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Achieving balance between infrastructure development and biodiversity conservation: benefits and challenges

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ABSTRACT

This study addresses the critical task of achieving a delicate equilibrium between infrastructure development and biodiversity conservation, focusing on Serbia as a case study. Infrastructure projects drive economic growth but often harm the environment. International financial institutions have stringent biodiversity requirements, while national legislation varies in detail. This research identifies key challenges, such as non-alignment with global standards, data gaps, capacity issues, and limited awareness. Solutions involve integrated approaches, improved communication, updated data, and resource allocation. Collaboration between stakeholders is crucial. Balancing development and biodiversity is not just a moral duty but an investment in our future. This study aims to raise awareness and inspire collective efforts to preserve biodiversity while ensuring prosperity.

1. Introduction

Sustainable development, as defined by the Johannesburg Declaration of 2002, is "development that meets the needs of the present generations without compromising the ability of future generations to meet their own needs." It has become a central theme of global development. With technological advancements and urbanization, infrastructure has become a key driver of economic growth, especially in developing countries like Serbia and the broader Western Balkans region. However, infrastructure development often leads to the degradation and loss of biodiversity, posing a global challenge to nature conservation. In light of these challenges, the United Nations has adopted seventeen Sustainable Development Goals (SDGs) for 2030, which include, among others, goals related to biodiversity conservation and sustainable use of ecosystems.

Biodiversity forms the foundation for the planet's sustainability and provides a wide range of services and resources, including food, water, medicine, as well as culture and aesthetics. On the other hand, infrastructure is essential for the socio-economic development but often has a negative impact on the environment. Hence, achieving a balance between these two components is crucial for sustainable development.

In Serbia, as in other developing countries, infrastructure development is a critical factor for economic progress. However, implementing infrastructure projects can be challenging, especially when it comes to biodiversity protection. Serbia's national legislation is mostly aligned with EU directives and is oriented toward biodiversity conservation. However, the extent of compliance and the level of detail in local legislation regarding biodiversity protection are subject to debate. Additionally, international financial institutions, which actively provide funding to variety of infrastructure projects in the region, are also focused on biodiversity conservation, and their requirements can be more stringent and demanding in some aspects compared to national legislation.

The aim of this paper is to spread awareness of the importance of the issues raised above and to explore ways to achieve the balance between sustainable infrastructure development and biodiversity conservation in Serbia. To do so, it will analyze the differences between biodiversity conservation requirements imposed by international financial institutions and those prescribed by the legislation of the Republic of Serbia. It will also explore the challenges in incorporating these requirements into the implementation of infrastructure projects in Serbia and will investigate and propose measures to overcome the identified barriers.

2. Benefits of Biodiversity Conservation

2.1. Ecological Benefits

Every ecosystem, whether terrestrial or aquatic, performs numerous vital functions that support life on the planet (CDC, 2015). However, human activities, including development, such as infrastructure construction, which leads to the damage or destruction of natural habitats, water and soil pollution and climate change, directly affect the vital functions of ecosystems (Bongaarts, 2019). The ultimate result of these activities can be the extinction of species and further disruption of ecosystems.

According to the Report on the Environmental Conditions in the Republic of Serbia for the period 2016-2020, Serbia is home to approximately 38,000 plant species and 17,000 animal species. Out of these, over 2,400 plant species and 1,100 animal species are considered endangered. The main reasons lay in habitat loss due to urbanization and infrastructure projects, excessive hunting and fishing, as well as climate change.

Biodiversity conservation allows ecosystems to adapt to changing conditions and maintain balance by preserving populations of plants and animals that support the food chain, thereby preventing invasive species from taking over (Millennium Ecosystem Assessmen, 2005). This balance, in turn, facilitates easier recovery from natural disasters and the negative impacts of human activities, which is crucial for the sustainability of life on Earth (Cardinale et al. 2012).

2.2. Social and Economic Benefits

In addition to ecological benefits, biodiversity conservation brings a range of social and economic advantages (Environmental Protection Agency, 2019). Here are some closely related to the topic under discussion: (1) increased resilience and reduced costs for natural disaster protection (caused by climate change) (The Nature Conservancy, 2018), (2) preservation of cultural heritage and traditions, (3) creation of green jobs (ILO, 2020; Secretariat of the Convention on Biological Diversity, 2009), (4) reduction of healthcare system costs (Costanza et al., 1997; McFarland et al., 2010; Shanahan et al., 2016).

2.2.1. Increasing Resilience and Reducing Costs for Natural Disaster Protection

Maintaining ecosystems like forests, rivers, and wetlands can help prevent floods and soil erosion, while coastal forests and marine algae can protect shores from erosion and hurricanes. Additionally, preserving wetlands and natural waterways can help prevent and reduce damage from droughts and floods.

Some studies have shown that preserving natural habitats can be more efficient and cost-effective in preventing damage from natural disasters than traditional engineering solutions. For example, a 2019 report by the World Wildlife Fund (WWF) found that coastal forests are more effective at preventing floods in some cases than human-made defensive barriers (The Nature Conservancy, 2018).

Preservation of Cultural Heritage and Traditions Various cultures are closely connected to the environment and depend on it for their survival. Many societies have customs and traditions related to nature and wildlife, and their unique characteristics are considered part of cultural heritage. In Serbia, for example, many customs and traditions are linked to a conventional rural way of life, which is directly connected to environmental preservation and biodiversity. It is essential to note that international standards set by financial institutions such as the World Bank (WB) or the European Bank for Reconstruction and Development (EBRD) recognize these natural characteristics as equally important as traditionally recognized cultural heritage, such as archaeological sites or monuments. The Republic of Serbia has also enacted a new Cultural Heritage Law in 2021 that aligns our legislation closely, and nearly entirely, with this vision of cultural heritage. Additionally, the further preservation of cultural heritage and traditions related to the environment can also contribute to the tourism industry. Many countries, including Serbia, have tourism programs that promote the characteristics and specificities of local ecosystems, as well as the preservation of natural and cultural heritage. This represents significant potential for the development of eco-tourism that combines biodiversity conservation with the promotion of cultural heritage and tradition (Doncheva et al., 2019; Environmental Protection Agency, 2019).

2.2.2. Creation of Green Jobs

Green jobs encompass positions that involve work contributing to ecosystem and biodiversity preservation, reduced energy consumption, decreased carbon use, and the reduction of waste and pollution. Concerning biodiversity conservation, the creation of green jobs can involve work in eco-tourism, organic agriculture, natural resource management, ecosystem restoration, biodiversity research, and monitoring, among other fields. According to a 2020 study by the International Labour Organization (ILO, 2020), nature and biodiversity conservation could create 24 million new jobs by 2030. This could be achieved through investments in sectors such as renewable energy, energy efficiency, green construction, sustainable agriculture and forestry, tourism (eco-tourism), and others.

2.2.3. Reducing Healthcare System Costs

Biodiversity provides many health benefits to people, including healthy food, medicinal plants, and green areas that reduce stress and improve mental health. Additionally, green spaces in cities reduce air pollution, temperature, and noise, which lowers the risk of respiratory and cardiovascular diseases. In this regard, biodiversity conservation can be beneficial to the healthcare system by decreasing the need for treatment costs and positively impacting the physical and mental health of individuals (McFarland, 2010).

2.3. Animal Rights Protection; Maintaining Balance in Nature; Ethics and Moral Reasons

As one of the species inhabiting the planet, it is our responsibility, and many believe it is our moral obligation, to preserve the nature we share with other beings. Without delving into details about topics such as animal treatment practices, breeding, and the exploitation of animals, it is essential to note that infrastructure development, and construction in general, profoundly impacts the animal world (Compassion in World Farming, 2022; Humane Society International, 2022). This impact ranges from direct killing and extermination of animals in specific areas to affecting their ability to move, migrate, temporarily or permanently settle, and access food sources (Norton, 1991; Rolston, 1988). There are numerous examples of how human dominance over nature can have adverse consequences, and all these processes contribute to ecosystem disruption, species endangerment or extinction, as well as climate change (Leopold, 1949; Shanahan, 2015; World Health Organization, 2016).

3. Analysis of Differences in Biodiversity Conservation Requirements between International Financial Institutions and the Legislation of the Republic of Serbia

3.1. Introduction to the Analysis of Differences

In order to preserve natural resources and reduce the negative impact on biodiversity, International Financial Institutions (IFIs) such as the United Nations (UN), the World Bank (WB), the International Finance Corporation (IFC), the European Bank for Reconstruction and Development (EBRD), and others establish standards related to biodiversity conservation and adopt practices that align with these standards. While the legislation of the Republic of Serbia is largely in compliance with the requirements of these institutions, these standards are stricter in some areas and also cover a broader range of topics. For instance, while the legislation of the Republic of Serbia mainly focuses on the protection of flora and fauna, the standards of international financial institutions also clearly define habitat protection, ecosystem management, pollution prevention, and more.

Therefore, the analysis of differences between the requirements of international financial institutions and the legislation of the Republic of Serbia regarding biodiversity conservation aims to identify disparities, shortcomings, and opportunities for improving Serbian legislation in terms of biodiversity conservation. By analyzing international standards and practices in relation to Serbian legislation, discrepancies can be pinpointed, and necessary changes can be identified to ensure alignment with international standards (EBRD, 2019; IFC, 2012; World Bank 2018).

3.2. United Nations Environment Programme (UNEP)

The United Nations Environment Programme (UNEP) plays a crucial role in global biodiversity protection governance. The requirements set for biodiversity conservation primarily relate to promoting sustainable development and protecting natural resources.

Their key requirements include:

- Promoting the sustainable use of natural resources,
- Protecting endangered species and their habitats,
- Preventing illegal wildlife trade,
- Reducing the negative impact of human activities on the environment
- Encouraging collaboration and partnerships to protect biodiversity globally.

These requirements are outlined in several relevant documents, such as the Convention on Biological Diversity (CBD), the Global Biodiversity Outlook 2030, and several other documents related to environmental conservation (CBD, 1992; UN Environment Programme, 2021).

3.3. The World Bank and Its Biodiversity Conservation Requirements

The Environmental and Social Framework (ESF) is the latest standard of the World Bank that addresses these E&S issues. This standard was adopted in 2016, replacing the previous safeguard policies. One of the key standards within the ESF is Standard 6, which pertains to biodiversity conservation, titled "Biodiversity Conservation and Sustainable Management of Living Natural Resources."

Standard 6 requires that projects financed by the World Bank establish systems and develop biodiversity management plans based on scientific and empirical data. Projects must address the conservation and sustainable management of living natural resources, including wildlife, plants, and entire ecosystems (World Bank, 2016).

Key requirements set by this standard include the assessment and management of a project's impact on biodiversity, the establishment of biodiversity

conservation objectives, the implementation of appropriate measures to achieve these objectives, and the planning and management of the use of living natural resources. Standard 6 also requires the identification, monitoring, and protection of endangered species and critical habitats. One of the goals should be a "net gain for Critical Habitat," meaning that the project should leave critical habitats in better condition than before the project started. Projects must align with biodiversity and ecosystem conservation goals and avoid negative impacts on natural habitats ("no net loss to Natural Habitat"). In cases where avoiding negative impacts is impossible, projects must adapt to reduce and mitigate those impacts and ensure a net gain for biodiversity. The World Bank also requires the involvement of local communities and stakeholder groups in project planning and implementation, especially in cases where projects affect habitats and resources used by these groups. Additionally, projects must be adapted to avoid and minimize potential negative impacts on cultural heritage and community rights (World Bank, 2016).

Key documents and plans are incorporated in Standard 6 requires from investors to prepare a series of key documents and plans to ensure adequate biodiversity conservation in the projects they finance. These key documents include:

- Biodiversity Baseline Studies and Assessment: A detailed description of the existing state of biodiversity in the project area, crucial for identifying critical habitats, endangered species, protected areas, sensitive points, and potential project impacts on biodiversity.
- Biodiversity Management Plan (BMP): This plan should contain specific measures for protecting and managing biodiversity during the project. The plan includes measures to reduce the project's impact on biodiversity, secure a net gain, and ensure its continued conservation after project completion.
- Biodiversity Action Plan (BAP): Usually based on the BMP, the BAP further defines and schedules specific actions related to aspects of the BMP (which can extend beyond the direct implementation of control measures on the construction site) needed to bring the project into compliance with the project requirements and Standard 6. The World Bank emphasizes that preparing these documents is critical for successful biodiversity protection and should be integrated into all project phases, from planning and implementation to monitoring and exploitation stages (World Bank, 2018).

3.4. IFC Biodiversity Conservation Requirements

The International Finance Corporation (IFC) has its own set of standards known as Performance Standards, which represent an international set of rules that the IFC applies to projects financed worldwide. Performance Standard 6 (Biodiversity Conservation and Sustainable Management of Living Natural Resources) is the standard that relates to biodiversity conservation and the sustainable management of living natural resources. IFC standards align with the World Bank's ESF standards when it comes to biodiversity protection requirements. Similar to the ESF, they require the preparation of a Biodiversity Baseline Study, Biodiversity Management Plan, and Biodiversity Action Plan, which we have already described in the previous section (IFC, 2012).

What IFC standards additionally provide are detailed guidelines for Performance Standard 6 (Guidance Note 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources), offering guidance on the practical application of IFC Performance Standard 6. These guidelines comprehensively describe the process of planning and managing biodiversity and natural resources within a project and thoroughly discuss the key documents mentioned earlier. In addition to guidelines for preparing these documents, assessments, project activities, and plans, the document also offers guidance on monitoring and evaluation of project's impact on biodiversity (IFC, 2019).

3.5. EBRD Biodiversity Conservation Requirements

The European Bank for Reconstruction and Development (EBRD) is a financial institution that aims to support the development of countries in transition to market economies, including projects related to environmental protection and biodiversity. They are one of the most active financial institution in our region. The EBRD Environmental and Social Policy from 2019 sets standards and guidelines that must be adhered to when implementing projects financed by the EBRD.

The EBRD policy Includes Performance Requirement 6 (PR6–- Biodiversity Conservation and Sustainable Management of Living Natural Resources), which relates to biodiversity conservation and the sustainable management of natural resources, as well as the integration of these aspects into project planning and implementation. The key requirements outlined in this standard are very similar to the previously mentioned standards of the World Bank and IFC and include:

- The need to assess the projec's impact on biodiversity and ecosystems as part of the environmental impact assessment and identify measures for their protection and conservation.
- The requirement to comply with relevant laws, regulations, and international conventions on nature and biodiversity protection during project planning and implementation.

- The demand for active involvement of stakeholders in decision-making processes related to natural resource management and biodiversity protection.
- The need to allocate resources for monitoring and reporting on the projec''s effects on biodiversity and ecosystems, as well as to take corrective measures in case of negative impacts (EBRD, 2019).

It is important to note that EBRD Performance Requirement 6 goes further and provides more detailed definitions of certain aspects of biodiversity protection than the World Bank and IFC standards. One key difference is the introduction of the term“"Priority biodiversity feature”" (PBF), which represents a subset of biodiversity that is irreplaceable or vulnerable but of lower priority than critical habitats (CH). PBF includes endangered habitats, endangered species, significant biodiversity features identified by a wide range of stakeholders or governments, and the ecological structure and functions necessary for the conservation and sustainability of PBFs. In practice, EBRD Performance Requirement 6 does not use the concept of natural habitats but defines them through CHs and PBFs.

In September 2022, EBRD issued an updated version of its guidance note on biodiversity protection (Guidance Note 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources), providing details on the application of EBRD Performance Requirement 6 in practice. The main objectives of this guidance are to encourage investors to integrate biodiversity issues into their projects and to provide a framework for managing biodiversity-related risks, much like the IFC guidelines. The guidance offers detailed instructions on identifying, assessing, and managing a projec''s impact on biodiversity and ecosystems. It also emphasizes the importance of partnering with stakeholders, including local communities, to achieve sustainable biodiversity management.

The key documents mentioned in the guidance are the Biodiversity Baseline Assessment, Environmental and Social Impact Assessment (ESIA), Biodiversity Action Plan (BAP), Environmental and Social Management Plan (ESMP), and Monitoring Plan. For each of these documents, the guidance provides details on their preparation and the topics they should cover. These documents are crucial for the successful protection of biodiversity and should be integrated into all project phases, from planning to implementation, monitoring, and exploitation (EBRD, 2022).

3.6. Other International Institutions and International Biodiversity Conservation Requirements

In addition to the institutions mentioned above, other international organizations also define their standards and guidelines that promote biodiversity conservation in the projects they finance.

Among those briefly mentioned in this paper are:

- KfW (Kreditanstalt für Wiederaufbau) –- the German development bank that aims to support sustainable economic, social, and environmental development in developing and transitioning countries. KfW also applies high standards for biodiversity conservation and natural resource protection in the projects it finances. Their approach focuses on integrating environmental aspects into all project phases, from concept to implementation and monitoring.
- European Investment Bank (EIB) - which has a Biodiversity Protection Policy aimed at integrating environmental aspects into all project phases.
- International Labour Organization (ILO), which also advocates for biodiversity conservation and has a set of standards and guidelines focused on the protection of natural resources and biodiversity in projects it finances (KfW, 2018; EIB, 2019; ILO, 2012).
- Equator Principles (EP) which represent a voluntary set of principles developed in 2003 with the aim of committing financial institutions to assess and manage social and environmental risks in projects involving large infrastructure projects. EP is based on the IFC Environmental and Social Performance Standards mentioned earlier. These principles apply to lenders, i.e., international financial institutions, that finance projects exceeding a certain financial threshold, encompassing a wide range of sectors, including energy, transportation, mining, and infrastructure. While they do not contain specific requirements for biodiversity conservation, they require that all projects covered by these principles conduct environmental and social impact assessments, including assessments of biodiversity impact.

All these institutions have a very similar approach and requirements for biodiversity conservation, aiming to integrate environmental aspects into all project phases and assess the impact of projects on biodiversity. The key differences usually revolve around the level of detail they cover and how strict they are regarding specific topics mentioned earlier. Discrepancies in requirements and details are often a result of the year when the standards were prepared / updated and came into force, rather than differences in approach or understanding of the importance of these issues. It is worth mentioning it often happens that a group of international financial institutions finances the same project, in which case the most stringent standards are adopted as the leading ones (Equator Principles Association, 2019).

3.7. Legislation of the Republic of Serbia Related to Biodiversity Conservation

In the Republic of Serbia, biodiversity conservation is governed by a series of laws and by-laws aimed at preserving biodiversity and natural resources in Serbia. Key requirements for biodiversity conservation include the protection of protected areas, species, and habitats, the reduction of pollution, and the protection of forest and water resources.

One of the most significant laws in this field is the Law on Nature Protection, enacted in 2009 (last amendments in 2021), which aims to preserve the natural wealth and biodiversity in Serbia. This law regulates the protection and use of natural assets, encompassing protected areas, species, habitats, as well as natural and cultural monuments. This law also establishes a system of protected areas, including national parks, special and strict nature reserves, natural monuments, protected habitats, and other protected natural values.

In addition to the Law on Nature Protection, the Law on Planning and Construction and the Laws on Environmental Impact Assessment are significant when it comes to biodiversity conservation. These laws prescribe the obligation to conduct environmental impact assessments for all projects that may have a significant impact on the environment, including biodiversity. Furthermore, the Law on Forests, the Law on Game and Hunting, and the Law on the Protection and Sustainable Use of Fishery Resources are important laws that prescribe measures for the protection and conservation of forest, game, and fish resources in Serbia. In addition to these laws, there are numerous subordinate acts that further regulate these areas.

3.8. Environmental Impact Assessment

Investors planning projects that could have an impact on biodiversity must prepare certain documents and plans to meet legal obligations and requirements. The key document related to biodiversity conservation is the Environmental Impact Assessment (EIA) study, through which an assessment of the impact on biodiversity is conducted, and measures for biodiversity protection are defined.

The process of determining the scope of the environmental impact assessment defines whether an EIA study needs to be prepared for the particular project, as well as the extent and level of detail of the impact assessment process. Depending on the defined scope and impact of the project, as well as the need for preparing an EIA study, further steps required for biodiversity protection may vary significantly. The EIA study than defines the next steps and planning documents required for the implementation of a specific project.

In addition, during the EIA preparation, investors are obliged to consult relevant institutions and experts, such as the Environmental Protection Agency, the Institute for Nature Conservation, the Ministry of Environmental Protection, as well as relevant local authorities. These institutions define their conditions and requirements and necessary protection measures, provide guidance and information on biodiversity conservation requirements and procedures, and grant approvals for plans and permits for projects that impact biodiversity (Official Gazette of RS, 2010; Official Gazette of RS, 2016, Official Gazette of RS, 2018).

3.9. Comparative Analysis of Requirements of International Financial Institutions and Serbian Legislation

As mentioned earlier, international financial institutions such as the World Bank, IFC, and EBRD have detailed guidelines concerning the assessment of biodiversity impacts, which are applied during project financing approvals. These institutions demand the execution of Environmental and Social Due Diligences and/or Environmental and Social Impact Assessments (ESIAs) which encompass biodiversity impact assessments in accordance with the best international practices, including international conventions and standards such as the Convention on Biological Diversity, Ramsar Convention, and the United Nations Framework Convention on Climate Change. Furthermore, they require projects to comply with relevant local legislation, regulations, and standards, as well as to adhere to planning documents related to biodiversity (Official Gazette of RS, 2016) Regulation on Waste Management Conditions.

The legislation of the Republic of Serbia also mandates the preparation of Environmental Impact Assessment (EIA) Studies for specific project categories, which include the assessment of biodiversity impact. However, the requirements of the legislation fall far short of the level of detail prescribed by international financial institutions. Moreover, the laws and subsidiary acts inadequately define the scope and level of detail required for the robust impact assessment, leaving room for significant differences in interpretation and understanding of the appropriate level of environmental impact assessment, including biodiversity impact assessment (World Bank, 2018).

When it comes to the analysis of biodiversity impacts specifically, substantial differences exist in the requirements between international financial institutions and Serbian legislation. Let’s demonstrate these on the examples of World Bank and EBRD requirements. Their demands necessitate a detailed determination of the baseline biodiversity conditions, including the identification and assessment of Critical Habitats and Primary Biodiversity Features (PBF).

Serbian legislation, through the EIA process, requires an assessment of baseline status of the biodiversity but does not recognize definitions such as CH and PBF. Instead, it defines terms like protected areas and endangered species, and requires an assessment of the impact on habitats that are part of the national network of protected areas, leading to significant differences in the final impact assessment results.

One example is Natura 2000, a comprehensive European network of protected areas, which is a cornerstone of biodiversity conservation within the European Union. Serbia, as a candidate country for European Union membership, is in the process of aligning its legislation with EU standards and requirements, including those related to environmental protection and biodiversity conservation. Part of this alignment process involves the recognition and implementation of the Natura 2000 network, which is an EU-wide network of protected areas established under the Birds Directive and the Habitats Directive to conserve biodiversity. This disparity underscores the need for a comprehensive comparative analysis between the requirements of international financial institutions and Serbia's evolving legal landscape. It is particularly vital to understand how the incorporation of Natura 2000 principles aligns with the criteria set forth by these institutions and how this recognition—or lack thereof—impacts Serbia's conservation efforts and development projects (IFC, 2012; EBRD, 2014).

Further differences include the definition of the temporal scope of seasons and periods when assessing biodiversity baseline status. For instance, Equator Principles as well as the standards of the World Bank, IFC, and EBRD demand that investors prepare a biodiversity impact assessment involving data collection on biodiversity throughout all seasons, with a particular emphasis on breeding, nesting, and migration periods. In contrast, Serbian legislation does not clearly define specific data collection requirements for the biodiversity baseline studies, which frequently leads to collection of only limited data sets not rarely covering only one season. As a result, the impact assessments based on this data fail to estimate the real significance of potential impacts on the biodiversity (Official Gazette of RS, 2016; World Bank, 2018; ICF, 2012; KfW, 2018).

Moreover, unlike with IFIs, there is no clear legal requirement in national legislation for preparing a biodiversity protection and management plan, a biodiversity protection action plan, a specific biodiversity impact monitoring plan, or a plan for sustainable use of natural resources. This lack of structure and planning documentation usually results in insufficient efforts to implement the measures defined to mitigate the potential impacts identified during impact assessments. Additionally, the World Bank and EBRD require monitoring both during and after project construction to track the achievement of project goals and its impact on biodiversity. On the other hand, local legislation allows for the definition of monitoring during construction phase in the EIA study but does not require or define post-construction monitoring (Official Gazette of RS, 2018).

In practice, these differences result in significant disparities in the quality of environmental impact assessments for projects prepared under local legislation when compared to international institution standards. This often leads to project implementation delays, the need for redesign, budget overruns, and sometimes even project suspension when such projects are considered for financing by international institutions. In any case, it is crucial for investors in Serbia to adhere to the requirements and guidelines of both international institutions and Serbian legislation to ensure projects are implemented in a sustainable and environmentally-friendly manner, with maximum time and cost savings.

4. Challenges in Implementing Requirements During Project Execution

The importance of recognizing and addressing challenges during the implementation of biodiversity preservation requirements in infrastructure projects cannot be overstated. These challenges have a direct impact on project sustainability, including financial viability, nature conservation, and long-term economic and social benefits. They also carry certain reputational risks. Understanding and adequately confronting these challenges are crucial for achieving a balance between infrastructure development and biodiversity preservation.

4.1. Differences in Requirements Between Serbian Legislation and International Institutions

Infrastructure projects implemented over the past decade, as well as those currently underway, often require compliance with international standards for biodiversity conservation since they, increasingly often, include international financing (loans). The differences we previously outlined regarding the biodiversity conservation approach between IFIs and the Republic of Serbia frequently result in the need for additional biodiversity impact assessments and plans in addition to the ones already conducted according to the national law, when international financing institutions become involved. These additional efforts serve to bridge the gaps and inconsistencies in the biodiversity protection approaches and improve the effectiveness of biodiversity protection measures. They also help identify critical habitats and species, as well as to set clear goals for monitoring and supervision (Official Gazette of RS, 2016; World Bank, 2018; KfW, 2018).

If these activities are not initiated in accordance with international standards from the outset, it often leads to project implementation delays due to the need for additional studies and plans, necessitates redesigning due to new findings, resulting in project delays and cost overruns, and in some cases, complete project suspension. Moreover, such situations sometimes lead to "creative" solutions that do not contribute to biodiversity preservation to the extent that would have been the case if the necessary standards had been considered from the beginning.

Additional challenge presents the confusion and unequal conditions for investors and project implementers in Serbia who seek the loans from the IFIs, as they are expected to adhere to stricter requirements and standards than the projects locally financed. This could sometimes result in additional costs to these investments putting the investors in unfavorable positions when compared to their competitors. All this can unnecessarily put biodiversity preservation at risk due to the failure to apply best conservation practices.

4.2. Availability and Quality of Biodiversity Data in the Republic of Serbia

During the preparation phase of biodiversity impact assessments, one of the steps involves analyzing currently available data on biodiversity status, so called “a desktop research”. According to the author's extensive experience, the current situation in the Republic of Serbia in this regard is far from adequate. For many areas, usually it is very difficult to obtain any data on biodiversity status, and for areas where data exists, it can be described as outdated, i.e., older than 10 years or even from several decades ago and with no sufficient details.

Furthermore, the existing data is not easily obtainable and is not organized in a way that allows for quick and easy access, such as through a unified biodiversity database. Often, the required data is available only for inspection in paper form. While easy access to available data would not completely eliminate the need for a field biodiversity status surveys, it would facilitate research and analysis times, a reduce likelihood of missing crucial historical information on biodiversity in an area. This would lead to time and cost savings through shorter assessment times and a reduced risk to face unexpected findings/risks in later stages of project planning and implementation.

An example of such invaluable resources are the Red Books, which serve as a comprehensive scientific database which lists species at risk of extinction. The primary purpose of these Red Books is to employ expert analysis and scientific methodologies to emphasize the urgency of preserving endangered species. They also identify weaknesses in the existing protection systems and propose potential solutions to mitigate the situation, or at the very least, slow down detrimental processes. Serbia has published six Red Books to date. The first, focusing on plant species, was published 20 years ago. Subsequently, books were dedicated to diurnal butterflies, amphibians, reptiles, birds, and orthopterans. Regrettably, access to these books is not open, and obtaining data, which could significantly benefit Environmental Impact Assessments (EIAs), is currently very complicated. There are no readily accessible online lists or databases featuring national evaluations according to the IUCN criteria, necessitating extensive page-flipping through these books. Additionally, deriving the Area of Occupancy (AOO) and Extent of Occurrence (EOO) for endangered species is challenging, as precise borders are often difficult to determine solely from the maps provided in these publications. While some of these books are not available for purchase, they may be found in specific public libraries.

4.3. Experience in Implementing International Standards in the Republic of Serbia and Human Resource Capacity

Anyone involved in the execution of large infrastructure projects is likely aware that there is a limited number of experts on the Serbian market with the necessary experience in addressing the impact of such projects on biodiversity. The authors’ experience suggests that there are highly qualified professionals in Serbia with experience working according to local legislation. However, it is no secret that for the current needs of infrastructure project development, this number is insufficient, and there are often situations where experts are unavailable during critical periods for biodiversity assessments. This situation also leads to delays and fluctuations in the quality of the output product, i.e., biodiversity status analyses.

Additionally, it should be noted that due to the differences in requirements mentioned earlier, there are situations where research results are not detailed enough to meet the requirements of international standards, often due to the application of different or insufficiently detailed monitoring methodologies or a lack of active baseline field research by experts with the required experience. Considering that gathering information on biodiversity status is tied to specific seasons, it is clear that additional data collection or data confirmation may take several months to a year, which can significantly impact the project timeline and costs.

4.4. Intersectoral and Interdisciplinary Collaboration

Preparation of an Environmental Impact Assessment Study, which should include an assessment of biodiversity impact is considered as example. To ensure a comprehensive study that covers all areas affected by

the project, experts working on the study need accurate data about the project's impact zone, which should be provided by the project team, including engineers, planners, and others. Best practices, including local legislation, dictate that the findings and protection measures prescribed by the EIA study should be integrated into the project at the very beginning, so that project designs and impact zones can be adjusted accordingly to minimize biodiversity impact and, if possible, contribute to its preservation. This process could be compared with the approach on how project solutions are altered to reduce the length of bridges or tunnels for construction methodology, cost, and safety reasons.

This leads to conclusion that project solutions should only be finalized and confirmed after the completion of the EIA study. Therefore, constant iterative communication and collaboration among all sectors and disciplines involved in projects preparation are necessary to ensure that all required solutions are adequately implemented. Of course, it is not always possible to reconcile the needs of all disciplines, emphasizing the importance of interdisciplinary collaboration. It is necessary to find compromise solutions based on interdisciplinary risk and impact analysis. Unfortunately, experience shows that this is not always the case, and it often happens that the EIA is conducted only when the project design is already complete and there offers minimal room for revision. In such cases, forced solutions and protection measures are often applied, which may not be optimal and do not provide the required level of protection, leading to further degradation.

4.5. Awareness of Time and Budget Needs for Adequate Biodiversity Protection During the Project

We have already mentioned that differences and challenges can lead to project implementation delays, either due to the necessity for additional studies and plans to comply with international standards or the need for additional baseline data collection that requires extra time. In addition, it often happens that project stakeholders and decision makers are aware of the need for impact assessment and biodiversity research but, due to limited prior experience, make incorrect conclusions about the time and budget required to conduct research and impact assessment in accordance with high international standards to ensure maximum biodiversity preservation.

For example, it often occurs that, due to a limited understanding of the necessary standards, the unavailability of updated data, and the late involvement of experts with adequate biodiversity conservation experience, project teams do not allocate enough time for proper research and impact assessment. This situation usually arises from the mistaken assumption that this task can always be completed in a period of 3 to 6 months, in line with the timeframes typically needed for other environmental topics. However, biodiversity is quite unique in this regard. Even when there are no additional limiting factors that require a specific approach, it should be assumed that adequate research and impact assessment will take a minimum of 12 months to cover all seasons and species-specific aspects affected by seasonal changes. It should be noted that for some species, 2 years of baseline data collection may be required.

With a similar premise about the required time and scope of research (lasting 3 to 6 months), there are often significant errors in budgeting for the biodiversity impact assessment activities. What is often overlooked, in addition to the required research duration, is its scope, the specific methodologies, the number of researchers with varying experience required, necessary equipment, and more. There is often an assumption that several tens of thousands of euros are more than enough to conduct the baseline data collection and prepare the necessary studies and plans. However, in practice, the situation is significantly different, and the required budgets (at the time of writing this paper) range from tens of thousands for extremely small projects with limited impact to several hundred thousand euros for large projects with significant scope and impact.

While this may sound like a lot, it should be considered in relation to the total investment size (sometimes in billions of euros), potential later costs that can be much higher, the avoidance of negative impacts on biodiversity and its preservation, and the potential impact on the project's and participants' reputation, as we increasingly witness.

4.6. Planning for Monitoring and Supervision

Without going into too much detail, this challenge is very similar to the ones we have previously discussed and often arises as a consequence of everything already mentioned, such as differences in requirements and standards and inadequate planning. Simply put, even when impact assessments are conducted adequately, the lack of monitoring and supervision means that we do not know and cannot confirm the real impacts, whether negative or positive, that the project implementation has on biodiversity. While in some cases, monitoring of biodiversity status is carried out during the construction phase, monitoring of biodiversity impact is rarely conducted during the operational phase. In addition to not being able to confirm the actual impacts predicted in the studies, the lack of monitoring leads to unclarity on potential additional impacts of projects during their operation that were not initially foreseen, as well as changes on site conditions that may influence significance of impacts.

All of this sometimes require revising the identified protective measures, which cannot be done if monitoring and supervision are not planned and implemented. This puts us in a situation where the impact on biodiversity can be significantly greater than initially predicted.

4.7. Proposed Mitigation Measures for Identified Challenges

Sustainable development requires efficient and decisive action in biodiversity conservation, as biodiversity plays a crucial role in maintaining ecosystem stability, ensuring the balance of economic, ecological, and social well-being. Therefore, recognizing and effectively addressing the aforementioned challenges are of paramount importance to ensure that infrastructure projects in Serbia do not jeopardize biodiversity but contribute to its preservation. This being said, we will now propose a framework of measures that the authors of this paper see fit for overcoming the identified differences. These measures can lead to achieving a better balance between the development of infrastructure projects and biodiversity conservation (CBD, 1992; Millennium Ecosystem Assessment, 2005).

4.8. Measures that could lead to overcoming the differences in requirements between Serbian Legislation and International Institutions

In line with the analysis presented earlier in the text, the authors propose the implementation of the following measures to reduce and eventually bridge the differences:

- Harmonization of domestic legislation with international standards and clear definition of biodiversity conservation requirements within national laws and regulations.
- Development of new legal frameworks and guidelines to more effectively regulate biodiversity protection (UN Environment Programme, 2021; EBRD, 2022).
- Development of additional detailed guidelines and instructions for investors and contractors, aimed at precisely defining the procedures that investors should follow to meet biodiversity conservation requirements. These guidelines should cover all relevant aspects, including procedures for collecting baseline biodiversity data, impact assessments, biodiversity management plan development, ecological damage compensation, and other relevant steps (UN Environment Programme., 2015).

Such alignment would lead to creating a clear legal framework for biodiversity protection in Serbia, improve transparency, and facilitate the assessment of biodiversity impact during project implementation.

Furthermore, these measures could contribute to precisely defining the procedures that investors should follow to meet biodiversity conservation requirements, set criteria for identifying critical and protected habitats, priority biodiversity features, protected species, and enable efficient planning and implementation of protective measures.

4.9. Measures related to Availability and Quality of Biodiversity Data in the Republic of Serbia

We have previously presented challenges related to this topic, which hinder the timely and efficient process of assessing the status of the biodiversity features and subsequently, the impact on those. The proposed measures are just some of the possibilities:

- Planned investments from the government in the projects related to biodiversity status determination in areas designated for infrastructure (and other) project development.
- Encouragement of investors to finance the determination of the status of biodiversity in areas planned for infrastructure (and other) projects.
- Establishment of a unified biodiversity status database, which would contain all relevant data in one place and be regularly renewed with up to date data. The premise here is a clear obligation for investors and state institutions to incorporate research data into a unified digital format, as well as to publicly disclose all collected data and provide easy access to all interested parties.

The proposed measures would lead to improvements in available desktop, i.e., input data on biodiversity status, necessary to serve as a basis for further detailed analysis and assessments. This would potentially lead to shorter field research times due to the availability of up-to-date initial data to complement the collected on-site baseline information.

Proper budget planning, both at the project and state levels, can ensure the allocation of necessary funds for biodiversity research. Effective implementation of these measures and addressing these challenges require good collaboration among relevant stakeholders, including government institutions, investors, international institutions and funds, as well as non-governmental organizations, to identify and leverage available sources of funding. The use of available international funds can potentially represent a significant step toward increasing financial resources for biodiversity conservation in Serbia and contribute to more efficient compliance with requirements in this field (European Union, 2021; UN Environment Programme, 2021; GEF, 2021).

4.10. Experience with the Implementation of International Standards in the Republic of Serbia and Human Resources Capacities

The following measures have been recognized as having the potential to help overcome a lack of sufficient experience in implementation of IFI standards in national projects:

- Alignment of educational programs to ensure a better understanding of biodiversity in all sectors that can have an impact on biodiversity conservation.
- Inclusion of relevant international standards and guidelines into educational programs, and linking and integration of biodiversity conservation requirements with traditional engineering standards and approaches.
- Educating investors about the specifics of biodiversity in the Republic of Serbia, thereby raising their awareness of its baseline status and related potential impacts.

These training programs should be dedicated to various stakeholders and participants in project-related processes, including relevant universities, investors, contractors, relevant state agencies, institutes, non-governmental organizations, and others involved in processes related to the construction of infrastructure (and other) projects and biodiversity conservation processes. Training and education can include university programs, workshops, seminars, public campaigns, and other forms of information dissemination and education. It is crucial to provide access to relevant information and resources to promote awareness of the need to achieve the balance between the development of infrastructure projects and biodiversity conservation (IUCN, 2019; IFC, 2012; CBD, 2014).

4.11. Measures to Improve Intersectoral and Interdisciplinary Collaboration

To improve intersectoral and interdisciplinary collaboration, it is first necessary to raise awareness of the cause-and-effect relationship between the development of infrastructure projects and biodiversity conservation. All recommendations given in previous chapters i.e. education and awareness-raising of stakeholders, consultation and collaboration among different disciplines involved in the project and inclusion of experts of various roles and backgrounds in planning and decision-making processes, are relevant for overcoming said challenge. In addition, the implementation of the following measures is recommended:

- Inclusion of biodiversity conservation experts in project development teams from the earliest stages of project planning.
- Ensuring the early involvement of relevant institutions and stakeholders in project planning and development.
- Ensuring constant iterative communication and collaboration among different disciplines (teams) involved in project preparation to adequately implement all necessary solutions.
- Conducting an Impact Assessment Study as early as possible in the project cycle, in parallel with project design (defining project solutions) to achieve incorporation of biodiversity conservation measures in the early stage of project design, where it is possible to eliminate, replace, and reduce impacts long before the start of construction and operation phases, and achieve optimal project solutions that will maximize biodiversity conservation and enhancement.

As mentioned earlier, experience has shown that it is not always possible to reconcile the requirements of all disciplines, which further emphasizes the importance of interdisciplinary collaboration to find compromise solutions based on integrative risk and impact analysis.

4.12. Raising Awareness of Time and Budget Needs for an Adequate Biodiversity Protection During a Project

Adequately assessing the time and budget needed for proper biodiversity impact assessment still pose a significant challenge. Previously listed challenges are closely related to this issue as all of them influence the time and budget planning for a project. Timely involvement of experts with experience in biodiversity conservation, ensuring adequate initial information on which planning is based on (baseline data, as well as the spatial and temporal scope of research), and clear communication among disciplines about interdisciplinary requirements and impacts can contribute to more precise planning of the required resources.

What must be emphasized once again is that even in cases where there are no additional limiting circumstances that require a specific approach, it should be assumed as an initial point that a minimum of 12 months is required for adequate field baseline studies and impact assessment. This timeframe covers all seasons and specific species affected by seasonal changes. Of course, this is only an empirical assumption that can be adjusted during the planning, research, and impact assessment processes if the situation allows. We mentioned that in some very specific cases, the required time may extend up to 2 years, but it can also be shorter than 12 months if the conditions on the ground and project solutions allow for it.

4.13. Improving Planning for Monitoring and Supervision

As previously mentioned, the lack of monitoring and supervision activities to confirm the actual level of impact and track the implementation of planned measures and their effectiveness, often results from differences in approaches between national legislation and international standards, as well as the lack of time and budget planning for these activities. Therefore, the previously recommended measures are applicable and valid when it comes to this topic. Additionally, the following measures are proposed:

- Inclusion of clear activities related to monitoring and supervision in the time and budget planning during the construction and operation phases of the project.
- Ensuring that these activities involve the sufficient number of experts with the adequate experience in biodiversity conservation, with a clear obligation to collect necessary data and report on implementation and impacts during construction and operation at regular intervals.
- Allocating adequate time and financial resources for monitoring and record keeping.

These recommendations should contribute to confirming real impacts and identification of new, unforeseen ones, and the monitoring of the effectiveness of planned measures. Based on this, if necessary, timely revision and adaptation of existing plans and measures can be carried out, all with the aim of achieving maximum results in biodiversity conservation.

5. Conclusion

Achieving a balance between infrastructure development and biodiversity conservation is one of the key challenges of our time. However, biodiversity conservation is not an obstacle to development but a direction toward sustainable solutions that will bring long-term benefits.

In this paper we demonstrated many challenges on the road of finding that balance, especially in developing countries like Serbia. Identified obstacles include a lack of alignment with international standards, improper biodiversity baseline data, insufficient capacity, expertise, experience among parties included in the project implementation, inadequate intersectoral and interdisciplinary collaboration, as well as a lack of awareness of the time and budget requirements for biodiversity protection throughout all project phases, including monitoring and supervision. Addressing these challenges requires the development of integrated approaches, improved communication between sectors, regular updating of biodiversity information, as well as the promotion of awareness and education about the importance of biodiversity across all sectors. The key is to establish mechanisms to ensure adequate expertise, time and financial resources for proper biodiversity conservation in infrastructure projects implementation. This would facilitate establishment of sustainable infrastructure development models that will allow Serbia to reap the benefits of infrastructure projects while simultaneously ensuring environmental preservation, as well as preservation of characteristics and diversity of biodiversity in these areas.

The journey to harmonize infrastructure development and biodiversity conservation in contexts like Serbia highlights several key challenges, it's crucial to acknowledge the study's limitations. Its focus primarily on Serbia may restrict broader generalization. The identified obstacles represent specific cases and may not encompass the full spectrum of issues encountered in such endeavors. The study serves to pinpoint issues rather than delve into comprehensive solutions. Data quality and availability could pose constraints, and the call for interdisciplinary collaboration lacks detailed methodologies. The paper's recommendations are context-specific to Serbia, requiring customization for other regions. Future research should address these limitations with adaptable and region-specific solutions for the complex task of balancing infrastructure development and biodiversity conservation.

Future directions of research in this area should focus on formulating adaptable solutions to address the specific challenges identified, tailored to individual contexts and regions. In practice, this involves enhancing capacity and expertise among stakeholders, fostering interdisciplinary collaboration, and creating mechanisms for efficient biodiversity conservation in infrastructure projects. Research should delve into case-specific applications and strategies, acknowledging international standards while recognizing the local nuances. Furthermore, there's a need to explore the potential for sustainable infrastructure models and quantify their economic and environmental benefits. In practical terms, the insights from this study should guide policymakers and practitioners in Serbia and beyond to allocate adequate resources and time for biodiversity conservation in infrastructure projects, aligning them with sustainable development goals. Future work should aim to translate awareness into proactive steps that foster integrated conservation and development, ensuring a harmonious coexistence between progress and biodiversity preservation for a better, more sustainable future.

To conclude, in the coming years, sustainable development and environmental conservation are expected to be extremely important topics to consider when it comes to the implementation of investments and projects. Therefore, it is essential to effectively address existing challenges in implementing biodiversity conservation requirements to achieve economic activities and progress in one hand and protect biodiversity in the other.

It is important to understand that biodiversity is not a luxury but an irreplaceable resource that provides clean air, water, food, and medicine. By caring for biodiversity, we are also taking care of ourselves. The goal of this paper was to raise awareness of this important issue and to serve as a call for action, education, and joint intersectoral and interdisciplinary efforts to preserve biodiversity while building a better future for all.

Afterall, achieving a balance between infrastructure development and biodiversity conservation is not only our moral responsibility but also an investment in the future of our planet.

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