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BALANCING ECONOMIC ACTIVITIES AND BIODIVERSITY: CATEGORIZATION OF PRO-BIODIVERSITY AND BIODIVERSITY-BASED BUSINESSES IN PROTECTED AREAS OF SOUTHERN EUROPE

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Abstract: *Pro-Biodiversity Businesses (PBB) and Biodiversity-Based Businesses (BBB) play distinct roles in integrating economic development with biodiversity conservation. PBBs explicitly aim to conserve biodiversity while ensuring financial viability, operating in sectors such as sustainable agriculture, forestry, ecotourism, and environmental consulting. Conversely, BBBs depend on biodiversity but do not necessarily contribute to its preservation, necessitating strong regulatory frameworks to mitigate environmental risks. Theoretical foundations such as Landscape Ecology, Island Biogeography, and Metapopulation Theory offer insights into the ecological dynamics influencing biodiversity conservation. These frameworks emphasize the importance of habitat connectivity, sustainable land management, and ecological resilience to mitigate habitat fragmentation and species loss. Businesses interact with biodiversity by utilizing ecosystem services and influencing ecological changes through land use, emissions, and resource extraction. Negative impacts include habitat destruction and pollution, whereas sustainable business models can contribute positively by supporting conservation initiatives and adopting eco-friendly practices. Several case studies illustrate successful integration of economic activities with biodiversity conservation. Challenges remain in balancing economic interests with conservation goals, particularly in protected areas where regulatory restrictions may generate resistance from local communities. Fostering PBBs and implementing*

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participatory conservation strategies can bridge these gaps, ensuring that biodiversity conservation and sustainable economic development are mutually reinforcing.

Key words: *Pro-Biodiversity Businesses (PBBs), Biodiversity-Based Businesses (BBBs), Sustainable Development, Biodiversity Conservation.*

1. Introduction

Biodiversity plays a fundamental role in sustaining ecosystems and providing essential services, including climate regulation, water purification, and soil fertility. However, human activities have significantly altered natural habitats, leading to biodiversity loss and ecosystem degradation. In response, conservation strategies increasingly emphasize integrating biodiversity protection with economic activities, fostering businesses that support environmental sustainability while generating financial returns.

Pro-Biodiversity Businesses (PBBs) and Biodiversity-Based Businesses (BBBs) represent two key approaches to integrating economic activities with biodiversity conservation. PBBs actively contribute to biodiversity protection as part of their core mission, incorporating sustainable practices into sectors such as forestry, ecotourism, and organic agriculture. These businesses demonstrate that financial viability and environmental conservation are not mutually exclusive but can be mutually reinforcing.

On the other hand, BBBs rely on biodiversity as a key resource for their operations, encompassing industries such as agriculture, fisheries, and tourism. While some BBBs contribute to conservation efforts, others may deplete biodiversity unless regulated effectively. Establishing a clear distinction between these business models is crucial to designing policies that promote sustainability. Understanding how businesses interact with biodiversity and leveraging their role in conservation is essential for addressing global biodiversity challenges while ensuring long-term economic development.

The primary objective of this manuscript is to explore the role of Pro-Biodiversity Businesses (PBBs) and Biodiversity-Based Businesses (BBBs) in fostering biodiversity conservation while ensuring economic sustainability. In an era where economic development often conflicts with environmental protection, understanding how businesses can contribute positively to biodiversity is crucial. PBBs are designed to integrate conservation efforts directly into their business models, ensuring that their financial success translates into tangible ecological benefits. Meanwhile, BBBs depend on biodiversity for their operations but may not inherently prioritize its protection. By examining these business models, this manuscript seeks to highlight both the opportunities and challenges in aligning economic activities with conservation goals.

A key component of this research is the theoretical exploration of biodiversity conservation within business contexts. Concepts such as Landscape Ecology, Island Biogeography, and Metapopulation Theory provide valuable insights into how businesses can operate within fragmented ecosystems while minimizing

ecological disruption. These frameworks help illustrate the potential for PBBs to enhance habitat connectivity and contribute to ecosystem resilience. Furthermore, case studies of successful PBB initiatives, such as ECO KARST and GrassLIFE, serve as practical examples of how businesses can balance profitability with sustainability. By analyzing these cases, the manuscript aims to identify best practices and key strategies that can be replicated in other regions.

In addition to examining business models and theoretical foundations, this study also assesses the role of policy and regulatory frameworks in supporting or hindering PBBs. Government incentives, legal protections, and corporate responsibility programs are essential mechanisms for ensuring that businesses contribute to conservation rather than exploitation. By providing policy recommendations and strategic insights, this manuscript seeks to bridge the gap between economic interests and environmental stewardship. Ultimately, the manuscript aims to offer a comprehensive understanding of how PBBs can serve as a viable solution to the ongoing challenge of biodiversity loss, fostering a sustainable future for both businesses and ecosystems.

This manuscript is structured as follows: Section 2 presents an overview of PBBs and BBBs, highlighting their differences and significance in conservation. while section 3 provides a theoretical foundation by exploring key ecological concepts relevant to biodiversity conservation and business integration. Section 4 discusses case studies that illustrate successful PBB models, while Finally, Section 5 concludes with recommendations for fostering sustainable business practices that contribute to biodiversity conservation.

2. The Concept of Pro-Biodiversity & Biodiversity-Based Businesses

Pro-Biodiversity Businesses (PBB) are enterprises that generate financial returns while actively contributing to biodiversity conservation. These businesses operate with a dual purpose: achieving economic sustainability and promoting the conservation and sustainable use of biological resources (Volles et al., 2019; RSPB, 2009). PBBs encompass various sectors, including agriculture, fisheries, forestry, eco-tourism, environmental research, and advisory services, ensuring their core business both depends on and contributes to biodiversity (Dickson et al., 2007).

They are characterized by their commitment to biodiversity conservation, equitable benefit-sharing, and sustainable ecosystem management (Bishop et al., 2008; Lambooy & Levashova, 2011). Some PBBs directly enhance biodiversity and ecosystem services, making conservation an integral part of their business models (van Leenders et al., 2015). Additionally, these businesses develop products or services that benefit local natural resources, operating in sectors such as tourism, sustainable agriculture, and agroforestry (Bovarnick & Gupta, 2003).

Biodiversity-Based Businesses (BBB), on the other hand, are enterprises that rely on biodiversity for their production processes. These include industries such as agriculture, fisheries, forestry, tourism, energy, and manufacturing, which depend

on healthy ecosystems to maintain air, water, and soil quality (Earthwatch Institute et al., 2002). While some BBBs inherently support biodiversity conservation—such as ecotourism, which depends on the preservation of natural landscapes—others may pose risks to biodiversity unless managed within a strong regulatory framework (Bayon et al., 2000). In cases where a business's profitability directly depends on a thriving ecosystem, such as nature-based tourism, there is a clear financial incentive to invest in biodiversity management (Bishop et al., 2008). However, biodiversity-based businesses alone should not be the primary strategy for conservation, as broader efforts in sustainable agriculture and land management may be more effective in protecting biodiversity on a larger scale (Bayon et al., 2000).

Key differences between these two categories. PBBs and BBBs differ in their objectives, relationship with biodiversity, and conservation impact:

Objectives: PBBs explicitly support biodiversity conservation while generating financial returns, engaging in ecosystem protection and sustainable resource use (RSPB, 2009; Bishop et al., 2008). In contrast, BBBs depend on biodiversity but do not necessarily prioritize its conservation, leading to varying impacts on ecosystems.

Impact: PBBs integrate conservation into their business models, ensuring financial success benefits ecosystems directly (van Leenders et al., 2015). Conversely, BBBs rely on biodiversity without guaranteeing its preservation, as seen in sectors like agriculture and forestry, which can either support or deplete biodiversity depending on sustainability practices (Bayon et al., 2000).

Regulatory Approaches: PBBs align with conservation policies to ensure long-term biodiversity benefits (Lambooy & Levashova, 2011), while BBBs require oversight and incentives to mitigate potential ecological harm. Only some BBBs, like ecotourism, naturally support conservation (Bayon et al., 2000).

Sustainability: PBBs inherently promote biodiversity conservation as a core aspect of their success (Dickson et al., 2007). In contrast, BBBs vary in sustainability based on whether they adopt conservation practices or contribute to biodiversity loss through unsustainable resource use (Bishop et al., 2008).

Designating protected areas (PAs) is widely regarded as one of the most effective strategies for global biodiversity conservation (Dudley et al., 2014; Johnson et al., 2017; Rodrigues et al., 2004). Studies show that well-managed PAs help prevent habitat loss and sustain species populations (Watson et al., 2014). Additionally, PAs support the livelihoods of millions of people and preserve land carbon stocks, playing a crucial role in climate change mitigation and regulation (Bertzky et al., 2012).

3. Theoretical Foundations

Landscape Ecology and Habitat Fragmentation

Landscape ecology is the study of the reciprocal interactions between spatial heterogeneity and ecological processes. This discipline emphasizes how spatial patterns influence ecological functions and vice versa. The field has its roots in the European tradition of regional geography and vegetation science, with Carl Troll coining the term in 1950. A defining characteristic of landscape ecology is its focus on spatial heterogeneity—variability in environmental factors across space and time—and its impact on ecosystems (Turner, 2005).

A central issue in landscape ecology is habitat fragmentation, defined as the process of breaking up continuous habitats into smaller, isolated patches, often due to human activities (Fahrig, 2003). Fragmentation has profound effects, including loss of biodiversity, reduced species movement, and increased ecosystem instability.

Island Biogeography Theory

Island Biogeography Theory (MacArthur & Wilson, 2001) explains species distribution in isolated habitats based on immigration and extinction dynamics. It holds particular relevance for protected areas, which function as "ecological islands" due to habitat fragmentation. The theory highlights that larger, less isolated habitats support greater biodiversity and experience lower extinction rates, guiding conservation strategies that emphasize larger reserves and ecological corridors (Lomolino et al., 2010).

The number of species in an island-like habitat depends on immigration, influenced by proximity to a species source, and extinction, which is reduced in larger areas with more resources. Larger protected areas generally sustain richer biodiversity, while smaller, more isolated ones face greater species loss risks. Conservation applications of this theory prioritize habitat connectivity to support biodiversity and ecological stability (MacArthur & Wilson, 2001).

While IBT remains fundamental in ecology, modern studies have expanded beyond its simplicity, incorporating landscape ecology, metapopulation dynamics, and conservation genetics for a more comprehensive understanding of fragmented ecosystems (Laurance, 2008).

Metapopulation Theory

Metapopulation Theory, proposed by Hanski (1999), describes populations as networks of subpopulations connected through migration, emphasizing the dynamics of extinction and recolonization. This theory is essential for biodiversity conservation, particularly in fragmented landscapes where species survival relies on dispersal between habitat patches (Levins, 1970). The theory underscores the importance of connectivity in maintaining genetic diversity and ecological resilience.

Hanski developed models integrating habitat patch size, quality, and isolation to predict species persistence. These models inform conservation strategies,

suggesting that maintaining corridors and stepping-stone habitats can enhance species survival. The Incidence Function Model (IFM) has been widely applied to study various taxa, including insects, amphibians, and small mammals (Moilanen, 2002).

Metapopulation Theory also plays a role in protected area management by guiding the design of conservation reserves that prioritize habitat connectivity. It has been used to assess species viability in fragmented landscapes and inform policies aimed at mitigating habitat loss and fragmentation (Hanski & Gilpin, 1991). Furthermore, the theory's relevance extends beyond conservation; it parallels epidemiological models, offering insights into understanding disease spread (Ovaskainen & Grenfell, 2003).

Despite its significance, Metapopulation Theory assumes discrete habitat patches, which may not fully apply to continuous landscapes. Future research should refine the theory to incorporate more complex ecological interactions and habitat gradients, enhancing its applicability in conservation planning (Fahrig, 2002).

4. Businesses interaction with biodiversity

In recent years, human activities have significantly increased their impact on natural resources. Simultaneously, public investments in protecting biodiversity, landscapes, and natural resources have also risen. However, biodiversity conservation cannot rely solely on public funding—it must also involve private entities whose activities depend on these natural resources, as they should contribute to their preservation like any other production factor (Earthwatch Institute et al., 2002).

This concept drives the transition of Biodiversity-Based Economic Activities (BBEA) into Pro-Biodiversity Economic Activities (PBEA), covering sectors such as agriculture, tourism, forestry, and fisheries (Bishop et al., 2008).

- Agriculture plays a crucial role, as healthy ecosystems support soil fertility, sediment control, and clean water. Key activities include organic farming, extensive grazing, landscape maintenance, seed production, and wetland management (Lambooy & Levashova, 2011).
- Agrobiodiversity is a vital component of PBB, focusing on preserving endangered crop varieties and livestock breeds, supported by EU Rural Development Programs and IPARD initiatives (Bayon et al., 2000).
- Ecotourism generates revenue based on ecosystem health. Activities include nature-based hotels, adventure tourism, and Ho.Re.Ca. services that promote biodiversity-based food products (Bishop et al., 2008).
- Forest Management contributes to biodiversity conservation through sustainable timber production, seed collection, non-timber forest product utilization, and eco-tourism within forested areas. Forestry service providers focus on pest control, fire prevention, and ecosystem restoration (Bovarnick & Gupta, 2003).

- Biodiversity Management Services (BMS) involve consulting on nature conservation, project impact assessments, biodiversity monitoring, and environmental certification (van Leenders et al., 2015).
- Sustainable Fisheries ensure ecosystem health and respond to market demands for responsible fishing practices. Examples include organic fish farming, ecotourism-based fishing, and controlling invasive species through targeted fishing (Dickson et al., 2007).
- Sustainable Hunting helps manage invasive species and maintain ecosystem balance. It plays a role in conservation through controlled hunting and habitat management strategies (RSPB, 2009).

In summary, PBB development supports biodiversity conservation while creating economic opportunities for local communities, aligning business needs with nature preservation goals (Volles et al., 2019).

Businesses interact with biodiversity in two main ways: by using ecosystem services and by influencing changes in ecosystems. Key interactions include:

- Economic exploitation (e.g., forestry, fishing, tourism), where sustainability is essential.
- Operational impacts such as land use changes, energy use, and hydrology alterations, which need to be minimized.
- Routine and non-routine consequences, including emissions, pollution, and environmental damage, with a goal of zero impact.

Negative business impacts include land conversion, over-exploitation, greenhouse gas emissions, pollution, and the introduction of invasive species. These can be direct or indirect through supply chains. Secondary impacts, like deforestation due to infrastructure development, can be harder to control and often exceed primary impacts in scale.

On the positive side, businesses can contribute to biodiversity by sourcing sustainably, supporting conservation projects, managing land to enhance biodiversity, and investing in eco-friendly innovation. In protected areas, sustainable business models can align economic goals with conservation efforts, helping to restore ecosystems and fund preservation initiatives (Parr and Simson 2007).

In protected areas, both PBBs and well-managed BBBs can foster synergies between economic development and conservation objectives. PBBs play an active role in ecological restoration and habitat protection, while BBBs, when adopting sustainable practices, can reduce environmental harm and contribute financially to conservation initiatives (van Leenders et al., 2015). Moreover, integrating conservation principles into BBB operations—such as implementing sustainable tourism models where visitor fees support park management—illustrates how these businesses can aid biodiversity conservation in protected areas (Bovarnick & Gupta, 2003).

Overall, PBBs take a proactive approach to biodiversity conservation by embedding ecological sustainability into their core strategies, whereas BBBs can contribute when effective management and regulations promote the sustainable use of natural resources in protected areas.

5. Case Studies in Biodiversity Conservation through Economic Activities

Several studies and projects have demonstrated how economic activities can positively impact biodiversity conservation. The "Probioprise" project (Dickson et al., 2007) explored the role of pro-biodiversity enterprises, identifying their contributions to biodiversity conservation and the motivations behind them. The "Corporate Biodiversity Management Handbook" assessed various biodiversity business sectors, evaluating successful approaches, challenges, and opportunities to integrate market-based conservation efforts. Additionally, “The Business of Biodiversity” highlighted how ecosystem services remain undervalued in markets, advocating for regulatory and economic mechanisms to ensure their proper recognition and conservation.

Numerous frameworks and guidelines have been developed to help businesses integrate biodiversity conservation into their operations. The “Biodiversity Check for Companies” (Kant et al., n.d.) serves as a tool for businesses to assess and mitigate their impacts on biodiversity while aligning with international environmental standards like EMAS III and ISO 14001. Similarly, the "Development Guide for Pro Biodiversity Business" (ECO Karst project) provides structured steps for establishing successful biodiversity-friendly businesses, particularly in protected areas. The "Business and Biodiversity Handbook" offers real-world corporate case studies, illustrating successful business transitions toward biodiversity-friendly practices.

Several EU-funded projects have successfully implemented biodiversity-friendly business models in Southern Europe, demonstrating that economic development and nature conservation can go hand in hand.

The Biodiversity Technical Assistance Unit (BTAU) Project aimed to integrate private-sector investments with public funding to create profitable small and medium-sized enterprises (SMEs) that contribute to biodiversity conservation, particularly in Natura 2000 sites and High Nature Value areas. This initiative, supported by the European Commission, was implemented in Bulgaria, Poland, and Hungary, where three biodiversity technical assistance units were established. These units helped identify and prioritize biodiversity-friendly businesses while facilitating investment through grants, loans, equity purchases, and microfinance agreements. As a result, the project encouraged private-sector involvement in financing and sustainably managing Natura 2000 sites, bridging funding gaps and promoting rural development RSPB (2009).

The ECO KARST Project focused on leveraging the natural heritage of seven protected karst areas in Central and Southeastern Europe as a driver for sustainable

economic development. By working in regions with unique karst landscapes and rich biodiversity, the project supported businesses that adopted sustainable management of ecosystems while raising awareness about their ecological sensitivity. One of its main achievements was promoting pro-biodiversity business opportunities, demonstrating that nature conservation and economic growth can be mutually beneficial (Gattenlöhner et al., 2018). The UNWTO "Practical Guide for the Development of Biodiversity-based Tourism Products" provided insights into sustainable tourism initiatives that contribute to biodiversity conservation, offering practical implementation tools for local businesses.

In Tuscany, the integration of organic farming and agro-tourism has revitalized rural economies while preserving biodiversity. Farmers have adopted sustainable agricultural practices that improve soil health and protect local ecosystems. One notable example is Tenute di Paganico Società Agricola, a large farm in the province of Grosseto that combines grain cultivation, vineyards, olive groves, and semi-wild livestock grazing. By offering visitors an authentic farm experience, including eco-friendly accommodations and local food tastings, this initiative supports the local economy while fostering environmental conservation (STAY project EU, 2024).

Another example is the GrassLIFE project in Latvia, which commenced in 2016. This project aimed to restore over 1,320 hectares of priority grasslands across 14 Natura 2000 sites. By collaborating with 12 farms, GrassLIFE implemented various restoration techniques and developed best practices to enhance both biodiversity and the economic viability of farming on semi-natural grasslands. These efforts have been instrumental in addressing the decline of biodiversity while supporting local agricultural economies (European Comission, 2023).

5. Concluding remarks

Balancing biodiversity conservation with sustainable economic development in Southern Europe's protected areas presents multifaceted challenges. The establishment of protected zones often imposes restrictions on resource use, leading to tensions between conservation objectives and local economic interests. This dynamic is particularly evident in regions where communities have historically depended on natural resources for their livelihoods.

One significant challenge is the perception among local populations that conservation efforts hinder economic growth. In many instances, protected areas are viewed as obstacles to development, especially when restrictions limit activities such as agriculture, forestry, and tourism. This perception can foster resistance to conservation initiatives, undermining their effectiveness. For example, in the Yancheng Biosphere Reserve in China, development activities within the reserve's zones have impacted endangered species and local waterbird communities, highlighting the complex interplay between economic development and biodiversity conservation (Ma et al., 2008).

Moreover, the implementation of conservation policies without adequate stakeholder engagement can exacerbate conflicts. Top-down approaches that

neglect the input and needs of local communities may lead to mistrust and non-compliance. Inclusive conservation strategies that involve local stakeholders are essential to reconcile biodiversity preservation with economic interests. Research indicates that interventions such as education, capacity building, and the development of sustainable livelihoods can serve as leverage points to promote positive transformations in protected areas (Cebrián-Piqueras et al., 2023).

Financial constraints further complicate the balance between conservation and development. Effective management of protected areas requires substantial investment, yet funding is often limited. This shortfall can impede the enforcement of protection measures and the development of infrastructure that supports both conservation and sustainable economic activities. A study evaluating protected area policies in the European Union found that, despite extensive land protection designations, the lack of ambitious conservation efforts and insufficient funding have limited the effectiveness of these areas in enhancing biodiversity (Grupp et al., 2024).

To address these challenges, fostering pro-biodiversity businesses (PBBs) within protected areas has emerged as a viable solution. PBBs are enterprises that generate financial returns without compromising the natural environments they depend on. In Central and South-Eastern Europe, the development of Biodiversity Investment Opportunities (BIO) maps has facilitated the identification of areas suitable for economic activities that align with conservation goals. This participatory approach has been effective in changing perceptions of both park managers and local communities towards protected areas, demonstrating that economic development and biodiversity conservation can be mutually reinforcing (Gorjanc et al., 2022).

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USKLAĐIVANJE PRIVREDNIH AKTIVNOSTI I BIODIVERZITETA: KATEGORIZACIJA PRO BIODIVERZITETNIH I NA BIODIVERZITETU ZASNOVANIH BIZNISA U ZAŠTIĆENIM PODRUČJIMA JUGOISTOČNE EVROPE

Apstrakt: *Pro-biodiverzitetni biznisi (PBB) i biznisi zasnovani na biodiverzitetu (BBB) imaju različite uloge u integraciji ekonomskog razvoja i očuvanja biodiverziteta. PBB-ovi su eksplicitno usmereni na očuvanje biodiverziteta uz obezbeđivanje finansijske održivosti, poslujući u sektorima kao što su održiva poljoprivreda, šumarstvo, ekoturizam i ekološko savetovanje. S druge strane, BBB-ovi zavise od biodiverziteta, ali ne doprinose nužno njegovom očuvanju, zbog čega je neophodno uspostaviti snažne regulatorne okvire kako bi se ublažili ekološki rizici. Teorijski okviri poput pejzažne ekologije, ostrvske biogeografije i teorije metapopulacija nude dragocene uvide u ekološku dinamiku koja utiče na očuvanje biodiverziteta. Ovi okviri naglašavaju značaj povezanosti staništa, održivog upravljanja zemljištem i ekološke otpornosti u cilju ublažavanja fragmentacije staništa i gubitka vrsta. Biznisi ostvaruju interakciju sa biodiverzitetom korišćenjem ekosistemskih usluga i uticanjem na ekološke promene putem korišćenja zemljišta, emisija i eksploatacije resursa. Negativni uticaji uključuju uništavanje staništa i zagađenje, dok održivi poslovni modeli mogu pozitivno doprineti kroz podršku konzervacijskim inicijativama i usvajanjem ekološki prihvatljivih praksi. Nekoliko studija slučaja prikazuje uspešnu integraciju ekonomskih aktivnosti i očuvanja biodiverziteta. Ipak, izazovi i dalje postoje u usklađivanju ekonomskih interesa i ciljeva očuvanja, naročito u zaštićenim područjima gde regulatorna ograničenja mogu izazvati otpor lokalnih zajednica. Podsticanje razvoja PBB-ova i sprovođenje participativnih konzervacionih strategija mogu prevazići ove prepreke i doprineti međusobnom jačanju očuvanja biodiverziteta i održivog ekonomskog razvoja.*

Ključne reči: *Pro-biodiverzitetni biznisi (PBB), biznisi zasnovani na biodiverzitetu (BBB), održivi razvoj, očuvanje biodiverziteta.*