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Analysis of The Compliance of The Implementation of West Bali National Park with The Criteria of Article 4 of The UNESCO MAB Program

Misti Khoirinsyroh Afebel[1], Abid Rohman[2]
[1,2] Social and Political Science, Universitas Islam Negeri Sunan Ampel Surabaya, Indonesia
Correspondence: mistikhoirinsyrohafebel@gmail.com

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ABSTRACT

This study examines the alignment of West Bali National Park with the concept of UNESCO's Man and the Biosphere (MAB) program based on the indicators of Article 4 Statutory Framework of the World Network of Biosphere Reserves. This study is motivated by the evolving conservation paradigm that increasingly emphasizes the integration of sustainable development, community empowerment, and area management, rather than focusing solely on the protection of biodiversity. This study employs a qualitative descriptive-analytical method. Data were collected through field observations, documentary studies, and literature reviews. The concept employed is the UNESCO MAB biosphere reserve concept, which emphasizes conservation functions, sustainable development, and support for environmental research and education. The results of this study indicate that TNBB has met the indicators outlined in Article 4 of the MAB through various efforts and their implementation. This compliance is evidenced by the presence of a representative mosaic of ecosystems, the protection of biodiversity for endangered species (*Leucopsar Rostchildi*), an adaptive zoning system, conservation-based ecotourism activities, and community involvement. Additionally, TNBB has supported logistical functions related to environmental research and education, though long-term monitoring is still required.

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INTRODUCTION

Conservation areas today face increasingly complex challenges due to increasing ecological pressures, the needs of economic development, and changing patterns of human interaction with the environment. In this context, conservation area management is no longer solely oriented toward biodiversity protection but also focuses on the area's capacity to support sustainable development and the well-being of local communities. This approach has evolved through the concept of *biosphere reserve* which UNESCO introduced through the program *Man and the Biosphere* (MAB). This program is a regional or area management model that integrates conservation, sustainable economic development, and support for environmental research and education. MAB is important because it offers an adaptive approach to maintaining the balance of natural ecosystems. It combines ecosystem protection with the socio-economic needs of the community, mutually supporting each other.

West Bali National Park is one of Indonesia's strategic conservation areas, particularly in Bali. TNBB boasts complex ecological characteristics and high value, serving as a sanctuary for several endemic species. This conservation area also comprises various ecosystem types, including rainforests, savannas, mangroves, and shallow marine waters, which provide habitat for flora and fauna. TNBB also serves as a space for interaction between various interests, ranging from conservation, sustainable tourism, marine and fisheries production, to the activities of the surrounding villages. This demonstrates

that while TNBB is primarily a conservation and biodiversity protection area, it also serves a socio-ecological role.

UNESCO's MAB biosphere reserve program is fundamentally built on the idea that conservation success is strongly influenced by an area's ability to integrate ecological functions with human activities in a sustainable manner. This underpins the understanding of conservation areas as collaborative spaces that enable harmonization between natural resource protection and controlled, safe utilization. In practice, biosphere reserves have three adaptive zoning structures: *core area*, *buffer zone*, And *transition area*. Therefore, biosphere reserves are not understood as exclusive conservation areas closed off from human activity. The zoning structure serves as an instrument for regulating the intensity of spatial use while simultaneously maintaining long-term ecosystem stability. Therefore, the effectiveness of area management is determined not only by the level of ecological protection but also by the ability of area governance to build a balanced relationship between humans and the environment.

From the perspective of UNESCO's MAB, the success of a biosphere reserve is also largely determined by the existence of adaptive institutions, local community participation, and support for environmental research and monitoring. Biosphere reserves generally have a mandatory principle, namely, a collaborative management system involving government, communities, academics, and the private sector in the decision-making process. Biosphere reserves are also positioned as living laboratories for the development of science, environmental education, and ecosystem-based sustainable development models. This approach emphasizes that the sustainability of conservation areas requires the synchronous integration of ecological, socio-economic, and institutional aspects, and cannot be achieved through administrative protection alone. Conceptually, Article 4 in *Statutory Framework of the World Network of Biosphere Reserves* establishes several important indicators for an area to be categorized as a biosphere reserve. These indicators include the representation of biogeographically important ecosystems, contributions to biodiversity conservation, the existence of a zoning system, support for sustainable development, and the availability of mechanisms for management, research, education, and community participation. From these indicators, criteria are formed that will make the biosphere reserve concept an evaluative instrument to describe the extent to which an area is able to carry out conservation and development functions simultaneously, not only as an international conservation status. Therefore, the approach of Article 4 of the UNESCO MAB is relevant to be used as an analytical tool in assessing the suitability of conservation areas in Indonesia, including TNBB.

The fundamental problem in managing conservation areas in Indonesia generally lies in the suboptimal integration between ecological protection and regional development interests. Various studies have shown that conservation areas often face issues of fragmented governance, conflicts over spatial use, low community participation, and weak integration of conservation programs with local development. In the context of the TNBB (National Park of Borneo), pressures on the area arise from tourism activities, coastal resource utilization, and the economic needs of communities surrounding the national park. Furthermore, the area's zoning and conservation functions have not been fully analyzed using a comprehensive biosphere reserve approach. This situation indicates the need to examine the extent to which TNBB has met the basic principles and become part of the UNESCO MAB biosphere reserve component, particularly based on the indicators in Article 4.

Several previous studies examining West Bali National Park have largely focused on species conservation, ecotourism management, and partial ecological studies of the area. Research on the Bali Starling, for example, has focused more on efforts to conserve the population and habitat of endemic animals. Other studies have discussed the development of conservation-based tourism or the analysis of the condition of mangrove and coastal ecosystems (Marbawa et al., 2014). Meanwhile, research on biosphere reserves in Indonesia generally focuses on areas officially designated as UNESCO biosphere reserves, such as Cibodas, Karimunjawa, or Komodo National Park (Purwanto et al., 2020). Consequently, research specifically examining national parks using UNESCO's Article 4 MAB indicators as the primary analytical instrument is still very limited. Therefore, this study is novel in its use of an evaluative approach based on *Statutory Framework* UNESCO to assess TNBB's potential as an area that meets the principles of a biosphere reserve. Another innovation lies in the integration of ecological analysis, zoning, governance, and community participation within a single conservation area evaluation framework.

Based on the description, this study aims to analyze the level of adequacy of West Bali National Park as a conservation area that fulfills the UNESCO MAB Biosphere Reserve concept based on the

indicators in Article 4. *Statutory Framework of the World Network of Biosphere Reserves.* This research is crucial because it will provide an overview of the region's readiness to implement a combined conservation management model based on sustainable development. This is because the biosphere reserve program can be a solution to the gap between communities and ecosystems. Furthermore, the results of this study are expected to provide recommendations for strengthening conservation area governance, developing policies within the biosphere reserve concept, and contributing academically to the development of conservation studies and protected area management in Indonesia.

RESEARCH METHOD

This study employs a qualitative method with an emphasis on a descriptive-analytical approach. This approach is used to analyze the extent to which West Bali National Park aligns with the concept of a biosphere reserve under UNESCO's Man and the Biosphere (MAB) program, specifically the indicators outlined in Article 4 of the Statutory Framework of the World Network of Biosphere Reserves. The focus of this study lies in assessing ecological conditions, the area's zoning system, sustainable development, community participation, area governance, as well as research and environmental education support implemented within TNBB. The researcher employs a descriptive approach because this study describes and evaluates the alignment of the conservation area's characteristics with the principles of UNESCO biosphere reserves.

Data collection in this study consists of primary and secondary data. Primary data was obtained through field observations in the TNBB area and the buffer zone villages. These observations were conducted to directly observe the dynamics of community activities and the implementation of the zoning system and area management. Observations were conducted on several community activities, such as mangrove tourism, traditional fishing activities, and fishing groups alongside community empowerment based on conservation. Meanwhile, secondary data was collected through documentation and literature reviews, including official documents from the TNBB Office, TNBB Statistical Data for 2024, regulations related to spatial planning and conservation, scientific journals, research reports, and the official UNESCO MAB document titled The Statutory Framework of the World Network of Biosphere Reserves.

Data collection techniques were conducted through observation, documentation, and literature review. Observation was used to obtain a direct understanding of the condition of the area and the socio-economic activities of communities around TNBB. Documentation involved collecting data on zoning, area size, the presence of protected flora and fauna, conservation programs, and the institutional structure of conservation communities. Literature review was used to strengthen the theoretical analysis regarding the concept of biosphere reserves, conservation area management, and the principles of sustainable development within the UNESCO MAB framework. All data obtained were then classified based on the indicators of Article 4 of the UNESCO MAB, such as ecosystem mosaics, biodiversity conservation significance, zoning systems, sustainable development, stakeholder engagement, and support for environmental research and education.

Data analysis was conducted using descriptive-qualitative techniques, with the indicators of Article 4 of the UNESCO MAB Program serving as the primary analytical framework. The collected data were analyzed through the stages of data reduction, data presentation, and drawing conclusions. In the reduction stage, data were selected based on their relevance to biosphere reserve criteria. Subsequently, the data were presented in the form of descriptions illustrating the degree of alignment between TNBB and each of the UNESCO MAB indicators. Finally, conclusions were drawn regarding the implementation and readiness of TNBB as an area with the potential to become part of the concept of a biosphere reserve based on conservation and sustainable development.

RESULT AND DISCUSSION

Analysis of Fulfillment of TNBB Criteria Based on The Framework Statutory Framework of the World Network of Biosphere Reserves Man and The Biosphere UNESCO

According to Article 1 (14) of Law Number 5 of 1990 concerning Conservation of Natural Resources and their Ecosystems, National Parks are natural conservation areas that have original ecosystems, managed with a zoning system that is utilized for research, science, education, supporting cultivation, tourism and recreation. The function of national parks is to preserve natural biological

resources and ecosystems as a protected area for life support systems, preserving the diversity of animal and plant species and utilizing natural biological resources and their ecosystems.

Ecosystem Mosaics and Biogeographic Regions

The West Bali National Park conservation area is a sanctuary and even home to the very rare bird species, the Bali Warbler (Leucopsar rothschildi). In addition to the Bali Warbler, many other protected fauna species are found, such as the pangolin, porcupine, jungle cat, and Timor deer. Marine animals include dugongs and bottlenose dolphins. Bird species include the black eagle, black-winged white-bellied kite, black-winged starling, falcon, and crested terns. Among the reptiles, there are olive ridley turtles, green turtles, hawksbill turtles, and bodo pythons. Within the flora, there are 276 protected plant species originating from various forest types, including the Bayur Ketangi, sandalwood, candlenut, sapodilla, and rosewood. The recorded biodiversity demonstrates that the TNBB mosaic has been beautifully illustrated and arranged. This biodiversity can be a major factor in conservation and ecosystem preservation. This biodiversity makes TNBB ready to be part of a biosphere reserve according to UNESCO Article 4.

Administratively, West Bali National Park is located within the Buleleng and Jembrana Regencies of Bali Province. To the north, West Bali National Park borders the Bali Strait, Pejarakan and Sumber Klampok Villages. To the east, it borders Pejarakan and Sumber Klampok Villages, to the west, Gilimanuk and the Bali Strait, to the south, Blimbingsari, Ekasari, and Melaya Villages, and to the southeast, Blimbingsari, Ekasari, and Melaya Villages. According to a 2014 Decree from the Minister of Forestry, TNBB covers a total area of 19,026.97 hectares.

The Director General of Nature Protection and Conservation has established four zones. The Core Zone covers 7,567.85 hectares of land and 455.37 hectares of water. The Jungle Zone, located to the north, south, west, and east, covers 6,099.46 hectares of land and 243.96 hectares of water. The Intensive Use Zone covers 1,645.33 hectares of land and 2,745.66 hectares of sea water. The Cultural Use Zone covers 245.26 hectares, located in the Menjangan Island, Teluk Terima, Prapat Agung, Bakungan, and Klatakan areas.

Within the TNBB area, there are zoning divisions with their respective functions. The Core Zone in the TNBB area is an absolute area. The Jungle Zone is a zone where research activities can be conducted similar to the core zone and also limited nature tourism activities. The Intensive Utilization Zone can also be utilized similarly to the core and jungle zones, with the addition of this zone can be used as a center for the development of natural tourism infrastructure that supports conservation activities. Then finally, there is the Cultural Utilization Zone, in this zone land and area use is permitted for local communities who depend on non-timber forest products for their livelihoods, such as plantations and livestock. The 2018 TNBB zoning revision included an expansion of the zone categories, namely traditional zones, religious, cultural, and historical zones, and special zones as additional zones. The TNBB area has also implemented a representative ecological system. This is indicated by the types of ecosystems that are still maintained within it. The diversity of these ecosystems consists of lowland ecosystems, coastal forest ecosystems, savanna ecosystems, mangrove ecosystems, seagrass ecosystems, and coral reef ecosystems (West Bali National Park Office, 2024).

Based on the MAB clause, ecosystem mosaics and biogeographic regions represent a puzzle-like representation of a collection of different ecosystem types connected within a single landscape. In this sense, a region must be representative of the unique biodiversity of its region. For example, the TNBB (National Park of Borneo) highlights the vulnerability of its endemic bird, the Bali Starling (Leucopsar Rothschildi). Furthermore, natural ecosystems coexist with human activities. Therefore, ecosystem mosaics also represent the gradation of human interventions around conservation areas, allowing them to be managed and utilized for sustainable development.

From the description of the data above, and with adjustments to the clauses in the MAB, TNBB has achieved the number one criterion referred to in article 4 of the Statuary of The World Network of Biosphere Reserve. The first clause of the MAB framework, Article 4, requires criteria for a mosaic of ecological systems representing key biogeographic regions. West Bali National Park (TNBB) representatively meets the criteria of the first clause because the TNBB area encompasses a diverse mix of ecosystems, spanning marine waters, coral reefs, mangroves, savannas, and lowlands. These diverse ecosystems make the area a natural laboratory suitable for fostering human interaction and environmental sustainability.

Therefore, TNBB is administratively responsible for the protection and security of flora and fauna habitats to ensure at least representative species continue to regenerate. The existence of preserved flora and fauna in TNBB serves as a model for sustainable development, emphasizing the interconnectedness of animal, plant, and human life. The existing ecosystem mosaic in TNBB is also sufficient to warrant comprehensive management, as all parts and types of animals and plants are interconnected, including with human activities within and around it.

Significance of Biodiversity Conservation

TNBB holds significant value by global conservation standards because it actively protects all the natural resources within and around the forest. TNBB is the only safe natural habitat for the Bali Warthog (*Leucopsar rothschildi*) which until now is included in the category of extinct species or Critically Endangered (BirdLife International, 2021). Besides the Bali Myna or Bali Curik, there is fauna that is also included in the Critically Endangered category, namely the Pangolin (Manis Javanica) (West Bali National Park Office, 2024). Protection of Pangolins is also clarified in the Regulation of the Minister of Life Protection and Forestry of the Republic of Indonesia number P.106/MENLHK/SETJEN/KUM.1/12/2018 concerning Protected Plant and Animal Species.

In addition to fauna, this area is designated to preserve several rare plants, such as the Keruing Bunga (Diptero Hasseltii). This plant species is classified as Critically Endangered (Ly et al., 2017). The high level of endemic vulnerability and the presence of these key species strengthens TNBB's position as a *Core Area* (Core Area) which is absolutely mandatory in the MAB concept. The implications of this conservation significance find the answer that TNBB has met the criteria requirements in fulfilling the core area criteria.



Figure 1 Conservation Status of *Manis Javanica* on the RedList

Tabel 1. Jenis-Jenis Flora Yang Dilindungi di TNBB

No.	Jenis Tumbuhan	Nama Ilmiah	
1.	Bayur	*Pterospermum diversifolium*	Tanaman la Mentan No. 54
2	Buni	*Antidesma bunius*	Tanaman langka
3	Bungur	*Langerstroemia speciosa*	Tanaman langka (IUCN; dilindungi SK Mentan No. 54/Kpts/Um/2/1972
4	Burahol	*Steleochocarpus burahol*	Tanaman langka
5	Cendana	*Santalum album*	Tanaman langka (IUCN; dilindungi SK Mentan No. 54/Kpts/Um/2/1972
6	Kemiri	*Aleuritas moluccana*	Tanaman langka (IUCN; dilindungi SK Mentan No. 54/Kpts/Um/2/1972
7	Kepah, Kepuh (Bali)	*Sterculia foetida*	Tanaman langka IUCN
8	Kesambi	*Schleichera oleosa*	Tananam langka IUCN
9	Kruing bunga	*Diptercocaus Hasseltii*	Tanaman langka BTNBB
10	Mundu	*Garcinia dulcis*	Tanaman langka IUCN
11	Pulai	*Alstonia scolaris*	Tanaman langka IUCN
12	Sawo kecik	*Manilkara kauki*	Tanaman langka (IUCN; dilindungi SK Mentan No. 54/Kpts/Um/2/1972)
13	Sono keeling	*Dalbergia latifolia*	Tanaman Langka (IUCN; dilindungi SK Mentan No. 54/Kpts/Um/2/1972)
14	Trengguli	*Cassia fistula*	Tanaman Langka

Sumber: *Statistik TNBB 2024*

Full translation

Figure 2 List of Several Plant Species in TNBB

The image above demonstrates that TNBB meets the criteria for biosphere reserve status due to its dedicated efforts to preserve its ecosystem and reduce the potential for species extinction. Furthermore, TNBB's unique capabilities will support the Man and the Biosphere program.

Opportunities for Sustainable Development on a Regional Scale

The third criterion requires the region to provide opportunities and support for ecologically and socio-culturally sustainable economic development. Within the TNBB boundary, this is realized through ecotourism activities and the management of fishing activities. Among the several buffer villages involved, the existence of sustainable ecotourism can be seen in one of them, namely in Karangsewu, specifically in Gilimanuk Village. In Karangsewu, ecotourism is carried out systematically and procedurally. The ecotourism offered is also attractive, such as the Mangrove Tour activity, which can also serve as an educational tour in its role (based on the authors' field observations). Furthermore, there are also controlled traditional fishing activities that prevent destructive impacts and massive exploitation of marine resources. Examples of these activities include the fishing groups in Gilimanuk Village, particularly those frequently fishing in the Karangsewu area: the Segara Mertha Fishermen's Group, the Teluk Asri Fishermen's Group, and the Karangsewu Fishermen's Group.

In this third clause, the Statutory Framework of the World Network of the Biosphere Reserve requires the implementation of sustainable economic and social development, which is the difference between the systems in national parks and biosphere reserves. This sustainable development exists to ensure that surrounding communities continue to live in harmony with nature and remain sufficient to meet their economic needs. Therefore, efforts are made to create harmony and good dynamics between conservation and the economy. Therefore, in its role, TNBB is declared sufficiently capable of fulfilling the third criterion of Article 4 of the Statutory Framework of the World Network of the Biosphere Reserve.

Adequate Area (Spatial Area)

A biosphere reserve must have sufficient area to support and carry out its three primary functions: conservation, development, and logistical support. Administratively, TNBB covers 19,026.97 hectares. This area is adequate for protecting life support systems. Meanwhile, the combined forest area of Jembrana and Buleleng Regencies is 86,649.84 hectares (Ministry of Forestry of the Republic of Indonesia, 2014). Based on the area data, the TNBB area and the two districts can fulfill three main components, namely conservation, development, and logistics functions.

The spatial planning of this area serves as a benchmark for avoiding instability in the habitat of native flora and fauna, ensuring the ecosystem's natural long-term continuity, minimizing inter-spatial conflicts, and planning for sustainable management. Furthermore, this planning also serves as a means to increase ecosystem effectiveness and achieve management objectives.

Fulfillment of the Zoning System

The fifth clause requires three basic zones to support the biosphere reserve, the three in question are: *Core Area* (Core) which is a conservation or protected area, *Buffer Zone* (Buffer), and *Transition Area* (Transition). The current TNBB zoning system is very adaptive to this framework, in which the TNBB zone will function as *Core Area* MAB, with a total area of 19,026.97 ha. With the description of the Forest Zone and Marine Protection Zone, it functions as *Buffer Zone*, while the Utilization Zone, Traditional Zone, and Special Zone will overlap strongly with the concept *Transition Area*. Meanwhile, areas outside the TNBB will be managed by the Jembrana and Buleleng KPH based on Buleleng Regent Regulation number 32 of 2024 concerning the Detailed Spatial Plan for the Gerokgak Urban Area for 2024-2024, as well as Jembrana Regency Regional Regulation (Perda) Number 1 of 2023 concerning the JEMBRANA REGENCY SPATIAL PLAN 2023 – 2043.

Furthermore, the buffer zone adjacent to the conservation area serves as a legal area for community activities, such as tourism, research, and education. Based on the 2024 TNBB Statistics, these activities support ecotourism and research activities by various parties. For example, the community of Penyangga Village, Karangsewu, conducts ecotourism refreshment and development activities.

Furthermore, the fifth criterion indicates the necessity of a transition area to support sustainable development. This area serves as a platform for interaction between the community and the area. It is filled with economic activities such as tourism services, tour guides, homestay rentals, local stalls, and fishermen around the TNBB area. Ecotourism activities include snorkeling, Curik Bali birdwatching, and mangrove tourism. Natural resource utilization activities include non-timber forest product harvesting, water use, and fishing. These activities can create a beneficial area and a place for the community to rely on for their livelihood. Based on direct field observations, all interaction activities are controlled and within reasonable limits due to the proximity to the conservation area. The ecotourism program remains conservation-based and fosters engagement with local communities, especially those in buffer villages. The control efforts undertaken by TNBB are complex and are demonstrated by joint patrols in each area, mangrove rehabilitation, the release of Bali starlings, environmental empowerment and education, and the establishment of tourism awareness groups in Sumberklampok and Pejarakan Villages (West Bali National Park Office, 2024).

Therefore, in light of these criteria, it is concluded that TNBB has implemented measures consistent with Article 4 of the Statutory Framework of the World Network of Biosphere Reserves, which states that communities are not a threat to conservation areas or the natural ecology, but rather partners in supporting the conservation and protection of the Earth's flora and fauna.

Organizational Arrangements and Stakeholder Engagement

Local community participation in conservation management in West Bali National Park is demonstrated through the involvement of various community groups. These groups play an active role in the area's conservation activities. This involvement is also manifested through the presence of Forest Police Partners (Mitra Polhut), Fire Awareness Communities (MPA), and conservation partnership groups in traditional zones such as the Segara Merta, Teluk Asri, and Karangsewu Fishermen's Groups (West Bali National Park Office, 2024). These groups are involved in and support a variety of activities, from area patrols, forest fire monitoring, community-based tourism management, and limited and controlled resource utilization in accordance with national park management regulations (West Bali National Park Office, 2020). The community's open participation in conservation activities demonstrates that TNBB management is gradually embracing and moving toward a collaborative approach between area managers and local communities, rather than being entirely centralized and rigid. In addition to strengthening conservation area protection, this involvement also serves as an effort to maintain the community's relationship with the resources that sustain their lives.

In Article 4 *Statutory Framework of the World Network of Biosphere Reserves* UNESCO emphasizes that organizational arrangements and stakeholder involvement are essential in the

management of biosphere reserves. Biosphere reserves serve as collaborative spaces involving governments, local communities, academics, and various other stakeholders in a participatory management process, not merely as ecological conservation areas, as is the traditional and rigid view. This approach aims to create a balance between biodiversity protection and the socio-economic sustainability of surrounding communities. In this context, local stakeholder involvement is an important indicator, demonstrating responsibility for management and community conservation awareness, as well as strengthening local capacity to support ecosystem sustainability. Therefore, the presence of conservation community groups in an area is a comprehensive part of assessing the area's suitability for UNESCO's biosphere reserve concept.

Based on these conditions, community involvement around the TNBB area demonstrates alignment with the participatory principle emphasized in Article 4 of UNESCO's MAB. The presence of Forest Police Partners (Polhut), Fire-Aware Communities (MPA), and other conservation partnership groups demonstrates that the community is not merely a user of the area, but also an actor involved in the protection and monitoring of natural resources. This is a positive indicator, as modern conservation area management tends to be more effective when the community is directly involved, particularly in decision-making processes and field management activities, as the community also has rights that should be exercised for the sake of justice. However, the level of potential participation among community groups still differs. This is due to several factors, such as the extent of institutional capacity, economic access, and the intensity of mentoring from area managers. Therefore, TNBB can be said to have a foundation for collaborative management that is quite in line with the concept of a biosphere reserve. This is characterized by meaningful community collaboration and participation. However, strengthening coordination and community empowerment for long-term planning is still needed.

Implementation Mechanism and Logistics Support

Management of West Bali National Park is not only focused on protecting the conservation area, but is also beginning to focus on strengthening research, environmental education, and collaborative governance. This is evident in the various research activities on biodiversity and area management conducted by academics and research institutions within TNBB. One such research is *Analysis of the Economic Value of the Karang Sewu Natural Tourism Object in the West Bali National Park Area, Jembrana Regency, West Bali* (Semarang et al., 2025). Analysis of this research is demonstrates that conservation areas in TNBB not only have ecological value but also economic value, channeled through sustainable nature tourism. Furthermore, TNBB also has programs that support environmental education. One of these is the *Visit School.* The aim of the Visit School program carried out by TNBB is toreminding and raising conservation awareness among students and the surrounding community to maintain environmental protection. Through this activity, TNBB demonstrates that learning spaces and developing environmental knowledge are also important and should be disseminated widely. Therefore, TNBB serves more than just a biodiversity protection area.

In Article 4 *Statutory Framework of the World Network of Biosphere Reserves* UNESCO, particularly in the final criterion, emphasizes that a biosphere reserve must be able to support research, monitoring, education, and training activities related to conservation and sustainable development. This provision makes biosphere reserves a living laboratory that can easily be used for research and knowledge development and can also improve community capacity. Development efforts in research and monitoring are also considered important because they can provide scientific data needed for adaptive area management. Meanwhile, environmental education serves to build public ecological awareness of the importance of natural resource conservation. Therefore, the existence of research programs, biodiversity monitoring, and conservation education are among the main indicators in assessing an area's suitability as a biosphere reserve.

In addition to its research and educational functions, Article 4 of UNESCO's MAB also emphasizes the importance of governance in implementing and formulating clear policy or management mechanisms in area management. In other words, a Biosphere Reserve must have an institutional structure, management documents, internal regulations, and cooperation between stakeholders capable of supporting the implementation of conservation and sustainable development functions in an integrated manner. In this context, area management does not only depend on government authority, but also requires the involvement of research institutions, local communities, educational institutions, and various parties interested in the area's sustainability. With organized governance, biosphere areas

are expected to be able to carry out their ecosystem protection functions while supporting community social and economic activities in a balanced and structured manner.

Based on existing conditions, TNBB demonstrates a fairly good level of alignment with the research and education principles stipulated in Article 4 of UNESCO's MAB. Research activities related to biodiversity and the tourism economy demonstrate that this area has been utilized as a space for the development of science and conservation studies. Furthermore, the existence of a program *Visit School* This demonstrates efforts to strengthen environmental education for the community and the younger generation. This is a positive indicator, as UNESCO places education and research as the primary functions of biosphere reserves in supporting the long-term sustainability of the area. With these activities, TNBB functions not only as a passive conservation area but also as a learning space that supports the development of ecological awareness in the community.

On the other hand, TNBB's alignment with the biosphere reserve concept still requires strengthening in terms of institutional integration and the continuity of the area's monitoring program. Although research and education activities are already underway, the intensity of collaboration between stakeholders and the availability of a long-term monitoring system still need to be developed to make area management more adaptive and based on scientific data. Furthermore, environmental education programs also need to be expanded so that they are not implemented solely for personal gain but become part of a sustainable area management strategy. Thus, TNBB can be said to have a sufficient foundation in accordance with UNESCO's MAB clauses regarding research, education, and area management.

CONCLUSION

Based on an analysis of the indicators outlined in Article 4 of the Statutory Framework of the World Network of Biosphere Reserves, West Bali National Park demonstrates a fairly high level of suitability as an area with the potential to support the UNESCO biosphere reserve concept. The park possesses strong ecological characteristics, including diverse terrestrial and coastal ecosystems, the presence of key species such as the Bali Starling, and well-preserved conservation functions. Furthermore, the area's zoning system and the presence of buffer villages demonstrate an interaction between environmental protection functions and the community's socio-economic activities. These conditions indicate that TNBB not only functions as a conservation area but also holds potential as a space for integration between humans and the environment, as emphasized in the UNESCO MAB concept.

The research findings also indicate that aspects of community participation, research, environmental education, and area governance are beginning to evolve toward collaborative management. The involvement of community groups such as the Forest Ranger Partners, the Fire Awareness Community, and fishing groups in conservation activities demonstrates a distribution of roles between area managers and local communities. Furthermore, the presence of biodiversity research, area monitoring, and environmental education programs such as Visit School demonstrates that TNBB has been carrying out some of the logistical support functions that are a key element of a biosphere reserve. Thus, the management of TNBB reflects a modern conservation approach that is not only focused on area protection but also on sustainable development and community capacity building.

Nevertheless, this study found that there are still several aspects that need to be strengthened to optimize the alignment of TNBB with the concept of a biosphere reserve. Strengthening institutional coordination, ensuring the consistency of long-term monitoring programs, and expanding stakeholder engagement remain challenges in the management of the area. Furthermore, the integration of scientific research, environmental education, and area management policies still requires more systematic and sustainable development. Therefore, this study confirms that TNBB has a sufficiently strong foundation to support the UNESCO MAB biosphere reserve concept; however, the optimization of collaborative governance and the strengthening of scientific support remain necessary to support the sustainability of the conservation area in the future.

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