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Ecosystem services of forests and their economic valuation: Prospects for sustainable development

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Abstract. The relevance of the topic is justified by the diversity of unique natural ecosystem objects in the territories of Kosovo and North Macedonia, where forestry activities are traditional. The aim of the study is to analyse the current state of ecosystem services provided by forests in Kosovo and North Macedonia in the context of their assessment and development prospects. Several general scientific empirical and theoretical research methods were employed, including comparison, generalization, analysis, synthesis, and abstract-logical methods. The article characterizes the current state of forest resource utilization in Kosovo and North Macedonia, highlighting key issues in the management of forest lands, including those hindering the development of ecosystem

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services. The study justifies indicators of the level of forest resource utilization in Kosovo and North Macedonia, examining the percentage ratio of forest cover indicators in the Western Balkan countries. The relationship between land areas of different categories and purposes in Kosovo is analysed, along with the designation of protected areas within forested areas in North Macedonia. The necessity of conducting an economic assessment of specific ecosystem services provided by forests is justified. Six methods used in the economic valuation of natural goods resulting from forest resource utilization are detailed, deemed most suitable for the Western Balkan countries. A comprehensive list of the most relevant functions of forests requiring economic assessment is compiled. Throughout the justification of all stages of the work, specific ecosystem services provided by forests that may gain greater importance in the future are identified. The practical significance of the study lies in forming the fundamental methodological aspects that can be utilized in the assessment of ecosystem services provided by forests

Keywords: natural forest complexes; Western Balkans; euro integration; climate change; qualitative and quantitative indicators

Introduction

Within the framework of the processes of rapid European integration, the policies of the Western Balkan countries aim to address environmental issues and conservation of natural resources in accordance with the norms and standards of the European Union related to standards for forest management, biodiversity conservation, forest fire control, and conservation of effective ecosystem forest services. Kosovo and North Macedonia, as countries with relatively unstable socio-economic development indicators, especially Kosovo with its precarious political situation, are obligated to incorporate the principles of the European Green Deal (2023) for the preservation of surrounding ecosystems and forest resources into their development strategies.

The issue of the insufficient balance in the functioning of ecosystem services provided by forests has become significantly more acute in Kosovo in recent times due to various factors. Over the past few years, forested areas have been excessively exploited and logged, primarily to meet the heating needs of the local population. Additionally, there is a lack of effective mechanisms for managing forest resources, and comprehensive programs for the development and protection of forested areas at the national level are nearly non-existent. If such programs do exist, they often involve tasks that are challenging to implement, while regulatory acts are not adapted to modern conditions and the needs of the forestry sector in the context of climate, hydrological problems, and soil degradation.

It is worth noting, that in North Macedonia, other problems related to the insufficient provision of ecosystem services by forests include illegal logging, the use of forested areas for other purposes, pollution with harmful substances due to anthropogenic activities, and the impact of other negative factors resulting from rapid urbanization. Loss of forest cover and low efficiency in forest regeneration are also notable issues. Forest resources have always held a fundamental place in the overall state system of the Western Balkans region. Therefore, it is essential to conduct an economic assessment of ecosystem services provided by forest resources. This serves as a crucial tool for ensuring sustainable forest management and the preservation of their natural capital. Such an assessment

plays a role in justifying the value of ecosystem services and evaluating the economic indicators of the indirect services of forests, such as climate regulation, soil moisture conservation, and others, which are inherently challenging to measure (Tykhonova *et al*., 2021).

F. Humolli *et al*. (2023) consider the utilization of Kosovo's forest resources within the context of its significant physical-geographical and tourist potential. The prevalence of extensive forested areas, nature conservation lands, and the diversity of biota, unique landscapes, and flora characterize the natural ecosystems of the country as an important recreational and tourist asset. In this context, references to forest protection directions and the designation of lands for recreational and nature conservation purposes are crucial. The creation of a database of nature conservation objects, forest inventory, and the formation of a tourism management system are possible through the application of effective qualitative and quantitative analysis methods.

Scholars A. Bajraktari *et al*. (2020) examine the advantages of Kosovo's territorial location at the centre of the Balkans concerning economic opportunities based on the use of natural resources, particularly forests. The authors note that the creation of new borders and trade restrictions between Kosovo and neighbouring countries following the breakup of Yugoslavia has changed the quantity and type of available timber. Despite political or economic factors, the forest and wood processing industry in Kosovo remains a crucial element of the national economy with potential for further development.

D. Sanchez *et al*. (2023) conduct an environmental assessment of Kosovo in the context of the negative problem of climate change using Google Earth Engine tools. One of the main elements in the research structure is the creation of a large-scale deforestation model over the last few years. This allows for the analysis of the temporal function and the determination of changes that have occurred for specific ecosystem services of the forest, such as reforestation speed and timber reserves.

A. Sertolli *et al*. (2023) examine the features of the functioning of natural forest complexes in the context of utilizing forestry waste for renewable energy purposes in Kosovo. The research results also highlight that Kosovo's forests currently provide an exceptionally high potential as a source of energy from biomass. This type of utilization of forest resources aligns with the directions of the European Green Deal initiative and the development of quality indicators for forest ecosystem services. Explorers Q. Ramshaj *et al*. (2021) conduct a detailed analysis of the current state of biodiversity in the natural forest complexes of Kosovo. The research reveals that many plant species are under the threat of extinction. Therefore, it is crucial to preserve and restore a wide range of different tree species, plants, animals, and microorganisms that interact with each other, creating ecological connections that contribute to maintaining balance in the system.

However, the issues of balanced use of forest resources in Kosovo and North Macedonia are not fully explored in the scientific literature, despite the unique natural ecosystems and landscapes of these countries and their significant socio-economic potential for the full revival of the forest industry and the provision of high-quality ecosystem services. The aim of the article is to substantiate the main reasons for the disruption of the cycle of effective forest ecosystem services in the territory of Kosovo and Northern Macedonia, and to identify areas of improvement in the utilisation of forest resources through modern methods of economic valuation of forest ecosystem services.

Materials and Methods

The information base of the research was the data from the International Monetary Fund

report on "Mitigation and Adaptation Challenges: How RSF (Resilience and Sustainability Facility) reform measures are aligned with the Green Agenda for the Western Balkans" (Republic of Kosovo..., 2023), which dealt with government policies and commitments from Kosovo regarding climate change, adaptation, and prioritization of the forestry sector to enhance environmental sustainability. According to the report formed by the representatives of the Economic Commission for Europe, the Food and Agriculture Organization of the United Nations, the Committee on Forests and Forest Industries and the European Forestry Commission on Forestry activities of the FAO Regional Office for Europe and Central Asia (2021), the report analysed the forestry activities of the FAO Regional Office for Europe and Central Asia analysed the current state of forest resources use in the territory of Kosovo and Northern Macedonia. Based on the Berlin initiative and the standing working group of the Regional Rural Development in South Eastern Europe (SWG) and their report Supporting the Regional Expert Working Group on Sustainable Forest Management in the Western Balkan Region (2022), the current state of forest management in Northern Macedonia and Kosovo was substantiated, in particular the ecosystem services of the forests of these countries were analysed in detail, as well as the main challenges currently existing in the field of forest management.

The scientific research was based on economic laws (law of self-interest, law of supply and demand) (Adam Smith Project, 2023), ecological laws (laws of biodiversity, climate change, toxic and hazardous substances, land, and water) (International Environmental Law..., 2017), their concepts and categories, as well as the main policy directions of European Green DEAL initiatives and modern geographical theories. The results of the work were substantiated by analysing the problem of declining indicators of forest ecosystem services and comparing the territorial development of natural forest complexes of two countries of the same historical and geographical region.

As a methodological basis, the general scientific methods of research were applied:

- method of analysis to substantiate the ratio of forest cover characteristics on the terrain of the Western Balkan states; characterization of the ratio of land area of different categories and purpose on the territory of Kosovo; description of the ratio of protected areas within forest areas on the territory of Northern Macedonia; formation of the main methodological aspects that can be used in the assessment of forest ecosystem services;
- synthesis method for studying the peculiarities of forest natural complex functioning in its integrity and mutual connection of its parts on the territory of Kosovo and Northern Macedonia, with the establishment of current problems of full utilization of forest ecosystem services;
- comparison method to characterize the current quantitative and qualitative indicators of forest lands on the territory of Kosovo and Northern Macedonia; substantiation of the problems of forest resources use affecting the quality of forest ecosystem services on the territory of Kosovo and Northern Macedonia;
- generalization method to justify the need for economic valuation of specific forest ecosystem services; presentation of methods used in the economic valuation of forest ecosystem services; in the context of economic, social and environmental aspects, further research directions in the field of prospective sustainable development of forest ecosystem services in the territory of Kosovo and Northern Macedonia were justified;
- abstract-logical method to clarify the essence of the main concepts, definitions, and categories in the field of forest ecosystem services and their economic valuation, as well as in generalizing and drawing conclusions.

During the study, the provisions of the international treaty aimed at preserving biological diversity – Convention on Biological Diversity (1992) and the norms of the Convention on the Regulation of International Trade in Endangered Species of Wild Fauna and Flora (CITES) (1973) were considered.

Results

The area occupied by forest resources is defined as a land plot with crown cover of trees of different species, or of the same type more than 10% and an area of more than 0.5 ha, where trees are able to reach a minimum height of 5 m and a maximum height of more than 100 m (Republic of Kosovo..., 2023). Forest resources are an important component of nature that includes various elements that can be utilized for different needs.

The ecosystem services of forests represent various useful functions and benefits that forests provide to people and other elements of the ecosystem. These services can be direct or indirect benefits, and they fulfil various ecological, economic, and social functions. Supply of wood and other forest products – the use of wood for construction, furniture, sports equipment, and musical instruments. Other forest products are needed for the food and medical industries. Water regulation – forest management plays an important role in water conservation and filtration, regulating water flows and ensuring water quality for different ecosystems and users. Climate regulation – trees absorb carbon dioxide, produce oxygen and influence the climate, which is important to combat climate change. Soil conservation – forest complexes help prevent soil erosion, preserve soil fertility, and improve soil morphological structure. Biodiversity – forest complexes promote the growth and maintenance of a large variety of plant, animal, and microorganism species (Zeki Başkent, 2021; Dashtbozorgi *et al.*, 2023). Recreational opportunities – areas occupied by forests serve as places for tourism, recreation, sports, and other recreational activities, which affect people's physical and mental health. Cultural heritage – some forest areas are natural monuments with a centuries-old history reflecting the culture and traditions of a region or country. For a full economic valuation of forest ecosystem services, the current advantages and disadvantages of forest natural complexes as a whole should be analysed.

Forest cover varies across the western countries of the Balkan region. The largest forest area is characterized by Bosnia and Herzegovina. At the same time, the countries presented in this study, namely Kosovo and North Macedonia, occupy the median forest cover in the overall ranking of countries in the Western Balkans (Fig. 1).

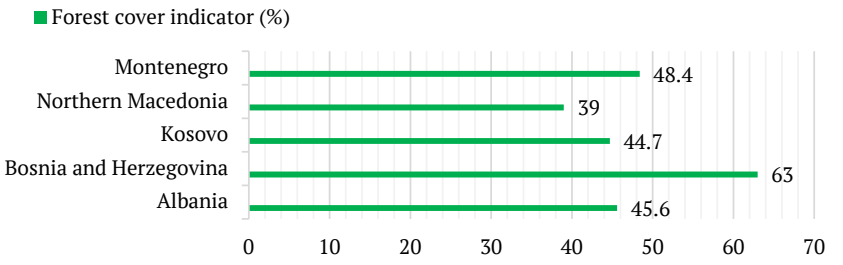

Figure 1. Percentage of forest cover in the countries of Western Balkans

Source: developed by the authors based on source data Forestry activities of the FAO Regional Office for Europe and Central Asia (2021)

It is important to note that the national policy directions for the effective management of forest resources are provided by the relevant executive authorities. For example, on the territory of Kosovo there is the Ministry of Agriculture, Forestry and Rural Development, which is subordinated to a separate executive body, the Forestry Agency. At the same time, in Northern Macedonia there is a sector of forestry and hunting, the peculiarity of this country is that the control over the lawful use of forest resources is carried out thanks to the Forest Police, which has responsibilities for the protection of forests in accordance with the Forest Law (2009) and is part of the Ministry of Agriculture, Forestry and Water Management (Sustainable Forest Management..., 2022).

The largest inventory of forests on the territory of Kosovo was conducted in 2012 and at that time the forest area was 481 thousand ha, respectively about 50% of the country's total area (Fig. 2). Since 2012 until now, changes in the forest area have been continuously monitored.

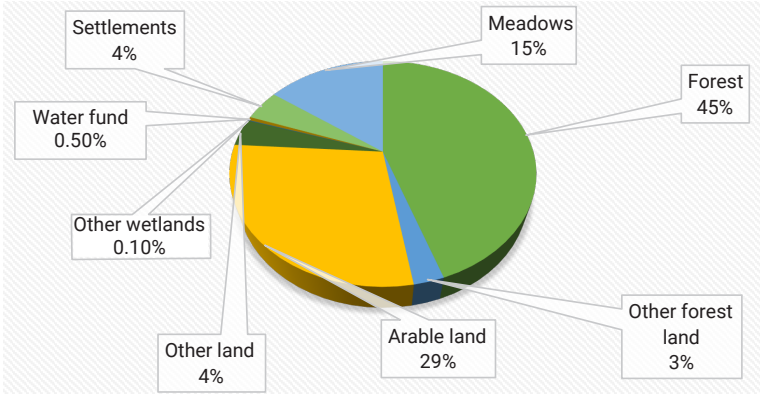

Figure 2. Percentage of land area of different categories and intended use in Kosovo

Source: developed by the authors based on source data Forestry activities of the FAO Regional Office for Europe and Central Asia (2021)

Since 2018, the implementation of the "National Forestry and Reforestation Programme of Kosovo", which will run until 2027, as well as the National Forest Health Programme (NFHP) 2018-2027 is taking place on the territory of Kosovo. The main objectives of these programmes are to increase the forest area by 5%. However, according to experts' assessments, these programmes contain rather complicated plans for implementation, as there is currently a shortage of highly qualified specialists in the forestry sector. In particular, insufficient funding of the programme also limits the implementation of its main goal. The main problems inhibiting the quality ecosystem services of forests in Kosovo are (Veselaj & Mustafa, 2015; Nichiforel *et al.*, 2021):

- more than 10% of the forest area is negatively affected by biotic and abiotic agents, which resulted in damage of 5.8 million m^3 of trees;
- forest fires, which occur in most cases due to the negligence of forest visitors or farmers, disturb forest areas in more than 12 thousand ha of the total forest area;
- cattle grazing causes mechanical damage to forestry lands on about 2 thousand ha of the total forest area;

• unfavourable weather conditions and climatic factors, such as drought and frost, affect the qualitative and quantitative properties of forests.

According to the latest forest inventory data, 40% of public forests and 29% of private forests in Kosovo are subject to uncontrolled or illegal logging. This situation is caused by the low socio-economic standard of living of rural inhabitants. At the same time, large amounts of forest residues are often left in the forest after logging, causing loss of forest fibre, increased insect pests and increased risk of forest fires (Sustainable Forest Management..., 2022). Soil degradation, in particular erosion inherent in mountainous areas, is the cause of decreasing quantitative indicators of forest resources, disturbing the integrity of surrounding ecosystems and reducing biodiversity.

Private forest owners do not currently produce quality forest management plans. Currently, the average private ownership of forest land is about 1.5 ha. As for Northern Macedonia, compared to Kosovo, the country has twice as much land area and forest natural complexes cover about 1 million ha, which is also twice as much. Accordingly, the forest area in Northern Macedonia accounts for 40% of the country's territory (Ramshaj *et al.*, 2021). Currently, the functioning of the forestry sector in Northern Macedonia is regulated by a few regulations, the most important of which is the document "Strategy for Sustainable Development of Forestry 2006-2026" (Sustainable Forest Management..., 2022). The key objectives of this Strategy are: balanced development of forest lands; protection of natural forest complexes, biodiversity; control of changing climatic conditions; implementation of effective mechanisms against soil degradation and desertification; effective spatial planning.

The main monitoring and evaluation of forest ecosystem services is carried out by the state enterprise "National Forests" and institutions for the management of protected areas. It is important to note that conservation and forest management in the territory of Northern Macedonia are identical concepts, which have a special role and importance. Thus, according to the intended purpose, more than 140 thousand ha of the total forest land area are special purpose forests, which include objects of national parks and multifunctional areas, as well as objects of natural reserve fund (Fig. 3).

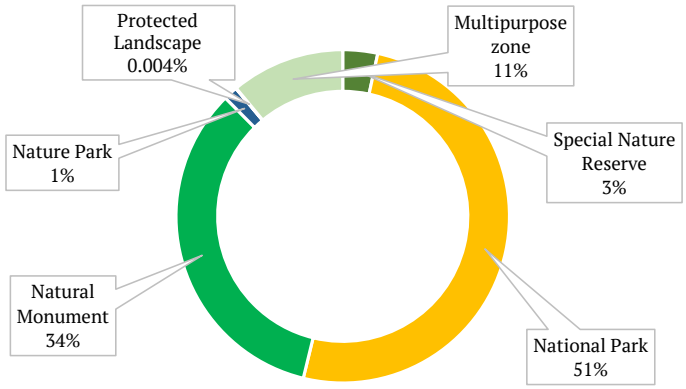

Figure 3. Percentage of protected areas within forested areas in North Macedonia

Source: developed by the authors based on source data Forestry activities of the FAO Regional Office for Europe and Central Asia (2021)

Private ownership dominates 11 per cent of the country's total forest land area, most of which is held by individuals or legal entities. It is important to note that private owners initiated the creation of the National Association of Private Forest Landowners (NAPFO). This organization has more than 200 forest management units in its membership, and is also engaged in the development of forest management plans, which are formed and improved every 10 years (Pérez-Sánchez *et al.*, 2021; Morgan *et al.*, 2022). It is also a positive practice that the country's leadership is trying to improve the level of training of forestry specialists by creating special school classes of forestry and landscape architecture. Such classes are currently established in 2 general education schools, and the Faculty of Forestry at the University of St Cyril and Methodius in Skopje is the highest institution for training forestry and landscape architecture specialists (Sustainable Forest Management..., 2022).

Even though the policy of North Macedonia aims to preserve the ecosystem services of forests at the heart of which solutions for reducing the risks of natural disasters, forest fires and ensuring hydrological balance, balanced land management in mountain landscapes, still some problems can be highlighted: insufficiently regulated legislative framework; lack of a complete, updated inventory of forest lands; lack of up-to-date indicators of quantitative and qualitative characteristics of forests; increase in the risk of forest degradation and forest degradation in the mountain landscapes. Forest ecosystem services cover a wide range of benefits and services provided to society, the economy, and the environment. Considering the characteristic features of the functioning of the forestry sector on the territory of Northern Macedonia and Kosovo, it will be relevant for these countries to conduct an economic valuation of specific forest ecosystem services (Table 1).

The economic valuation of forest ecosystem services is a complex process involving different methodologies and approaches (Fig. 4).

Table 1. Features of the economic assessment of forest ecosystem services in Kosovo and North Macedonia

Forest ecosystem service	Features of evaluation
Water conservation	Forests act as natural filters that improve water quality. The assessment may include measuring reductions in water treatment costs.
Biodiversity	Woodlands are home to many species of plants and animals. Biodiversity valuations may include the cost of conserving unique species and their genetic material.
Mitigating climate change	Trees absorb carbon dioxide, which mitigates the effects of climate change. Assessment may include measuring reduction in cost of climate disasters.
Recreational opportunities	Forests provide places for rest and recreation. However, economic assessment may include measuring profits from tourism and active recreation.
Provision of timber and non-timber products	Forests are a source of building materials, wood, cellulose, medicinal plants and other products. The assessment describes the market price of these materials.

Source: developed by the authors according to source Forestry activities of the FAO Regional Office for Europe and Central Asia (2021)

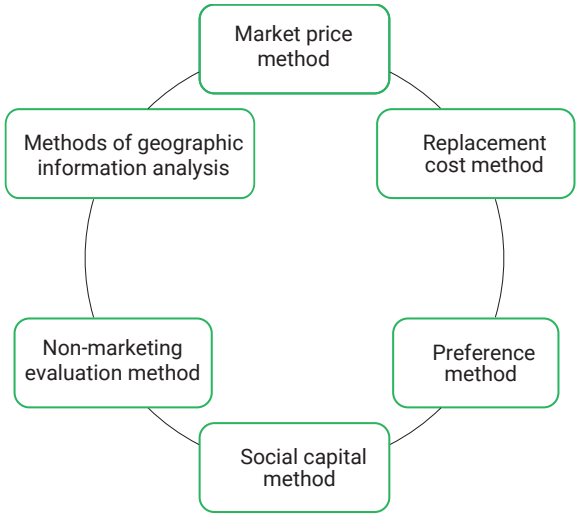

Figure 4. Methods used in economic valuation of forest ecosystem services
Source: developed by the authors

Thus, the economic valuation of forest ecosystem services aims to determine the value and importance of the various benefits and forest ecosystem services. Figure 4 presents six best-practice methods for economic valuation of forest ecosystem services for the territory of Kosovo and North Macedonia. The market price method is based on existing market prices of forest products and services, such as timber, forest products, tourism, and recreation. This method is applicable to those services that have direct commercial value. The replacement cost method calculates the replacement costs of ecosystem services, for example, if water or soil values are lost due to deforestation. The costs of restoring or creating alternative systems can serve as a basis for valuation. The preference method measures people's willingness to pay to conserve or restore ecosystem services. It can involve various survey and analysis techniques, such as contingent analysis, in which interviewees express their willingness to pay for certain benefits.

The social capital method compares changes in social capital (e.g. health, education, safety) before and after changes in forest ecosystems. This method seeks to link ecosystem services to societal well-being and living standards. The non-market valuation method has no obvious market analogue, in the context of climate regulation, biodiversity maintenance, aesthetic values. Various methods are used here, including expert judgement and life cycle value methods. Geo-information analysis methods rely on the use of geospatial data to assess and mapping ecosystem services, which can include estimating soil coverage, changes in vegetation, water quality and other parameters (Crivellaro *et al.*, 2021).

The assessment of forest ecosystem services is a complex and multidimensional process that involves analysing various aspects such as biodiversity, climate regulation, water resources and others. The main aspects of the methodology that can be used in the assessment of forest ecosystem services in the territory of Kosovo and Northern Macedonia are summarized in Table 2.

Table 2. Characteristics of the main methodological aspects that can be used in assessing forest ecosystem services

Methodological aspects	Characteristic
Identification and classification of services	Identification of various ecosystem services of forests. This may include services related to timber, water, climate, biodiversity, recreation and other aspects.
Quantification	Measuring or estimating the quantities and characteristics associated with the provision of ecosystem services. For example, volume of wood, amount of carbon, species diversity.
Selection of assessment methods	Selection of assessment methodology depending on specific services and data availability. Various methods may include economic methods, geographic information analysis, biophysical modelling.
Valuation of non-market services	For services that do not have direct market equivalents (e.g. climate regulation, maintaining biodiversity), use methods such as contingent analysis or preference methods to measure people's willingness to pay for these services.
Data Integration	Integrate results from different sources and valuation methods to form an overall picture of the value of ecosystem services.
Time frame	Accounting for temporary changes in the provision of ecosystem services and their values. This may include analysing trends and predicting future changes.
Stakeholder involvement	Involving stakeholders in the assessment process, such as local communities, businesses, and government agencies. This will help to accommodate different points of view and needs.
Results report	Generating reports describing methodology, data, results, and conclusions. Documenting all methodology and data used is important for transparency and reusability.
Update and adjustment	Regularly update assessments to reflect changes in forest conditions, including due to climate change, human impacts and other factors.

Source: developed by the authors

The future of forest ecosystem services depends on several factors such as climate change, technological advances, social and economic transformations. However, some forest ecosystem services may become more important in the future, in particular: carbon storage and offsetting services may become more popular due to increasing attention to climate change (Weiss *et al.*, 2019). Forests can be used to produce carbon credits and other emission reduction instruments. Forests are major sources of biodiversity, and services related to conserving the gene pool of forest species and maintaining biodiversity may increase in importance in the future. Some forest species may contain various bioactive substances with medicinal properties. The development of forest medicine as a separate branch and biopharmacy may bring out new possibilities for medical utilization of forest resources. The use of modern technologies such as satellite data, drones and artificial intelligence can improve forest management to optimize the supply of various ecosystem services.

Discussion

Forest ecosystem services play a key role in ensuring the stability of natural ecosystems and

human well-being. The economic valuation of these services is important for sustainable development and efficient environmental management. Forests provide a wide range of ecosystem services, including purifying air and water, supporting biodiversity, regulating climate, supplying timber for industrial purposes, and providing raw materials for pharmaceuticals and nutrition. Assessing the economic value of these services helps to understand their importance to the economy and society. Forests provide recreation and leisure areas, improving people's physical and mental health. In doing so, economic valuation helps to account for these positive impacts on quality of life. The ecosystem services of forests act as natural barriers, protecting against landslides, floods, and other natural disasters (Ospanova *et al*., 2021). Economic valuation incentivizes the development of sustainable forestry practices, balancing timber extraction with the preservation of ecosystem functions. Justifying the total return from forestry operations to the national economic system helps in determining optimal natural resource management strategies and managing the risks associated with the loss of ecosystem services.

X. Naime *et al*. (2020) from Norway and Mexico explore the characteristics of natural regeneration of secondary forests as an important source for the provision of forest ecosystem services to meet consumer needs. The authors also note that balanced land management is also critical for climate change mitigation. However, to maximize natural regeneration, synergies between different types of forest ecosystem services and consumers need to be established. In doing so, scientists recommend applying economic valuation of forest ecosystem services through contingent valuation and direct market value methods. Such a method is appropriate for determining the stocks of wood and carbon sinks in young and secondary forests. As a result of the study, it was possible to establish that for consumers or landowners it would be more economically efficient to naturally regenerate older forest areas because young secondary forests are valued for the future, not for the present. Natural regeneration of forests is the key to the provision of all other services and goods resulting from forest management (Onopriienko *et al*., 2023). It is worth agreeing with the fact that balanced management and rational utilization of forest resources is the key to a faster recovery of the qualitative and quantitative properties of forests. This study notes the extraordinary role of forests in preventing active climate change, but does not detail the processes of natural forest regeneration.

D. Saha & A. Taron (2023) from India and Sri Lanka explore the general concept of forest natural complexes ecosystem and their importance for maintaining sustainable ecological and economic development of the country. The forest ecosystem is fundamental to economic-ecological permanence. India is home to the largest forest complex on planet earth, the Sundarbans. It is this complex that provides numerous ecosystem services to the forest dwellers and the local rural population. In this study, scientists used the non-market valuation or contingent valuation method to determine the personal contribution that the population is willing to make to accelerate the natural regeneration processes of the forest. Currently, consumers are willing to forego excessive cutting of timber or obtaining other forest products during active forestry activities (Ivanova *et al*., 2023). This position of the population allows the largest forest area on the planet to have a perspective of development and future. The present study confirms the importance of the results of the work from India and Sri Lanka because the key role in the conservation of natural resources, in particular natural forest complexes, is played by human consciousness

and understanding of the fact that the present requires the population of the planet Earth to understand the significant damage from excessive anthropogenic pressure. In this analysis, the authors present information revealing the problem of rather uncontrolled deforestation in both Kosovo and Northern Macedonia. Large-scale forest fires are not uncommon as a result of farmers' activities in Kosovo.

K. Shrestha *et al*. (2023) from Nepal and Switzerland note the importance of research on the features of biodiversity as an important ecosystem service of forests in the territories of the Far Eastern Himalayas. The paper finds that most of the studies conducted recently have analysed the quantity of timber reserves, water use patterns, and recreational services. Only 15% of all studies focus on biophysical characterization and assessment of socio-cultural aspects. The authors also advise that during the study of ecosystems. their forest services should be considered in an integrated manner, rather than individual components of natural forest complexes. In doing so, the causes and issues that influenced the disruption of the overall ecosystem cycle should be justified. This paper shares the importance of research in the context of an integrated study of all ecosystem services, at least a brief analysis of them to enable the formation of an overall system, as each country will have its specificities, considering climatic, resource, socio-economic and political aspects. In the present study results, experts note that a full economic valuation of the use of forest resources and the provision of related ecosystem services requires an analysis of current advantages and disadvantages in the functioning of forest natural complexes as a whole.

F.A. Taye *et al*. (2021) from Denmark and Australia consider the importance of meta-analyses of the economic value of global forest ecosystem services in the context of an effective tool for understanding and assessing the contribution of forests to the economy and the overall well-being of society. Such analyses systematize and synthesize existing economic research and data aimed at determining the value of the diverse ecosystem services that forests provide. The value of conserving the unique plant and animal species that exist in forests can be determined based on the value to science, the potential medicinal or biotechnological value of some species (Skliar *et al*., 2020). Forests influence atmospheric composition by deepening carbon and providing other climate services. The value of services can be determined in the context of reducing greenhouse gas emissions and building climate resilience. Forests offer places for recreation, tourism, and other recreational activities. The value of this service can be determined through the tourism industry and other ways of spending time in forests (Hrynyk *et al*., 2023). Meta-analyses can help to establish an overall picture of the economic value of forest ecosystem services and their impact on the sustainable development of society. It is also important to consider social and environmental aspects when considering the value of forests to society. In the current results of the study, the authors partially analysed forest natural complexes, considering their contribution to the national economic system.

In summary, the forest ecosystem services and other natural complexes not only sustain nature, but are critical to sustainable development and human well-being. Conservation and sustainable management of ecosystems are key to safeguarding these important services for future generations. For example, forests are an important element of ecological resilience, facilitating adaptation to changes in the natural environment and the robust functioning of ecosystems. Trees and vegetation keep the soil layer from degradation processes and prevent erosion. This helps maintain soil fertility

and prevents pollution of water bodies. Forests create natural landscapes that are attractive for recreation, tourism and leisure, contributing to the physical and mental health of people.

Conclusions

Forest ecosystem services are the diverse benefits and functions that forests provide to the environment, society, and the economy. They include aspects such as climate regulation, water harvesting and filtration, biodiversity, provision of timber, honey, and medicinal plants, as well as recreational and cultural values. These services play a key role in sustainable development, maintaining the ecological balance and well-being of countries, regions.

Despite numerous challenges, the ecosystem services of forests in the territory of Kosovo and Northern Macedonia are a significant source of economic potential. An effective forest management policy can be the first step in achieving the desired high income from the forest industry in the system of national economy, as well as sustainable future development of forest ecosystem services. Due to the unique configuration of relief on the territory of the Western Balkans, the identity of geological and pedological composition and climatic conditions, it is possible to develop ecotourism in Kosovo and Northern Macedonia, which will involve forest areas as a territorial basis for the provision of this ecosystem service. At the same time, the preservation of the qualitative and quantitative properties of forest lands in these countries plays a considerable role in the socio-economic development of rural areas. In this case, the consumer demand of the population can be provided with various ecosystem services of forests, in particular, the use of wood, technical, medicinal, and other forest products.

Sustainable development of forest ecosystem services is a key aspect of ensuring the ecological balance and well-being of society and requires a comprehensive and integrated approach that considers economic, social and environmental requirements. In particular, further research directions in the field of prospective sustainable development of forest ecosystem services could be: integration of forest ecosystem services into regional and local development strategies; developing financial instruments such as carbon credit markets to create economic incentives for the conservation and restoration of forest ecosystem services; building collaborative work with local communities, forest owners, businesses, and government will promote a balanced approach to managing forest ecosystem services; designing green infrastructure based on forest ecosystem services; development and implementation of effective legal mechanisms is a key factor in ensuring the sustainable development of forest ecosystem services.

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Conflict of Interest

None.

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Екосистемні послуги лісів та їх економічна оцінка: перспективи сталого розвитку

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Анотація. Актуальність теми зумовлена різноманіттям унікальних природних екосистемних об'єктів на територіях Косово та Північної Македонії, де лісогосподарська діяльність є традиційною. Метою дослідження є аналіз сучасного стану екосистемних послуг, що надаються лісами в Косово та Північній Македонії, в контексті їх оцінки та перспектив розвитку. Використано низку загальнонаукових емпіричних і теоретичних методів дослідження, зокрема порівняння, узагальнення, аналіз, синтез, абстрактно-логічний метод. У статті охарактеризовано сучасний стан використання лісових ресурсів у Косово

та Північній Македонії, виокремлено ключові проблеми в управлінні лісовими землями, зокрема ті, що перешкоджають розвитку екосистемних послуг. У дослідженні обґрунтовано показники рівня використання лісових ресурсів у Косово та Північній Македонії на основі аналізу відсоткового співвідношення показників лісистості в країнах Західних Балкан. Проаналізовано співвідношення між земельними площами різних категорій та цільового призначення в Косово, а також виділення природоохоронних територій у межах лісових масивів у Північній Македонії. Обґрунтовано необхідність проведення економічної оцінки конкретних екосистемних послуг, що надаються лісами. Детально описано шість методів економічної оцінки природних благ, отриманих в результаті використання лісових ресурсів, які вважаються найбільш придатними для країн Західних Балкан. Складено вичерпний перелік найбільш важливих функцій лісів, які потребують економічної оцінки. В ході обґрунтування всіх етапів роботи визначено специфічні екосистемні послуги, що надаються лісами, які можуть набути більшого значення в майбутньому. Практичне значення дослідження полягає у формуванні фундаментальних методологічних аспектів, які можуть бути використані при оцінці екосистемних послуг, що надаються лісами

Ключові слова: природні лісові комплекси; Західні Балкани; євроінтеграція; зміна клімату; якісні та кількісні показники