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ECOLOGICAL AND ECONOMIC ASPECTS OF RESOURCE MANAGEMENT IN NATIONAL PARKS OF SERBIA

Abstract: *As important protected areas, national parks of Serbia face the increasing challenge of sustainable natural resource management. This paper explores opportunities to enhance the existing management through an integrated approach, focusing on the synergy between biodiversity conservation and the economic valorisation of ecosystem services. Through a combination of strategic document analysis, a review of scientific literature, and empirical case studies in selected national parks, this research critically assesses current methodologies and proposes an innovative methodological framework. Within the case studies, qualitative and quantitative methods will be employed for a detailed analysis of biodiversity status, identification of priority ecosystem services, and assessment of their economic potential. The aim of the research is to define concrete policy and practice recommendations for improving the integrated management of national parks in Serbia and ensuring long-term biodiversity conservation, while sustainably valorising ecosystem services for the benefit of local communities and society as a whole.*

Keywords: biodiversity, ecosystem services, valorisation, integrated management, national parks of Serbia

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INTRODUCTION

National parks are the most strictly protected areas in the Republic of Serbia, encompassing ecosystems of exceptional biodiversity, landscape value, and cultural significance. Covering approximately 1.5% of the national territory, the five designated national parks: Tara, Kopaonik, Fruška Gora, Đerdap, and Šar Mountain form the ecological backbone of the country and are classified primarily under IUCN categories II and V (Avramović, 2014). These protected areas play a crucial role in conserving endemic and relict species, maintaining ecological balance, and offering a wide array of ecosystem services.

Despite their ecological importance, Serbian national parks face increasing pressures stemming from unsustainable resource use, underfunded conservation frameworks, and insufficient integration of socio-economic objectives into management plans (Milutinović, 2019). Challenges such as unregulated tourism, illegal logging, inadequate waste management, and weak enforcement mechanisms threaten both biodiversity and the long-term provision of ecosystem services (CIB, 2021). Moreover, economic valuation of ecosystem services is rarely applied in practice, which limits the visibility of their contribution to human well-being and local economies (Avramović, 2005).

A prevailing characteristic of natural resource management in these areas is the dominance of conventional (sectoral) approaches, which often prioritise short-term economic gains over long-term

ecological sustainability. Consequently, the current paradigm fails to acknowledge the interdependence between ecosystem health and sustainable development (Adžemović, 2016). Recent policy recommendations and academic discourse advocate for a shift toward integrated management strategies that reconcile biodiversity protection with economic valorisation, particularly through participatory governance and the application of ecosystem-based models (WWF Adria, 2017; Milutinović, 2019).

This paper aims to explore the ecological and economic aspects of natural resource management in Serbian national parks by employing a multidisciplinary framework. Through strategic document analysis, literature review, and selected case studies, the research identifies critical shortcomings in current practice and proposes a comprehensive methodological framework that integrates biodiversity conservation with sustainable economic utilisation of ecosystem services.

THEORETICAL BACKGROUND

Ecosystem Services and Their Classification

Ecosystem services represent the benefits that humans derive from functioning ecosystems, and they are typically classified into four broad categories: provisioning (e.g. food, water, timber), regulating (e.g. climate regulation, flood control), cultural (e.g. recreation, spiritual value), and supporting services

(e.g. soil formation, nutrient cycling) (MEA, 2005). In the context of national parks, these services are particularly significant due to the high level of biodiversity and relatively undisturbed natural processes.

The recognition of ecosystem services as a measurable and valuable output of protected areas has significantly contributed to redefining conservation strategies. Rather than focusing solely on preservation, contemporary management frameworks now seek to ensure the sustainable delivery of ecosystem services for the benefit of current and future generations (Ruiz-Frau et al., 2017).

Economic valorisation of ecosystem services

Economic valuation is a crucial tool for quantifying the importance of ecosystem services and integrating them into policy and decision-making. Methods such as contingent valuation, cost-benefit analysis, and ecosystem accounting allow for the estimation of the monetary value of natural capital (Costanza et al., 2014). In Serbia, however, the application of these methods in national park management remains limited, often due to the absence of reliable ecological and socio-economic data (Avramović, 2005).

The lack of economic visibility of ecosystem services contributes to their undervaluation and, consequently, to resource mismanagement. A shift toward economic valorisation can help align conservation priorities with sustainable development goals by highlighting the real value that ecosystems provide to local communities and national economies (Milutinović, 2019).

Integrated natural resource management in protected areas

Integrated natural resource management (INRM) is an approach that combines ecological, social, and economic objectives into a unified framework. Unlike conventional sectoral management, INRM recognises the interconnectivity of ecosystem components and emphasises adaptive, participatory, and cross-sectoral decision-making processes (IUCN, 2013). The effectiveness of INRM has been demonstrated in numerous case studies globally, particularly in landscapes characterised by complex socio-ecological interactions.

In the context of Serbia's national parks, integrated management is essential for balancing conservation goals with the economic needs of local communities. This involves multi-level governance, transparent institutional arrangements, legal mechanisms, stakeholder participation, and effective monitoring and evaluation systems (WWF Adria, 2017; CIB, 2021).

METHODOLOGY

This research employs a qualitative-quantitative mixed-method approach aimed at critically evaluating the ecological and economic dimensions of resource management in Serbia's national parks. The methodology combines a review of strategic documents

and scientific literature, field-based case studies, and expert evaluation to develop an integrated management framework tailored to the socio-ecological realities of the parks.

Document and policy analysis

The study begins with an analysis of national and international strategic and legal documents related to biodiversity conservation, protected area governance, and ecosystem service management. Key sources include the Law on National Parks (National Assembly of the Republic of Serbia, 2015), the Law on Nature Protection, Serbia's Biodiversity Strategy, as well as international conventions, such as the Convention on Biological Diversity (CBD) and the Aarhus Convention. The objective is to identify institutional gaps, overlapping responsibilities, and implementation inconsistencies that hinder effective management.

Literature review

An extensive review of peer-reviewed scientific literature, grey literature (institutional reports, NGO publications), and doctoral dissertations was conducted. Sources were selected for their relevance to ecological economics, conservation policy, and integrated resource management. Special emphasis was placed on studies addressing the valuation of ecosystem services, governance structures in protected areas, and participatory management models (Adžemović, 2016; Milutinović, 2019; Avramović, 2014; CIB, 2021).

Case studies

Three case studies were selected to reflect geographic, ecological, and governance diversity among national parks in Serbia:

- *Fruška Gora national park*, characterised by significant anthropogenic pressure and overlapping land uses;
- *Tara national park*, a model for forest ecosystem conservation with developing ecotourism initiatives;
- *Đerdap national park*, notable for its transboundary ecological value and conflicts arising from hydroelectric infrastructure.

For each park, data on biodiversity status, protected zones, land use dynamics, and economic activities (e.g. tourism, forestry, local enterprise) were collected through official reports, GIS maps, and publicly available monitoring data from the Institute for Nature Conservation of Serbia and the Environmental Protection Agency.

Stakeholder perspective and participatory elements

Where available, perspectives from local community representatives, park authorities, and NGOs were incorporated through desk-review of reports, user councils (WWF Adria, 2017), and previously conducted participatory studies. These sources help to assess how inclusive and responsive current management models are to stakeholder needs and ecological objectives. It should be noted that this

research relies on the analysis of these secondary data sources for stakeholder perspectives, as primary data collection through new interviews or surveys was beyond the scope of this particular study.

RESULTS AND DISCUSSION

Current state of natural resource management in Serbian national parks

Serbia's national parks (NPs) are characterised by rich biodiversity and diverse ecological functions, but their management is often constrained by overlapping competences, limited financial resources, and insufficient institutional coordination (Avramović, 2014).

In Fruška Gora NP, intense anthropogenic pressure, especially through tourism, agriculture, and illegal construction, has led to significant habitat fragmentation and ecosystem degradation (CIB, 2021). The management plan prioritises infrastructural development and timber extraction, often at the expense of conservation objectives.

Tara NP, by contrast, is considered an example of better-integrated conservation planning. It maintains stable populations of large mammals, such as the brown bear (*Ursus arctos*), and supports ecotourism initiatives based on biodiversity and landscape value. However, there is still a lack of systematic valuation of ecosystem services and their inclusion in economic planning (Milutinović, 2019).

In Đerdap NP, conflicts arise from the coexistence of protected natural values and large infrastructure such as the Iron Gate hydroelectric power plant. Changes in water levels have affected riparian ecosystems and fish habitats, yet management efforts remain limited in their capacity to reconcile ecological goals with energy and transport policies (Adžemović, 2016).

The main challenges of current practices include:

- *Fragmentation in the implementation of measures* – lack of coordination between different sectors often leads to overlaps or inconsistencies in measures.
- *Limited financial resources* – funds allocated for nature conservation and local infrastructure development are often insufficient.
- *Lack of integrated planning* – ecological and economic goals are not adequately aligned in existing management plans.
- *Insufficient involvement of local communities* – local communities are often not sufficiently included in decision-making processes, which can lead to conflicts of interest.

Primary ecological priorities in Serbia's national parks include:

- *Habitat protection and restoration* – implementing measures to preserve natural habitats and revitalize threatened ecosystems.

- *Biodiversity monitoring* – regular assessments of key species populations and identification of priority areas for conservation.
- *Control of invasive species* – mitigating the impact of invasive species that threaten local ecosystems.
- *Climate change adaptation* – introducing strategies to manage the effects of climate change on natural resources.

These activities require an interdisciplinary approach and ongoing collaboration between researchers, institutions, and local communities.

Valuation and prioritisation of ecosystem services

Across all three parks, provisioning services (e.g. timber, non-timber forest products, water) dominate management strategies, while regulating and cultural services remain undervalued or ignored. This reflects a broader trend in Serbian protected areas, where short-term extractive economic benefits are prioritised over long-term ecological sustainability (Avramović, 2014). For example, the potential of carbon sequestration in Tara's forests or the value of pollination services in Đerdap is neither quantified nor reflected in park revenue structures.

Furthermore, cultural ecosystem services – such as spiritual value, recreation, and educational use – are often acknowledged rhetorically but lack budgetary or operational support. In Fruška Gora NP, the zoning system allows construction in areas with high biodiversity value, which undermines the park's cultural and ecological integrity (CIB, 2021).

Toward integrated and participatory management

The lack of stakeholder involvement in decision-making processes has been repeatedly identified as a barrier to effective governance. While Serbia's Law on National Parks recognises the role of user councils, in practice these bodies lack authority and operate with limited transparency (WWF Adria, 2017). Successful examples from Tara NP show that participatory ecotourism models – where local residents are partners rather than passive beneficiaries – result in higher conservation effectiveness and community support.

The persistence of these governance gaps, despite formal commitments to participatory models, suggests deeper, systemic challenges. The prioritisation of extractive benefits is often not just a managerial decision but reflects the enduring influence of powerful economic sectors, such as forestry, energy, and large-scale tourism, whose national-level interests can overshadow conservation mandates. Furthermore, the weakness of participatory bodies like user councils may be linked to a legacy of centralised, top-down governance that is slow to yield effective decision-making power to local actors. Overcoming these entrenched issues requires more than policy reform; it necessitates a fundamental shift in political will and the

genuine empowerment of local communities and conservation authorities.

A shift toward integrated management would require:

- adoption of ecosystem service valuation as a standard practice in planning;
- introduction of multi-stakeholder decision-making mechanisms;
- transparent zoning revisions to prioritise ecological functionality; and
- targeted investments in capacity building for park authorities and local actors.

The integration of ecological indicators (e.g. habitat integrity, species richness) with socio-economic metrics (e.g. income from nature-based tourism, ecosystem service trade-offs) can provide a robust basis for adaptive management (MEA, 2005; Costanza et al., 2014).

National parks not only provide ecological benefits but also possess significant economic potential through ecosystem services that support local and regional development. Key ecosystem services include climate regulation, water purification, sustainable tourism, recreation, and provisioning of food and medicinal resources. However, their valuation and utilisation are often underdeveloped, limiting the contributions that national parks can offer to the economy.

Key economic components to consider are the following:

- *Valuation of ecosystem services* – assessing the economic value of services such as carbon sequestration, water filtration, and biodiversity maintenance.
- *Development of sustainable tourism* – providing tourism activities that are environmentally responsible yet economically viable.
- *Education and promotion* – raising awareness of the economic potential of national parks through campaigns and educational programs.
- *Partnerships with local communities* – engaging local populations in the production and services related to the parks, further contributing to local development.

In this paper, economic aspects were analysed through quantitative methods for assessing the economic value of ecosystem services and qualitative methods involving opinions from local actors and stakeholders. The focus is on identifying tangible pathways to amplify the economic role of national parks within sustainable development frameworks.

Limitations of the study

The authors acknowledge certain limitations that frame the findings of this research. The assessment of stakeholder perspectives, being based on a desk-review of existing documentation rather than primary data collection, may not fully capture the most current or nuanced views of all relevant parties. Therefore, the conclusions drawn in this area should be seen as indicative of trends found in publicly available reports and prior studies. Future research would significantly

benefit from direct engagement with stakeholders through targeted interviews and surveys to validate and expand upon these findings, providing a more dynamic and detailed understanding for policy and management recommendations.

CONCLUSION

This paper has explored the ecological and economic aspects of resource management in Serbia's national parks through an integrated analysis of legal frameworks, management practices, and case study evidence. The findings confirm that while national parks possess significant biodiversity and ecosystem service potential, current management approaches often fail to achieve a balance between conservation and sustainable use.

Dominant practices remain extractive and sectorally fragmented, with limited application of economic valuation tools and insufficient stakeholder engagement. Provisioning services are prioritised, whereas regulating and cultural services remain under-recognised, leading to misaligned planning and resource allocation. Moreover, institutional mechanisms for participatory governance are either weak or underutilised, further limiting the responsiveness of management structures to ecological and community needs.

To address these gaps, the following recommendations are proposed:

- *Adopt ecosystem service valuation* as an integral component of management planning, using internationally recognised methodologies tailored to local conditions.
- *Reform zoning regulations* to reflect ecological priorities, especially in parks under high anthropogenic pressure.
- *Strengthen participatory governance*, particularly by empowering user councils and enhancing transparency in decision-making.
- *Integrate biodiversity and socio-economic indicators* into a unified monitoring and evaluation framework to support adaptive management.
- *Invest in capacity building* for park staff, local communities, and institutions responsible for national park oversight.
- *Align ecological and economic balance* by coordinating measures for nature protection with opportunities for the sustainable use of ecosystem services.
- *Implement participatory management* by actively involving local communities in the decision-making process to ensure economic benefits for the local population while respecting ecological principles.
- *Foster interdisciplinary collaboration*, connecting scientific disciplines such as ecology, economics, and sociology, to design sustainable management strategies.
- *Establish monitoring and evaluation systems* for the regular tracking of resource conditions and

evaluating the impact of implemented measures on ecological and economic aspects.

- *Develop education and awareness-raising programs* to inform local communities and the broader public about the importance of national parks and their economic potential.

Implementing these recommendations requires coordinated efforts among environmental authorities, park administrations, scientific institutions, and civil society. Only through integrated and evidence-based management can Serbia's national parks fulfil their dual mission: conserving biodiversity and contributing to the sustainable development of society.

Future research should prioritize the inclusion of primary stakeholder data and explore the development of ecosystem service-based financial instruments (e.g. green bonds, payment for ecosystem services) tailored to Serbian national parks.

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