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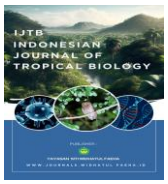

Original Research Paper

Bioconservation Management of Protected Forest Areas: A Case Study in the West Rinjani Forest Management Unit

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Abstract

Sustainable forest management is essential to maintaining ecological integrity and improving community welfare. This study aims to assess the performance of the West Rinjani Forest Management Unit (KPHL Rinjani Barat) in implementing conservation-based forest governance. A descriptive qualitative approach was applied, involving field observations, semi-structured interviews with key stakeholders, and document analysis. The data were analyzed using the Miles and Huberman interactive model through data reduction, data display, and conclusion drawing. The results indicate that KPHL Rinjani Barat achieved the highest performance score (3) across all six evaluation indicators, including competency standards, operational consistency, planning effectiveness, and implementation of forest utilization and protection. Despite this, only 20% of the long-term forest management plan (RPHJP) could be executed due to limited financial support. The study concludes that while institutional performance is strong in planning and community facilitation, funding constraints hinder full implementation. This highlights the urgent need for policy reform in budgeting systems to strengthen forest governance at the local level. Scientifically, this study supports the integration of bio-conservation principles into decentralized forest management and recommends increased state and stakeholder investment to ensure ecological sustainability and socio-economic benefits for forest-dependent communities.

Keywords: Diversity, Community forestry, Governance, NTFPs, Sustainable management.

INTRODUCTION

Conserved forest areas play a very important role in maintaining the balance of the ecosystem. Protected forests serve as protectors of soil and water resources, and provide various ecosystem services such as flood control, water management, and erosion prevention, all of which contribute to the preservation of soil fertility and water quality (Miura et al., 2015; Casagrande et al., 2020). Additionally, protected forests are habitats for various types of flora and fauna, including endemic and rare species, making them crucial for maintaining biodiversity (Zeng et al., 2022; Brockerhoff et al., 2017). Protected forests also act as carbon sinks, helping to mitigate climate change and maintain microclimate stability (Zeng et al., 2022; Brockerhoff et al., 2017). These functions not only support ecosystem balance but also provide direct benefits to humans, such as maintaining air quality and groundwater availability (Miura et al., 2015; Hanna et al., 2019; Casagrande et al., 2020).

Pressure from land conversion, illegal logging, encroachment, and weak institutional governance has led to a decline in the quality and ecological function of protected forests in various regions (Purwandari & Herdianto, 2024; Damiti et al., 2025). This problem is further exacerbated by overlapping spatial planning policies, unclear land status, and low human resource and funding capacity in forest management (Dellasala et al., 2025). The minimal involvement of local communities in forest conservation efforts also triggers tenure conflicts and low conservation awareness (Miura et al., 2015; Hanna et al., 2019). As a result, forest degradation has occurred, characterized by the loss of biodiversity and declining ecosystem functions, which has a direct impact on the environment and the well-being of communities surrounding the forest (Dellasala et al., 2025; Grantham et al., 2020; Laurance et al., 2012; VMosquez-Grandón et al., 2018; Morales-Hidalgo et al., 2015).

Various previous studies on the management of protected forest areas and the institutional framework of Forest Management Units (FMUs) have generally focused on policy aspects, tenure conflicts, or community empowerment (Lindenmayer, 2018; Carey, 2003; Zhu & Song, 2020). These studies highlight that the main challenges in managing KPHs, such as in KPH Rinjani Barat, include conflicts between communities and the government, as well as weak institutional capacity, which impacts the effectiveness of sustainable forest management. The bioconservation approach to forest management emphasizes balancing timber production and biodiversity conservation thru zoning and ecosystem-based management (Dellasala et al., 2025; Grantham et al., 2020; Laurance et al., 2012; Vásquez-Grandón et al., 2018; Morales-Hidalgo et al., 2015). Models like "Triad" zoning, which combines conservation zones, ecological management, and

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intensive production, have been developed to minimize impacts on biodiversity while still meeting production needs (Betts et al., 2021). However, the implementation of these models at the KPH level is still very limited, and most research and implementation are conducted more in formal conservation areas than in production forest or protection forest management units (Betts et al., 2021; Duncker et al., 2012). Thus, there is a need to expand the study and implementation of the bioconservation approach in KPH management, so that the management of protected and production forests can be balanced with efforts to conserve biodiversity and ecosystem sustainability (Betts et al., 2021; Duncker et al., 2012).

The novelty of this research lies in its approach, which explicitly integrates bioconversation principles into the management of protected forest areas under the authority of the West Rinjani Forest Management Unit. This research not only analyzes the institutional structure and planning processes but also assesses forest utilization by local communities based on the principles of biodiversity conservation, ecosystem restoration, and the sustainability of forest ecological functions. This approach opens up space for developing a protected forest management model that is not only protection-oriented but also capable of accommodating sustainable utilization by local communities while maintaining the ecological integrity of the area. Therefore, this research is highly necessary to provide new contributions to the development of adaptive and bioconservation-based forest management practices at the site level.

RESEARCH METHODS

Time and place of the research

This research was conducted on May 27, 2024, at the Technical Implementation Unit of the Rinjani Barat Forest Management Unit (KPH), located in Selaparang District, Mataram City, West Nusa Tenggara Province. Geographically, the research location is situated at coordinates 8°33'59.65" S and 116°07'52.53" E.

Type of research

This type of research is descriptive qualitative, aiming to describe in detail the process of managing protected forest areas in the West Rinjani Forest Management Unit (KPH) based on data and information obtained in-depth (Creswell, 2014).

Reseach population and sample

The study population includes all stakeholders related to the management of protected forests in the West Rinjani Forest Management Unit (KPH), including KPH officials, local communities, and other relevant stakeholders. The sample consists of 10 informants selected using purposive sampling, which is sampling based on specific criteria considered capable of providing complete and relevant information (Sugiyono, 2018). The research variables include planning aspects, institutional aspects, forest utilization, and the application of bioconversation principles. Data was collected thru observation, semi-structured interviews, and field documentation using interview guidelines and recording.

Procedure of research

The research began with a preliminary study to understand the context and issues of protected forest management. Then, primary data was collected thru direct observation and in-depth interviews with selected informants. Data verification was conducted thru source triangulation to enhance data validity. Documentation in the form of photos and field notes was also used to support the interview findings. All data was then classified and organized by research theme for further analysis.

Research Data Analysis

The data was analyzed descriptively and qualitatively using the Miles and Huberman (1994) model, which includes data reduction, data presentation, and conclusion drawing. Data reduction aims to filter and simplify the data, data presentation facilitates understanding of patterns and themes, while conclusions are drawn based on interpretation of patterns and relationships between data. The analysis process is carried out iteratively to ensure the validity and reliability of the research results.

RESULTS AND DISCUSSION

The Rinjani West Forest Management Unit (BKPH) was established between 2006 and 2008, starting with the preparation of guidelines and design maps for the division of KPH areas. The Rinjani West Protected Forest Management Unit (KPH) is one of the model KPHs in NTB, recognized as the best KPH in 2015 for its achievements in the Forest Partnership program, which addressed tenure conflicts in its working area. KPH Rinjani Barat was designated as a Model Protected Forest Management Unit (KPHL) in West Nusa Tenggara Province based on the Minister of Forestry Decree Number SK.785/Menhut-II/2009 dated December 7, 2009. The working area, based on the area determination according to Minister of Forestry Decree Number 337/Menhut/VII/2009 dated June 15, 2009, is recorded as 40,983 Ha, consisting of 28,911 Ha of protected forest (HL), 6,997 Ha of limited production forest (HPT), and 5,075 Ha of permanent production forest (HP).

Management of protected forest areas in the Rinjani Barat Forest Management Unit (KPH)

Planning is the most important stage in forest management functions, especially for dealing with the ever-changing dynamics of the external environment. An effective planning process must be based on rational and systematic procedures, not just intuition or guesswork, in order to produce accurate and sustainable decisions (Başkent et al., 2020; Baskent, 2024; Kangas et al., 2015). This also applies to forest area management organizations, such as KPH Rinjani Barat, which divides forest management plans into two: long-term forest management plans (RPHJP) prepared every 10 years, and short-term forest management plans (RPHJPD) prepared and implemented annually. RPHJPD includes strategies for improving the economy of communities around forest areas thru the utilization of environmental services and non-timber

forest products (NTFP), which aligns with the principles of sustainable forest management and community empowerment (Palaschuk et al., 2024; Zeilika et al., 2021; Başkent et al., 2020). This participatory and data-driven approach to planning is crucial to ensure that economic, social, and ecological benefits are achieved in a balanced manner (Palaschuk et al., 2024; Zeilika et al., 2021; Başkent et al., 2020; Kangas et al., 2015). Thus, systematic and participatory planning is key to managing the West Rinjani Forest Management Unit (KPH), both for preserving the ecosystem and improving the welfare of communities around the forest.

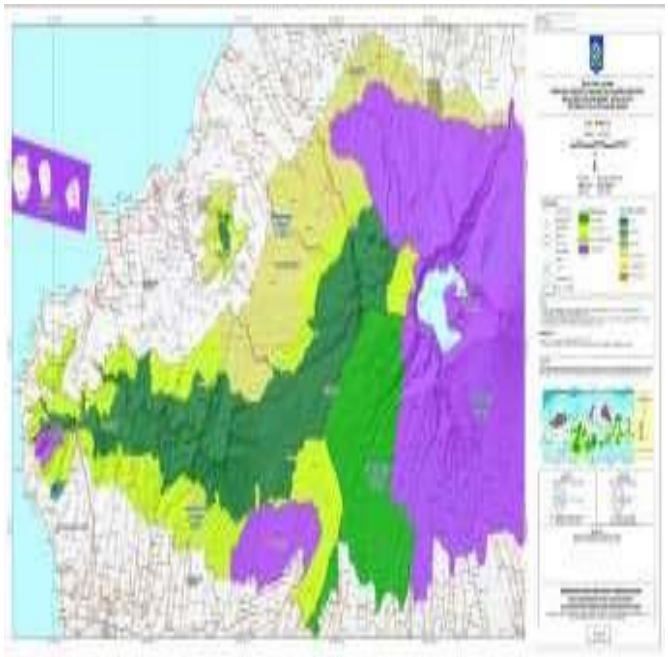

Figure 1. Map of protected forest areas in the West Rinjani KPH

Typology of Protected Forest Management in the Rinjani Barat Forest Management Unit (KPH)

The management of protected forests is regulated by Government Regulation Number 6 of 2007 and Government Regulation Number 3 of 2008. The objectives of managing protected forest areas are as follows: a) To enhance the protective function for soil, water, climate, plants, animals, and the nation's historical and cultural values. b) To maintain the diversity of plants, animals, ecosystem types, and natural uniqueness. The West Rinjani KPH Unit divides the typology of protected forest management in the West Rinjani KPH area into 3 parts:

1. 1. The core zone in the West Rinjani KPH protected forest area has a land area of 15,587.3 Ha. This zone falls into the category of primary forest with high canopy cover, which is because the core zone forest area has
2. The Special Zone covers an area of 98 hectares and is classified as secondary forest because it has been influenced by human activity, including customary forests. The Special Zone has a relatively moderate density.
3. The Utilization Zone covers an area of 13,225.7 hectares and is classified as tertiary forest due to human intervention to utilize forest products, as evidenced by significant changes in the forest area, such as the replacement of most tree species by the community. In this zone, forest density is relatively low, usually due to land conversion. This area used to have heterogeneous plant species diversity, but over time it has become a region with relatively homogeneous diversity.

The management of protected forest typologies in the West Rinjani KPH area is closely related to the local community (Palaschuk et al., 2024; Zeilika et al., 2021). Various challenges that often occur in the field, such as deforestation, illegal logging, and tenure conflicts. In the management activities carried out, several problems were found, namely, forest and land conflicts with the community. This happened because of weak governance and economic pressure on the community, which led people to exploit natural resources (Palaschuk et al., 2024; Zeilika et al., 2021; Başkent et al., 2020; Kangas et al., 2015). Even today, there are still tenure conflicts with the people of Sesaot Village, specifically regarding the community's rejection of the area's change in function to conservation forest, as well as land use conflicts with the people of Rempek Village.

Implementation of community-based and sustainable protected forest management in the West Rinjani Forest Management Unit (KPH)

The establishment of Forest Management Units (FMUs) plays an important and strategic role in the management of state forest areas at the site level. One strategy that must be implemented to achieve the sustainability of the forest's functions and roles is appropriate policy support thru the implementation of forest management with partnership activities (Zeilika et al., 2021; Başkent et al., 2020; Kangas et al., 2015). The policy of management thru a partnership scheme aims to develop the capacity and provide access for local communities in order to cooperate in forest management to improve community welfare.

The current role of the KPH is solely as a facilitator, with no direct partnership with community groups in sustainable forest management. KPH Rinjani Barat serves as a companion for all forms of utilization of protected forest areas carried out by the surrounding community. This is done to achieve one of the visions and missions of the West Rinjani KPH, which is "Sustainable Forests, Prosperous Communities." Communities have full control over forest area management as long as they comply with applicable regulations. The distribution of the proceeds from the utilization of protected forests is carried out in accordance with the initial agreement that has been reached (Başkent et al., 2020; Kangas et al., 2015).

The protected forest areas in West and North Lombok are under the supervision of the West Rinjani KPH. For communities living near forest areas, the forest holds very complex value. People living around forest areas are highly dependent on forest products. Some communities in West Lombok and North Lombok, who reside near protected forest areas, rely on their income from gardening, utilizing non-

timber forest products such as sugar palm, rattan, coffee, environmental service utilization, and the use of protected forest areas. The activities of communities near protected forest areas can be seen in Table 1.

Table 1. Utilization of Non-Timber Forest Products by Communities near the Protected Forest Area

No	Activity	Location	Utilization of Forest Products
1.	Coffee	Santong, Selelos and Tanjung	Coffee
2.	Palm sugar	Tamansari, Langko, and Gili Madia	Sugar palm fruit
3.	Rattan	Bentek and Tanjung	Rattan

The utilization of non-timber forest products in protected forest areas is carried out by the community (Table 1) by selling non-timber forest products (NTFPs) obtained in their raw state. However, since the establishment of the West Rinjani Forest Management Unit (KPH), the community has begun to process their harvest into higher-value products. For example, arenga palm, which is usually processed into arenga sugar, can be developed into ant sugar products. The community receives full support from the KPH, starting from the proposal-making process to obtain funding, securing halal certification, and assisting with promotional activities. This is done to improve the welfare of the local community around the area in Table 2.

Table 2. Pemanfaatan Jasa Lingkungan oleh masyarakat sekitar kawasan hutan Lindung

No	Activity	Location	Attraction
1.	Sesaot Nature Tourism	Sesaot	Bathing place
2.	Aik Nyet Nature Tourism	Buwun Sejati	Bathing place
3.	Ranget bathing place	Suranadi	Bathing place
4.	Timponan waterfall	Batu Mekar	Waterfall

The utilization of environmental services by communities surrounding the protected forest area in the West Rinjani KPH region (Table 2) is largely related to water management for tourism purposes. Water sources around the community, especially in the villages of Sesaot, Buwun Sejati, Suranadi, and Batu Mekar, are developing the water source areas into bathing tourism destinations. The activity was facilitated by the West Rinjani KPH, which provided the necessary facilities and infrastructure for the tourist area. This has an impact on increasing the income of local communities, regional income, and provincial income. Supervision by the West Rinjani KPH is carried out to assess the extent to which the planned activities are progressing and their alignment with what was planned.

Table 3 shows that the West Rinjani Forest Management Unit has managed well, as evidenced by the score of 3 obtained for each evaluation indicator used. However, in the implementation of the management plan that was drawn up, only 20% of all RPHJPs could be carried out.

The performance of the Rinjani West Protected Forest Management Unit (KPHL) is considered very good based on six key indicators of institutional evaluation. Each indicator received the maximum score (3), reflecting compliance with regulations and the implementation of institutional functions in accordance with applicable forest management standards. For the first indicator, which is the competency standard for forest management, it was found that the operationalization of KPH activities has followed the provisions in Article 6 paragraph 2, which serves as the basis for assessing institutional competency. This indicates that operational activities at the Rinjani Barat KPHL are carried out by competent and trained human resources in accordance with legal and technical provisions (Palaschuk et al., 2024; Zeilika et al., 2021; Başkent et al., 2020; Kangas et al., 2015).

The consistency indicator for the implementation of operationalization functions also received a perfect score. KPHL Rinjani Barat has carried out all institutional functions as stipulated in Article 8 paragraph 2, including forest management activities, the preparation of long-term (RPHJP) and short-term (RPHJPD) management plans, forest area utilization, and area rehabilitation implementation. This performance shows that management functions are not only planned on paper, but are actually carried out in reality on the ground (Miura et al., 2015; Hanna et al., 2019; Casagrande et al., 2020). Similarly, in terms of the effectiveness of forest management and planning, management planning has been well executed, as evidenced by the availability of various important spatial documents such as RPHJP maps, geological maps, and area boundary maps. This indicates that data-driven and spatial approaches are becoming an integral part of the forest management decision-making process (Miura et al., 2015).

The fourth indicator, which is the development of a forest management plan based on the results of forest inventory, shows that the Rinjani Barat Forest Management Unit (KPHL) has prepared the 2023–2033 Long-Term Forest Management Plan (RPHJP), which is currently in the process of being approved, and is implementing the approved RPHJPD. Although the planning documents are available, only about 20% of all RPHJP plans can be implemented, mainly due to limited local budgets. Although the KPH received external funding support, the amount was not sufficient to finance all planned forest management activities. This is an important note that good administrative achievements have not fully aligned with field implementation capacity, and indicates the need for a review of budget regulations to ensure optimal forest management at the site level.

The fifth indicator, related to the utilization and use of forest areas, shows that the West Rinjani Forest Management Unit (KPHL) has developed various forms of utilization, including non-timber forest products (NTFP), limited timber harvesting, and environmental service utilization (Miura et al., 2015; Hanna et al., 2019; Casagrande et al., 2020).. This utilization actively involves the local community surrounding the forest within the framework of conservation and welfare improvement, reflecting the success of KPH in implementing a participatory approach. Finally, the implementation of forest protection activities also showed good results, with the scope of protection covering the elements as stipulated in Article 33. Area protection is implemented by assigning staff to each resort, allowing for comprehensive and sustainable monitoring of the forest area (Casagrande et al., 2020).

In general, although the institutional performance of the West Rinjani KPHL is rated as very good based on technical and administrative indicators, there are still constraints in the full implementation of the long-term management plan due to budget limitations (Dellasala et al., 2025). Therefore, fiscal policy support and adjustments to funding regulations are needed to ensure that forest management activities can be carried out optimally, sustainably, and have a direct impact on improving ecosystem functions and the welfare of communities around protected forest areas (Vásquez-Grandón et al., 2018; Morales-Hidalgo et al., 2015).

Table 3. Performance Evaluation of the West Rinjani KPLH

Indicator	Quality Element	Score	Notes
Competency standards forest management	The operationalization of KPH has been based on market competency standards, paragraph 6, section 2.	3	Berdasarkan hasil wawancara, pihak KPH telah mematuhi regulasi yang berlaku dalam melakukan operasional KPH Rinjani Barat.
Consistency in implementing operational functions	Consistency of KPH forest management functions based on Article 8 paragraph 2.	3	KPH Rinjani barat telah melaksanakan fungsi dari KPH sesuai peraturan yang berlaku, mulai dari pelaksanaan tata hutan, penyusunan rencana pengelolaan hutan (RPHJP dan RPHJPD), pemanfaatan, penggunaan kawasan hutan hingga rehabilitasi
Effectiveness of forest management	Effective forest management distribution is carried out by the KPH office, in accordance with Article 13 paragraph (1) of the Law.	3	Pihak KPH merencanakan dengan baik terkait perencanaan pengelolaan hutan, hal ini dibuktikan dengan peta terkait RPHJP yang terdapat pada gambar 1, terdapat pula peta geologi dari kawasan rinjani barat dan peta tata batas.
Competency Standards Forest Management Consistency in Implementing Operational Functions	Availability of forest management plans at KPH offices in the form of RPHJP and RPHJPD.	3	KPH Rinjani barat telah melaksanakan RPHJP untuk tahun 2023-2033 yang menunggu pengesahan dan RPHJPD yang telah disahkan.
Effectiveness of forest management and forest management planning by the KPH Office Compilation of 10 Forest Management Plans Based on Forest Management	Realization of forest utilization forms by KPH. Protection activities have accommodated the scope regulated in Article 33.	3	Based on the interview results, forest utilization in the KPH Rinjani Barat area includes the utilization of NTFPs, timber forest product collection, environmental services, and area utilization.
Results Fulfillment of the Scope of Forest Utilization and Use by KPH Implementation of the scope of forest protection activities		3	The West Rinjani KPH has conducted protection activities thru officers assigned to each resort.

CONCLUSION

Forest management by the West Rinjani KPH has been well implemented, from the RPHJP planning activities to the RPHJPD. The West Rinjani KPH, as a facilitator, guides the community in sustainable forest utilization activities to improve the welfare of the surrounding community thru the utilization of non-timber forest products (NTFP) and environmental services. Although the management is good, only 20% of the RPHJP plan could be implemented, indicating a need for regulatory improvements regarding the budget to enhance the performance of the West Rinjani KPH.

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