESs provided by PAs increases with each passing day of hostilities. Institutions of the nature reserve fund, the State Co-inspection and state enterprises of the forest industry record crimes against nature. The damage caused to these territories and their biodiversity will need to be assessed to further compensate the biodiversity losses in Ukraine.

### Recreational ESs of PAs

About 80–90% of the ESs of nature reserves and facilities are global ESs (climate regulation, global carbon balance stabilization, etc.), and the share of local ecosystem services (e.g., production) represents 2–3% of the volume (The Economics of Ecosystems and Biodiversity for National and International Policy Makers, 2009). Such local ESs include recreational, as PAs are important places where people visit for rest, recovery and strengthening of physical and spiritual needs. Recreation and ecotourism belong to the group of cultural ESs (Haines-Young and Potschin, 2018). In accordance with the CICES classification v. 5.1, cultural ESs of PAs can be divided into three sections, which include:

- Direct interactions with ecosystems that need to be in the environment. These are the services that facilitate health, recreation, research, education and aesthetic pleasure.
- Indirect or remote contacts – internal rather than physical interactions, often emotional, which do not require being in the environment. For instance, services that help to meet spiritual, religious and creative needs, broaden horizons, conduct entertainment, etc.
- Other features of living systems that have cultural significance (Table 2).

Ecosystem recreational services of PAs include recreation in nature, health improvement, nature observation, meeting the cultural and cognitive needs that people receive during walking, running, cycling and skiing, picnics, observation of flora and fauna, travel to enjoy the surrounding picturesque landscapes, fishing, hunting, picking berries, picking mushrooms, etc.

The nature reserve fund (NRF) has a significant share in the supply of these services in Ukraine, as it covers ecosystems that have special environmental, scientific, aesthetic, recreational and other values. PAs and objects within Ukraine are characterized by rich landscapes, biotic diversity, cleanliness and preservation of the natural environment, which makes them attractive as places of recreation for locals and tourists.

As of January 1<sup>st</sup>, 2021, the NRF of Ukraine consisted of 8,633 territories and objects comprising 4.485 million hectares. The NRF covers 6.8% of the territory of Ukraine. Approximately 63% of its area is occupied by territories and objects of national importance and 27% of local importance (<https://wownature.in.ua>).

The possibility of providing recreational services in each category of the NRF differs; in some cases, it is active recreation, while in others, it is in the form of more passive interactions with the environment. This is due to the functional purposes and tasks assigned to these categories. Recreational PAs primarily include national natural and regional landscape parks, which occupy about 50% of the NRF, as well as some biosphere reserves, parks, monuments of landscape art, zoos and dendrological parks (Table 3). The network of recreational PAs encompasses all regions of Ukraine and consists of five biosphere reserves, 53 national nature parks, 85 regional landscape parks, 13 zoological parks, 62 arboreturns and 588 parks-monuments of landscape art (<https://wownature.in.ua>).

Recreational activities are organized in accordance with the following: the functional zoning and organization projects of national natural parks and regional landscape parks; protection, reproduction and recreational use of their natural complexes and objects; organization projects of biosphere reserves and protection of their natural complexes; and maintenance and reconstruction projects (parks-monuments of landscape art, projects of territory organization of zoos, arboretums, etc.).

Table 2. Classification, characteristics and possibility of using cultural ecosystem services of protected areas on the basis of CICESV 5.1

Department	Group	Class	Usage	
Direct interactions with ecosystems that involve being in the environment	Physical and experiential interactions with the natural environment	Ecosystem characteristics that provide activities to promote health, wellness or enjoyment through active interaction	Use of PA ecosystem elements for sports, ecotourism, recreation, leisure and walks, etc.	
		Ecosystem characteristics that provide activities to promote health, wellness or enjoyment through observation or passive interaction	Use of PA ecosystem elements for the purposes of relaxation, counteraction to stress and depression using, at the same time, passive ways of perception (e.g., sounds, smells, picturesque landscapes, etc.)	
	Intellectual and representative interactions with the natural environment	Ecosystem characteristics that allow research or production of traditional ecological knowledge	Use of PA ecosystem elements for research, background monitoring and implementation of pilot projects.	
		Ecosystem characteristics that provide education and training	Use of PA ecosystem elements for the purposes of education and training, conducting field practices, educational camps, etc.	
		Ecosystem characteristics that are important regarding cultural heritage	Use of PA ecosystem elements as an element of cultural heritage and history of the region.	
		Ecosystem characteristics that allow to experience aesthetic sensations	Using PA ecosystem elements for aesthetic pleasure.	
	Indirect, remote, often internal interactions with ecosystems that do not require a presence in the environment	Spiritual, symbolic and other interactions with the natural environment	Ecosystem elements that have a symbolic meaning	Using PA ecosystem elements as a „business card” of a country or region
			Ecosystem elements of sacred or religious significance	Use of PA ecosystem elements for spiritual needs, such as religious and sacred places (springs, caves, grottoes, etc.).
			Ecosystem elements used for entertainment and demonstration.	The usage of PA ecosystem elements in media topics and materials for the interest and entertainment of viewers.
		Other characteristics of the natural environment that have untapped value	Characteristics or ecosystem features that have existential value	The use of PA ecosystem elements considering the individual characteristics of the individual user.
Ecosystem characteristics or features that can be recorded or memorized			The use of PA ecosystem elements in literary, artistic, cinematic creativity, etc.	
Other ecosystem features	Others	Others	–	

In turn, the development of recreational activities in Ukraine is not provided for nature reserves, sanctuaries, natural monuments, protected tracts and botanical gardens. However, the ecosystems of these PAs provide recreational services to local people and visitors in the form of nature observation, relaxation and rest to counteract stress and depression using passive ways of perception, such as sounds, smells and picturesque landscapes. In most instances, the fee for using this type of ES is either non-existent or symbolic.

Currently, when assessing the recreational activities of PAs in Ukraine, only those services that bring direct income from their implementation are considered. Some examples of direct income include entrance fees to national parks, excursion services, payment for hiking routes and ecological trails, services related to camping (setting fires, tents, car parking), accommodation and catering services, souvenir sales and tourist information products.

Table 3. Categories of nature-protected areas of Ukraine and associated possibilities for providing recreational services

Protected area category of Ukraine	IUCN protected area category	Amount	Area (square thousand hectares)	Recreational zones	Ecological trails	Touristic routes	Possibility of providing touristic services	
							Active interaction	Passive interaction
Nature reserves	I	19	206.6	–	+	–	–	+
Biosphere reserves	I	5	479.1	+	+	+	+	–
National nature parks	II	53	1,387.1	+	+	+	+	–
Regional landscape parks	V	85	828.8	+	+	+	+	–
Reservations	IV	3,398	1,434.4	–	+	+	–	+
Protected tracts	III	802	95.6	–	+	+	–	+
Nature monuments	III	3,580	35.6	–	+	+	–	+
Botanic gardens	V	28	1.9	–	+	–	–	+
Zoological parks	V	13	0.4	+	–	–	+	–
Dendrology parks	V	62	1.7	–	+	–	–	+
Park-monuments of landscape architecture and horticultural art	V	588	13.4	+	+	–	+	–

The cost of so-called recreational information ESs (non-commercial usage) is about twice as high as the cost of services that are commercial in nature (Mekush *et al.*, 2016). However, their value is not estimated and is not considered in the practical activities of PAs. Therefore, when comprehensively planning the development of PAs, including recreation and tourism, it is necessary to consider the cost of all ESs that people receive in meeting recreational needs.

The conditions for the installation of recreational services are the mandatory presence of consumers of these services in the ecosystem and consumer physical or intellectual interactions with them. Therefore, during recreational ecosystem assessment services, it is necessary to consider two groups of elements: natural resources (nature and availability) and the demand for specific services (Kulczyk *et al.*, 2014).

Boyd and Banzhaf (2006) highlighted that the benefits people receive from ESs are a complex good, with components comprising nature and ordinary man-made goods and services. Using the example of recreational fishing as a kind of recreation, they argue that the benefits people receive from ecosystems during the implementation of this activity consists of the following elements:

- direct ESs, such as water, fish and partial shore development.
- direct ordinary services including travel and partial shore arrangement as well as indirect ordinary services such as fishing equipment.

Therefore, the assessment of ESs for recreation and tourism should consider natural resources and the demand for them as well as the availability of appropriate infrastructure, goods and services that contribute to the receipt of these ecosystem benefits.

#### **Identification and evaluation of recreational ESs**

The implementation process of the ES concept in the practice of PAs should consist of four stages: identification of ESs, determination of economic value, determination of the beneficiaries of these services and formation of a mechanism of payments for ESs.

GIS technology is a widely used tool that can identify and evaluate ESs. By using GIS, inventory, mapping and ES spatial assessment can be conducted, and the geography of the main beneficiaries of these services can be determined. Some advantages of GIS are that it allows for the combination of diverse data in an analysis, it facilitates processing and the relations between different types of elements, and it uses detailed data from remote sensing of the Earth, which gradually expands the inventory scope.

Now, integrated modelling platforms are widely used to assess and map ESs. One of these platforms is InVEST (Integrated Valuation of Ecosystem Services and Trade off stool). These are a set of open access GIS tools, developed within the framework of the Natural Capital Project (<https://naturalcapitalproject.stanford.edu/software/invest>). It includes separate models for different ESs, which are used and combined to analyse spatial models of ESs or to track changes caused by changes in the surface of the earth. The main inputs to InVEST are land cover data and other relevant environmental variables, and the results are the ES assessments in biophysical and, occasionally, monetary units.

The purpose of the InVEST recreation model is to predict the spread of person-days of recreation, based on the locations of natural habitats, accessibility and built features, such as roads, that factor into decisions about where to recreate (Adamowicz *et al.*, 2011). In the absence of empirical data on visits to recreational areas, the program uses data obtained through a proxy to view photos with geotags posted on Flickr. Using photographs, the model predicts how future changes in natural objects affect the attendance levels and displays on the map current and future models of recreational usage.

The possibility of using the InVEST software complex to assess the recreational ESs of nature-protected territories of Ukraine is complicated by the insufficiency or absence of the necessary spatial data and empirical data on visits to recreational locations of nature-protected territories.

When conducting an economic assessment of recreational ESs, the method of transport and travel costs is commonly used (Solon, 2008; Mekush *et al.*, 2016). The idea of introducing the method of transport and travel costs was first proposed in the 1930s by H. Hotelling and was used to determine the value of US national parks. The primary prerequisite of the method is the identification of monetary costs associated with visiting the object with the cost of services that are being used. The assessment can only use the actual costs of moving visitors from the place of residence to the object and the costs incurred during the trip, such as accommodation, meals, ticket prices and souvenirs, in comparison to the stay of vacationers at home and the cost of earnings lost during recreation (Degtyar, 2012). To assess recreational services, PAs should estimate the average cost of vacationers to visit.

In connection with the current and difficult security situation in Ukraine, resulting from the Russian Federation military aggression, it is challenging to conduct a full-fledged and reliable investigation on the evaluation of recreational services of nature conservation areas based on the average costs to vacationers as it is based on a survey of respondents. During the survey of respondents, it is necessary to establish the types of recreation, the frequency and duration of visits to the nature conservation object, the type of transport and the types of food and accommodation.

However, future research and results of these assessments can be used to determine the recreational value of the territory and to establish an entrance fee that covers the costs of preserving and maintaining the recreational area.

## Summary and concluding remarks

In modern conditions of limited natural resources, there are conflict situations in society and in the administrations of PAs regarding the introduction of restrictive measures for nature use in the NRF. One such measure is to limit the recreational usage of a territory to reduce the natural degradation of complexes and preserve the recreational value. However, inventory, mapping and economic evaluation of ESs can provide a strong argument confirming the relevance and need for environmental measures to reduce anthropogenic pressures and preserve ecosystems on the basis of human well-being.

When determining the value of recreational ESs, it is necessary to consider the importance of these services at different spatial scales. Evaluation of recreational services within environmental territories is important both at the national and regional levels as well as at the level of a separate PA. At the state level, recreational ES assessments are important to justify the preservation of biodiversity and increase the network of PAs, which contributes to strengthening the health of citizens and improving the environmental situation. At the regional level, ES assessments are important regarding the preservation of PAs as unique and popular recreation areas for the residents of the region. Conducting assessments at the local level helps local people understand the benefits they receive from the PA ecosystems in which they are living.

The introduction of the ES concept in the recreational activities of Ukrainian PAs is hampered by a number of unresolved issues, the main of which are: the war with the Russian Federation; the lack of a separate strategy for the use and preservation of ESs at the legislative level; the lack of methodological recommendations for inventory, mapping and assessment of ESs at the local level (within the PA); the lack of a developed system for calculating compensation for the degradation of ESs; the low level of information and educational campaigning on the implementation of ESs; and the interdependence of human well-being and ecosystem sustainability.

Having solved the problems mentioned above, the introduction of the ES concept in the recreational activities of Ukrainian PAs will analyse the benefits and threats between economic and environmental aspects of recreational resources as part of ESs. Through assessing recreational ESs, their real value can be calculated and an objective entrance fee to the protected area can be established, which will contribute to additional funding for environmental activities. Given the cost of ESs, the consequences of different scenarios of PA spatial development during management decisions can be predicted and will play an important role as an informational and educational tool among vacationers.

Therefore, future research of recreational ESs in PAs, by using modern GIS tools, should include identification, assessment of economic value, beneficiary identification of services, formation of a payment mechanisms for ESs and modelling of possible recreational activities while maintaining ecosystem resilience.

## References

- Adamowicz, W. K., Naidoo, R., Nelson, E., Polasky, S. and Zhang, J., 2011, "Nature-based tourism and recreation: Theory and Practice of Mapping Ecosystem Services", in: P. Kareiva, H. Tallis, TH Ricketts, GC Daily and S Polasky (eds.), *Natural Capital: Theory and Practice of Mapping Ecosystem Services*. Oxford University Press, New York, NY, pp. 188-205.
- Boyd, J. and Banzhaf, H. S., 2006, *What are Ecosystem Services? The Need for Standardized Environmental Accounting Units*. papers.ssrn.com. Available at: [https://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=892425](https://papers.ssrn.com/sol3/papers.cfm?abstract_id=892425)
- Brown, T. C., Bergstrom, J. C. and Loomis, J. B., 2007, "Defining, valuing, and providing ecosystem goods and services", *Natural Resources Journal*, 47(2), 329–376.
- Burkhard, J., de Groot, R., Costanza, R., Seppelt, R. J., Argensen, S. E. and Potschin, M., 2012, "Solutions for sustaining natural capital and ecosystem services", *Ecological Indicators*, 21, 1–6.
- Chervanev, I. G., Bortnik, L. M. and Grishchenko, N. V., 2013, "Natural capital as a subject of environmental economics and a constructive factor of nature management", *Bulletin of H.M.U. named after V.N. Karazin*, 38(1049), 220–229.



- Costanza, R., 2008, "Ecosystem services: multiple classification systems are needed", *Biological Conservation*, 141(2), 350–352.
- Costanza, R., d'Arge, R., de Groot, R., Farber, S., Grasso, M., Hannon, B., Limburg, K., Naeem, S., O'Neill, R. V., Paruelo, J., Raskin, G. R., Sutton, P. and van den Belt, M., 1997, "The value of the world's ecosystem services and natural capital", *Nature*, 387, 253–260.
- Czajkowski, M., Bartczak, A., Markiewicz, O., Markowska, A., Melichar, J., Scasny, M. and Skopkova, H., 2007, "Lake water quality valuation-benefit transfer approach vs. empirical evidence", *Ekonomia*, 19, 156–193.
- Daily, G. C. and Matson, P.A., 2008, "Ecosystem services: From theory to implementation", *Proceedings of the National Academy of Sciences*, 105(28), 9455–9456.
- Degtyar, N. V., 2012, "Modern methods of economic evaluation of ecosystem services", *Effective Economy*, 2. Access mode: [http://nbuv.gov.ua/UJRN/efek\\_2012\\_2\\_45](http://nbuv.gov.ua/UJRN/efek_2012_2_45).
- The Economics of Ecosystems and Biodiversity for National and International Policy Makers // Responding to the Value of Nature, 2009, URL: <http://www.teebweb.org/wp-content>
- Fedorenko, M. A., 2017, "Classification of ecosystem services of protected areas", *Balanced Nature Management*, 6(1), 78–83.
- Gavrilenko, O. P., 2018, "Ecosystem services management: implementation strategy in Ukraine", *Bulletin of the Taras Shevchenko National University of Kyiv. Series: Geography*, 1(70), 29–35.
- Gavrilenko, O. P., 2019, "Conflicts of nature management in the context of ecosystem services losses", *Scientific Bulletin of Kherson State University. Series: Geographical Sciences*, 10, 101–106.
- Gavrilenko, O. P. and Tsyganok, E. Y., 2018, "Degradation of ecosystem services of protected areas in urban areas", *Bulletin of the Kyiv National University named after Taras Shevchenko. Series: Geography*, 4(73), 10–14.
- Gavrilyuk, R., Stankevich-Volosyanchuk, O. and Savchenko, S., 2021, *Ecosystem services and hydropower: pilot application of European instruments in the river basins of the Eastern Partnership countries. Case of Ukraine*. Kyiv: National Ecological Center of Ukraine.
- Haines-Young, R. and Potschin, M., 2018, Common International Classification of Ecosystem Services (CICES) V5.1 and Guidance on the application of the revised structure. <https://cices.eu>
- Hermes, J., Van Berkel, D., Burkhard, B., Plieninger, T., Fagerholm, N., von Haaren, C. and Albert, C., 2018, "Assessment and valuation of recreational ecosystem services of landscapes", *Ecosystem Services*, 31, 289–295.
- Kalamucka, W., 2015, "Ecosystem services for tourism on the example of the designed Roztocze Cross-Border Biosphere Reserve", *Studies and Materials of the Nature Education Center*, 45, 90–96.
- Karasev, O. O. and Chervanev, I. G., 2013, "Intangible nature management", *Problems of Continuous Geographical Education and Cartography*, 18, 70–73.
- Kulczyk, S., Woźniak, E., Kowalczyk, M. and Derek, M., 2014, "Ecosystem services in tourism and recreation: Revisiting the classification problem", *Economics and Environment*, 4, 84–92.
- Kulczyk, S., Woźniak, E., Kowalczyk, M., and Derek, M., 2014, "Scope and scale in the inventory of ecosystem services for tourism and recreation on the example of sailing", *Problemy Ekologii Krajobrazu*, 38, 135–147.
- Lukavenko, Y. I. and Derevskaya, K. I., 2017, "Economic assessment of the cost of direct ecosystem services usage of the Askania steppe (on the example of the biosphere reserve 'Askania-Nova')", *Scientific Notes of NaUKMA*, 197, 38–46.
- Mekush, G. E. and Ushakova, E. O., 2016, "Evaluation of the value of ecosystem services for the development of recreation and tourism", *Bulletin of Siberian State University of Geosystems and Technologies*, 33(1), 200–209.
- Millennium Ecosystem Assessment, 2005, *Ecosystems and Human Well-being: Biodiversity synthesis*. Washington D.C.: World Resources Institute, Island Press.
- Maes, J., Teller, A., Erhard, M. et al., 2014, *Mapping and Assessment of Ecosystems and their Services: Indicators for Ecosystem Assessments Under Action 5 of the EU Biodiversity Strategy to 2020*. Luxembourg: Publications Office of the European Union.
- Mishenin, E. V. and Dehtar, N. V., 2015, "Economics of ecosystem services: theoretical and methodological foundations", *Marketing and Innovation Management*, 2, 243–257.
- Natural Capital Project. InVEST models recreation – Access mode: <https://naturalcapitalproject.stanford.edu/software/invest-models/recreation>
- Nature Reserve Fund of Ukraine: official site – Access mode: <https://wownature.in.ua/>

- Regulations on recreational activities within the territories and objects of the nature reserve fund of Ukraine: Order of the Ministry of Environmental Protection of Ukraine dated 22.06.2009 nr. 330. URL: <https://zakon.rada.gov.ua> (application date 19.11.2019).
- Shishchenko, P. G., Gavrilenko, O. P. and Tsyganok, E. Y., 2019, "Ecosystem value of Holosiivskiy forest as an urban protected area: causes and consequences of degradation", *Ukrainian Geographical Journal: Scientific and Theoretical Journal*, 4, 40–49.
- Solon, J., 2008, "The concept of 'Ecosystem Services' and its application in ecological and landscape research", *Problems of Landscape Ecology*, 21, 25–44.
- Kumar, P. (ed.), 2010, *The Economics of Ecosystems and Biodiversity: Ecological and Economic Foundations*. London – Washington: Earthscan.
- Vallecillo, S., LaNotte, A., Zulian, G., Ferrini, S. and Maes, J., 2019, "Ecosystem services accounts: Valuing the actual flow of nature-based recreation from ecosystems to people", *Ecological Modeling*, 392, 196–211.
- Varivoda, Y. O., 2017, "Management of nature reserves and objects of Kharkiv region on the basis of ecosystem approach", *Bulletin of Kharkiv National University named after V.N. Karazin. Series: Ecology*, 16, 53–60.