Symbiosis Civicus

Symbiosis Civicus, Month Year, Vol. (No.):Page
DOI: https://doi.org/10.32663/.....

Forest Rehabilitation Strategies and Environmental Impact Management Due to *Illegal logging* in the Bukit Rimbang - Bukit Baling Baling Wildlife Sanctuary Area

Oki Novriyanto [1*], Anto Ariyanto, [2] & M. Rawa El Amady [3]

[1] Graduate School of Agricultural Sciences, Universitas Lancang Kuning, Pekanbaru-Riau
E-mail: okinovriyanto12@gmail.com
[2] Graduate School of Agricultural Sciences, Universitas Lancang Kuning, Pekanbaru-Riau
E-mail: antoariyanto@unilak.ac.id
[3] Graduate School of Agricultural Sciences, Universitas Lancang Kuning, Pekanbaru-Riau
E-mail: rawapasca@unilak.ac.id

ARTICLE HISTORY

Received : 2026-01-26
Revised : 2026-02-04
Accepted :2026-04-30

Keywords:
Illegal logging,
Forest Rehabilitation,
Environmental Impact,
Governance,
Rimbang hill- Baling Hill

CC BY SA

ABSTRACT

Illegal logging is one of the main threats to the sustainability of the Bukit Rimbang - Bukit Baling Baling Wildlife Sanctuary, which has a wide-ranging impact on the forest ecosystem and the social and economic lives of the surrounding communities. This research aims to analyze the impact of *illegal logging* from ecological, economic, and social perspectives, and to examine the forest management and rehabilitation strategies implemented in the area. This research uses a qualitative approach with data collection techniques including in-depth interviews and field observations. The research participants consisted of 5 government and forestry officials (BBKSDA, DLHK, KPH, and Forestry Police), 4 local community members and traditional leaders, and 2 representatives from NGOs and conservation communities. Data analysis was conducted using the interactive analysis model of Miles and Huberman, which includes data reduction, data presentation, and conclusion drawing. The research results show that *illegal logging* causes ecological degradation in the form of reduced forest cover, damage to wildlife habitats, and disruption of ecosystem functions. From an economic perspective, forest damage reduces the potential for sustainable use of natural resources, while from a social aspect, it leads to conflict, weakening of customary norms, and low environmental awareness. The strategy to mitigate the impact of *illegal logging* is implemented thru strengthening law enforcement, integrated monitoring, community empowerment, and cross-sectoral collaboration. Forest rehabilitation strategies are aimed at species-based ecological rehabilitation using local species, implementing adaptive environmental management, community involvement, and strengthening environmental governance. This research recommends strengthening collaborative management between government, NGOs, and communities as an effort to achieve forest rehabilitation and sustainable management of conservation areas.

1. INTRODUCTION

Forests play a fundamental role in maintaining the stability of the global ecosystem and supporting the sustainability of human life. Their ecological function extends beyond providing oxygen and absorbing carbon dioxide, to regulating water systems, preventing erosion, providing habitat for flora and fauna, and supporting complex life systems. In Indonesia, the role of forests extends beyond social and economic functions, as most communities, particularly those in rural areas and those bordering conservation areas, depend directly and indirectly on forest resources for their livelihoods. According to data from the Ministry of Environment and

Forestry (KLHK, 2023), Indonesia's forest area covers more than 120 million hectares, comprising conservation forests, protected forests, and production forests. However, pressure on forest resources continues to increase due to overexploitation, land conversion, and weak oversight at the local level.

One of the most serious threats to forest sustainability in Indonesia is the practice of illegal logging, which has been systematic and organized for decades. This activity is not merely a violation of forestry laws but also an environmental crime with multidimensional impacts, ranging from ecosystem degradation and loss of biodiversity to disruption of hydrological balance and increased risk of ecological disasters such as floods and landslides. According to the World Resources Institute (2018), illegal logging has become a major cause of deforestation in Indonesia's tropical forests, with serious impacts on carbon emissions and the loss of the forests' ecological function as life support.

In the context of Riau Province, the problem of illegal logging has long been a critical issue threatening important conservation areas, including the Bukit Rimbang Baling Wildlife Sanctuary, located within the administrative areas of Kampar and Kuantan Singingi Regencies. This area is one of the last remaining bastions of Sumatra's lowland tropical rainforest, boasting high biodiversity and vital ecological functions. In addition to serving as a water catchment area for the Subayang and Kampar Rivers, this area is also a habitat for endangered species such as the Sumatran tiger (Panthera tigris sumatrae), tapir (Tapirus indicus), sun bear (Helarctos malayanus), and various endemic Sumatran bird species. Therefore, Bukit Rimbang Baling holds strategic ecological and scientific value in the context of Indonesian biodiversity conservation.

However, over the past two decades, this area has experienced increasing anthropogenic pressure due to illegal logging, encroachment, and land conversion to plantations and shifting agriculture. Based on monitoring results from the World Resources Institute (WRI) Indonesia's Places to Watch program (2018), forest cover loss of 76.59 hectares was found between March and June 2018. This figure increased significantly, reaching 266.5 hectares by 2022 (Jikalahari, 2022). This increase indicates that illegal logging in the Bukit Rimbang Baling Wildlife Reserve has evolved from a subsistence activity to an organized economic activity involving a trans-regional illegal timber trade network.

From an ecological perspective, the loss of forest cover leads to habitat fragmentation, a decline in wildlife populations, and a reduced ability of the ecosystem to maintain hydrological balance. Abiotically, vegetation degradation leads to increased surface water runoff, river sedimentation, and soil degradation due to erosion. These conditions worsen river water quality and disrupt the area's function as an ecological buffer for the surrounding area. The socio-economic impacts are also significant: surrounding communities lose their livelihoods from non-timber forest products such as honey, rattan, resin, and medicinal plants, and experience a decline in well-being, leading to the emergence of shifting agriculture practices that exacerbate deforestation.

This ecological damage is exacerbated by weak monitoring and law enforcement systems. According to a report by the Riau Natural Resources Conservation Agency (2024), most illegal logging activities take place in the protected forest area of the Bukit Rimbang Resort without official permits, with operations involving community groups, transporters, and wood collectors. Social factors such as low legal awareness, economic dependence on forest products, and limited alternative livelihoods are the main causes of the recurrence of illegal logging practices at the local level.

In terms of policy, the Indonesian government has demonstrated its commitment to sustainable forest management through various regulations, such as Presidential Instruction No. 5 of 2001 concerning the Eradication of Illegal Logging, Law No. 18 of 2013 concerning the Prevention and Eradication of Forest Destruction (P3H), and the forest and land rehabilitation program (RHL). However, the effectiveness of these policies remains low because they lack integration with a socio-ecological approach and fail to address the root causes of the problem at the community level.

Therefore, a forest rehabilitation and environmental impact management strategy is needed that is not only technical but also adaptive and participatory. This strategy must integrate ecological restoration efforts through reforestation, enrichment planting, and ecosystem-based restoration with community empowerment in natural resource management. According to Sitorus (2025), the concept of adaptive environmental management emphasizes the importance of a flexible, sustainable approach based on field data and involving multiple stakeholders in the decision-making process. Within this framework, the management of conservation areas such as the Bukit Rimbang Baling Wildlife Sanctuary must be directed at balancing ecosystem preservation, improving community welfare, and enforcing environmental laws.

Furthermore, Rahmawati and Elias (2025) emphasize that forest rehabilitation in Indonesia requires collaboration between the government, conservation institutions, academics, and local communities. Effective rehabilitation involves more than just tree planting, but also the restoration of ecosystem structure and function, enabling long-term ecological and socio-economic sustainability. Thus, the study "Forest Rehabilitation Strategy and Management of the Environmental Impacts of Illegal Logging in the Bukit Rimbang Baling Wildlife Sanctuary" is crucial for formulating strategic steps to mitigate forest degradation and achieve equitable and sustainable natural resource management.

Based on the description and explanation in the background, this research will analyze and answer the following questions:

1) What are the ecological, economic, and social impacts of illegal logging in the Bukit Rimbang Baling Wildlife Sanctuary?
2) What are the strategies for mitigating the impacts of illegal logging in the Bukit Rimbang Baling Wildlife Sanctuary?
3) What are the strategies for forest rehabilitation resulting from illegal logging in the Bukit Rimbang Baling Wildlife Sanctuary?

2. LITERATURE REVIEW

Benyamin Oulaana et al. (2023) explain that wildlife sanctuaries are part of natural forests that serve a strategic function as ecosystem buffers and primary protectors of wildlife habitats vulnerable to environmental pressures and degradation. These areas not only play a role in preserving biodiversity but also contribute significantly as water catchment areas and natural carbon sinks. Therefore, wildlife sanctuaries play a crucial ecological role in maintaining environmental stability and supporting sustainable climate change mitigation efforts.

The term "illegal logging" comes from English and is composed of two words: "illegal" and "logging." The word "illegal" means unauthorized, prohibited, or contrary to law, while "logging" comes from the word "log," meaning log or log. Logging is therefore defined as the activity of felling and transporting wood to processing facilities. Although the term "illegal logging" is not explicitly mentioned in the Forestry Law, conceptually, this practice refers to the logging and utilization of forest products carried out without permits or in violation of applicable laws. This aligns with the definition in Black's Law Dictionary, which states that illegal means forbidden by law or unlawful (Murhaini, 2012).

In the context of restoring degraded forest areas, Rahmawati and Elias (2025) in their "Literature Study of Land Forest Rehabilitation Methods in Indonesia" define forest rehabilitation as a series of technical and social activities aimed at restoring ecological functions and increasing forest land productivity. These rehabilitation efforts are carried out through various approaches, such as reforestation, planting local species, and implementing sustainable agroforestry systems. Forest rehabilitation is not only interpreted as replacing lost vegetation, but also as a process of restoring ecological balance while strengthening the harmonious relationship between humans and the environment.

Furthermore, according to Sitorus (2025) in Langgas: Jurnal Studi Pembangunan (Langgas: Jurnal Studi Pembangunan), environmental impact management is an integral part of the concept of Adaptive Environmental Management, an environmental management approach that emphasizes a continuous learning process (learning by doing) in responding to ecosystem dynamics and uncertainty. Environmental impact management is defined as a series of activities including identification, assessment, monitoring, and adjustment of policies or actions to minimize the ecological, social, and economic impacts arising from development or exploitation of natural resources.

Meanwhile, Supriatna (2023) emphasized that strategies to prevent illegal logging and forest encroachment are planned and systematic efforts to control forest exploitation activities by optimizing institutional strengths and utilizing available policy opportunities. This strategy is implemented using a participatory approach involving communities and supported by an integrated monitoring system. Its implementation includes strengthening institutions at the grassroots level, increasing human resource capacity in the forestry sector, and expanding legal access for communities to utilize forest products sustainably.

3. METHOD

This research was conducted in Riau Province, specifically in the Bukit Rimbang-Bukit Baling Baling Wildlife Reserve area, which was chosen because it is still considered vulnerable to illegal logging activities. Data collection was conducted from September 2025 until completion through field observations and coordination with relevant agencies, such as the BKSDA, the Riau Provincial Police, and village officials around the area. This research used a qualitative descriptive approach because the data obtained were narrative and contextual. This approach places the researcher as the main instrument, with purposive sampling techniques, data triangulation, and inductive analysis that emphasizes the meaning of phenomena rather than generalization (Sugiyono, 2019). The research data consisted of primary and secondary data. Primary data were obtained through interviews, observations, questionnaires, and documentation, while secondary data came from official documents from relevant government agencies. Informants were selected purposively based on their competence and direct involvement in area management, and were developed through snowball sampling (Bungin, 2007). Data analysis used the Miles and Huberman interactive model which includes data reduction, data presentation, and drawing conclusions/verification, which were carried out repeatedly before, during, and after data collection to ensure the validity of the research findings (Sugiyono, 2018; Arikunto, 2013; Haryoko et al., 2020).

4. RESULT AND DISCUSSION

4.1. The Impact of Illegal Logging in the Bukit Rimbang - Bukit Baling Baling Wildlife Area from an Ecological, Economic, and Social Perspective

Illegal logging in the Bukit Rimbang-Bukit Baling Baling Wildlife Reserve is an environmental issue with multidimensional impacts. Interviews with government and forestry officials, community members, traditional leaders, religious leaders, village government officials, and representatives of environmental NGOs (NGOs) revealed that illegal logging not only threatens the sustainability of the forest ecosystem but also impacts the social structure and economic sustainability of communities surrounding the area. This empirical finding aligns with various previous studies confirming that illegal logging is a major factor in forest degradation in Indonesia (Nurlita & Kusuma, 2019; Tutrianto, 2021).

1. Ecological Impact of Illegal Logging

From an ecological perspective, interviews indicate that illegal logging has led to a decline in the quality of the forest ecosystem in Bukit Rimbang-Bukit Baling Baling. Forestry officials and NGOs revealed that uncontrolled logging has resulted in the clearing of land cover, the destruction of vegetation structure, and the disruption of wildlife habitats. This has a direct impact on the decline in biodiversity and the weakening of the area's ecological function as a water catchment area and a buffer for environmental balance.

Forest destruction due to illegal logging also increases the area's vulnerability to ecological disasters, such as floods, landslides, and drought. Communities and village governments have stated that changes in forest conditions have affected soil stability and river water discharge in the surrounding area. This finding is consistent with previous research, which found that forest degradation due to illegal logging significantly contributes to the increased risk of environmental disasters and reduced ecosystem carrying capacity (Illegal Logging Prevention Strategy in Regency G, 2020; Analysis of Causal Factors and Illegal Logging Prevention Strategy, 2018).

Furthermore, the loss of forest vegetation disrupts long-term ecological cycles. Previous studies have confirmed that forest ecosystem restoration requires a long time and is costly, especially if the damage is massive and repeated (Rio Tutrianto, 2021). Thus, illegal logging not only causes immediate damage but also threatens the long-term sustainability of the ecological function of conservation areas.

2. Economic Impact of Illegal Logging

From an economic perspective, interview results revealed a paradoxical impact of illegal logging on communities surrounding the area. On the one hand, a small portion of the community views illegal logging as a quick source of income to meet short-term economic needs. This situation is generally driven by limited employment opportunities and limited access to alternative livelihoods. However, on the other hand, the majority of respondents emphasized that the long-term economic impact of illegal logging is actually detrimental.

Forest destruction leads to a decline in the productivity of natural resources that have traditionally been the basis of the community's economy, such as non-timber forest products, agriculture, and inland fisheries. Communities stated that forest degradation reduces water availability and soil fertility, thus affecting agricultural yields and household incomes. This finding aligns with research indicating that illegal logging weakens the local economic base and reinforces the cycle of structural poverty in areas surrounding forests (Adrianti & Kusuma, 2019).

Furthermore, the economic costs of environmental damage, such as losses from floods and landslides, far outweigh the short-term economic benefits of illegal logging. Previous research confirms that forest destruction creates negative externalities that burden communities and the government, including the costs of forest rehabilitation and disaster management (Government Strategy to Prevent Illegal Logging in West Muna Regency, 2020). Therefore, illegal logging cannot be viewed as a sustainable economic solution.

3. Social Impact of Illegal Logging

From a social perspective, interviews indicate that illegal logging has impacted the social order and cultural values of the communities around Bukit Rimbang and Bukit Baling Baling. Traditional and religious leaders stated that illegal logging practices contradict local wisdom and moral norms that govern the relationship between humans and nature. This violation of customary rules and religious values has the potential to weaken social cohesion and a sense of togetherness within the community.

Furthermore, illegal logging also triggers potential social conflict. Village governments and communities have revealed tensions between groups involved in illegal logging and those opposing the practice. This conflict is not only horizontal but can also escalate into conflict between the community and law enforcement officials. This finding aligns with previous research that suggests illegal logging is often a source of social conflict at the local level, particularly when law enforcement is inconsistent (Admin OJS, 2020).

Another social impact is a decline in public security and trust in the forest management system. Weak oversight and law enforcement, as expressed in interviews, foster the perception that illegal logging can continue without strict consequences. This situation has the potential to weaken community participation in forest preservation and reduce the effectiveness of overall environmental governance.

4.2. Strategies for Addressing the Impacts of Illegal Logging in the Bukit Rimbang - Bukit Baling Baling Wildlife Area

Illegal logging in the Bukit Rimbang-Bukit Baling Baling Wildlife Sanctuary is a complex and multidimensional environmental issue, as its impacts not only damage the forest ecosystem but also affect the social and economic stability of surrounding communities. Based on qualitative research involving government and forestry officials, local and indigenous communities, and environmental NGOs, strategies to mitigate the impacts of illegal logging must be implemented in an integrated and sustainable manner. This strategic approach includes ecological rehabilitation, the implementation of adaptive environmental management, community empowerment, and strengthening environmental governance as an integral part of the conservation area management system.

1. Ecological Rehabilitation as a Strategy for Recovering Environmental Impacts

Ecological rehabilitation is the primary strategy for mitigating the impacts of illegal logging, which has led to forest cover degradation, wildlife habitat fragmentation, and the decline in ecological function in the Bukit Rimbang-Bukit Baling Baling Wildlife Sanctuary. Research results indicate that ecological damage caused by illegal logging cannot be reversed through technical replanting alone but requires an ecosystem-based restoration approach.

The ecological rehabilitation approach emphasizes restoring the structure and function of forest ecosystems through the use of local species, protecting rehabilitation areas, and controlling further disturbances from illegal activities. Research by Tutrianto (2021) confirms that ecosystem-based forest rehabilitation is more effective in restoring biodiversity and ecological stability than conventional rehabilitation focused solely on plant numbers. In the context of Bukit Rimbang and Bukit Baling Baling, interviews indicate that rehabilitation without area security risks failure due to repeated damage.

Therefore, ecological rehabilitation strategies must be positioned as long-term efforts integrated with area protection, thereby sustainably mitigating the impacts of illegal logging.

2. Adaptive Environmental Management in Addressing the Dynamics of Illegal Logging

Strategies for mitigating the impacts of illegal logging also require the implementation of adaptive environmental management. Adaptive environmental management is a management approach that is responsive to changing ecological and social conditions and based on continuous learning. The research results indicate that the characteristics of illegal logging in Bukit Rimbang and Bukit Baling Baling are dynamic, shifting locations, and adapting to the level of supervision.

In this context, mitigation strategies cannot be static but must adapt to the patterns of damage and pressures that occur. Research by Nurlita and Kusuma (2019) confirms that adaptive forest management allows policymakers to adjust monitoring, rehabilitation, and community empowerment strategies based on constantly changing conditions on the ground. Interviews with forestry officials indicate that mapping areas vulnerable to illegal logging and periodically evaluating patrol effectiveness are part of adaptive management practices that are beginning to be implemented.

Adaptive environmental management also requires the integration of ecological and social data in decision-making. With this approach, strategies to mitigate the impacts of illegal logging can be continuously adjusted to remain relevant and effective in the long term.

3. Community Empowerment as a Social Strategy to Mitigate the Impacts of Illegal Logging

Research findings confirm that community empowerment is a key strategy in mitigating the impacts of illegal logging. Local communities living around the Bukit Rimbang-Bukit Baling Baling Wildlife Reserve have a direct relationship with forest resources, both as a source of livelihood and as a socio-cultural space. Therefore, strategies to mitigate the impacts of illegal logging must involve communities as subjects, not simply as objects of policy.

Community empowerment is aimed at increasing capacity, increasing environmental awareness, and developing sustainable alternative livelihoods. The study, "Government Strategy to Prevent Illegal Logging" (2020), showed that communities' economic dependence on illegal activities can be reduced through conservation-based economic empowerment programs, such as the utilization of non-timber forest products and agroforestry. These research findings align with interviews, which showed that communities are more willing to support forest protection efforts when they have legal and sustainable livelihoods.

Beyond economic aspects, community empowerment also includes strengthening the role of traditional and religious leaders in instilling environmental conservation values. Thus, strategies to mitigate the impacts of illegal logging become more effective because they are supported by social and cultural legitimacy.

4. Strengthening Environmental Governance as a Strategic Framework

Strengthening environmental governance is a strategic foundation for mitigating the impacts of illegal logging. Research shows that weak area governance, particularly in terms of inter-agency coordination and consistent law enforcement, is a factor that exacerbates the impacts of illegal logging. Therefore, mitigation strategies must be directed at improving transparent, accountable, and collaborative governance systems.

Research by Admin OJS (2020) confirms that weak environmental governance opens up opportunities for repeated forestry violations. In the Bukit Rimbang-Bukit Baling Baling context, governance strengthening is carried out through increased coordination between the BBKSDA (National Conservation Agency), the Forest Management Unit (FMU), the Environment and Forestry Agency (DLHK), law enforcement officials, and the involvement of NGOs and the community. Collaborative governance allows for a clear division of roles and more effective oversight of conservation areas.

Furthermore, governance strengthening also includes recognizing local wisdom and integrating it into area management policies. This approach strengthens policy legitimacy and increases community compliance with conservation regulations.

5. Integration of Strategies to Mitigate the Impacts of Illegal Logging

Based on research and literature reviews, strategies to mitigate the impacts of illegal logging in the Bukit Rimbang-Bukit Baling Baling Wildlife Sanctuary cannot be implemented in isolation. Ecological rehabilitation, adaptive environmental management, community empowerment, and strengthening environmental governance must be combined within a single, integrated strategic framework. Research by Rio Tutrianto (2021) confirms that an integrated approach is key to successful post-forest destruction management.

This strategic integration enables efforts to mitigate the impacts of illegal logging to not only restore ecological conditions but also strengthen the area's social and institutional resilience. With an integrated approach, the impacts of illegal logging can be systematically mitigated while preventing future re-destruction.

In summary, the strategy to mitigate the impacts of illegal logging in the Bukit Rimbang-Bukit Baling Baling Wildlife Sanctuary must be understood as a long-term process that requires the commitment and collaboration of all stakeholders. Ecological rehabilitation plays a role in restoring environmental functions, adaptive environmental management ensures strategies remain relevant to field dynamics, community empowerment strengthens social support, and strengthening environmental governance becomes an institutional framework that ensures the sustainability of area management. By implementing these strategies consistently and in an integrated manner, efforts to mitigate the impacts of illegal logging in the Bukit Rimbang - Bukit Baling Baling Wildlife Sanctuary have great potential to achieve conservation goals while improving community welfare in a sustainable manner.

4.3. Strategy for forest rehabilitation due to illegal logging in the Bukit Rimbang - Bukit Baling Baling Wildlife Area

Illegal logging is a major contributing factor to forest degradation in conservation areas, including the Bukit Rimbang-Bukit Baling Baling Wildlife Sanctuary. Research shows that illegal logging practices have caused significant ecosystem damage, such as reduced forest cover, disturbed wildlife habitats, decreased soil and water quality, and weakened forest functions as life support for surrounding communities. Therefore, post-illegal logging forest rehabilitation cannot be carried out in a piecemeal and short-term manner but must be designed as a comprehensive and sustainable strategy involving various stakeholders.

In this context, the forest rehabilitation strategy is not simply defined as the technical activity of replanting, but as a process of ecosystem restoration integrated with social, institutional, and environmental governance aspects. This approach aligns with the modern perspective on forest rehabilitation, which emphasizes the simultaneous restoration of ecological, social, and economic functions of forests (Tutrianto, 2021).

1. Ecological Rehabilitation as the Foundation for Forest Recovery

Ecological rehabilitation is a key pillar in the forest recovery strategy for illegal logging in the Bukit Rimbang-Bukit Baling Baling Wildlife Sanctuary. Ecological rehabilitation aims to restore the structure, function, and dynamics of forest ecosystems disrupted by illegal logging. Research shows that forest damage in this area involves more than just tree loss, but also changes in vegetation composition, soil degradation, and disruption of the hydrological cycle.

The ecological rehabilitation approach emphasizes the use of local species suited to the area's biophysical conditions, thereby supporting natural regeneration and increasing ecosystem resilience. Research by Tutrianto (2021) confirms that ecosystem-based rehabilitation is more effective than monoculture rehabilitation because it increases biodiversity and long-term ecosystem stability. In the Bukit Rimbang-Bukit Baling Baling context, interviews with forestry officials indicate that replanting with local species, such as lowland forest trees, is considered more adaptive and sustainable.

Furthermore, ecological rehabilitation also includes protecting the rehabilitation area from further disturbances, such as encroachment and re-logging. Without adequate protection, rehabilitation efforts risk failure and a repeat of the cycle of damage. Therefore, ecological rehabilitation must be viewed as a long-term process that requires ongoing monitoring and evaluation (Nurlita & Kusuma, 2019).

2. Adaptive Environmental Management in Forest Rehabilitation

The forest rehabilitation strategy for the Bukit Rimbang-Bukit Baling Baling forest area requires the implementation of adaptive environmental management. Adaptive environmental management is a flexible, learning-based management approach that is responsive to the dynamics of environmental and social change.

Research shows that the level of forest damage and illegal logging pressures in this area are dynamic, requiring rehabilitation strategies to adapt to constantly changing conditions on the ground.

Adaptive environmental management allows area managers to adjust rehabilitation methods based on monitoring and evaluation results. For example, if a planting method is unsuccessful due to soil conditions or wildlife disturbances, the rehabilitation strategy can be adjusted to a more appropriate approach. Research by Nurlita and Kusuma (2019) suggests that adaptive forest management increases the chances of successful rehabilitation because decisions are based on empirical evidence and field feedback.

In practice, adaptive environmental management in Bukit Rimbang-Bukit Baling Baling is implemented through mapping critical areas, determining rehabilitation priorities, and periodically evaluating the success of restoration activities. This approach also encourages the integration of ecological and social data into rehabilitation planning, ensuring that the strategies implemented are not only ecologically effective but also socially acceptable.

3. Community Empowerment in Forest Rehabilitation

Research results show that the success of post-illegal logging forest rehabilitation depends heavily on the level of involvement and empowerment of the surrounding community. Local communities play a strategic role as those closest to the forest area and most impacted by forest destruction. Therefore, forest rehabilitation strategies must actively involve the community in all stages, from planning, implementation, and monitoring.

Community empowerment in forest rehabilitation includes capacity building, providing sustainable livelihood alternatives, and strengthening environmental awareness. The study "Government Strategy in Preventing Illegal Logging" (2020) showed that rehabilitation programs involving the community tend to be more sustainable because they create a sense of ownership of the forest area. Interviews in this study also indicated that communities are more willing to participate in forest planting and maintenance activities when they directly benefit from the economic and social aspects.

Beyond economic aspects, community empowerment also includes strengthening local values and customary wisdom that support forest conservation. Traditional and religious leaders play a crucial role in instilling environmental norms and ethics that encourage communities to maintain the results of forest rehabilitation. Thus, forest rehabilitation is not only technical but also rooted in the social and cultural values of local communities (Admin OJS, 2020).

4. Strengthening Environmental Governance in Forest Rehabilitation

Strengthening environmental governance is a key element in the forest rehabilitation strategy for illegal logging in the Bukit Rimbang-Bukit Baling Baling Wildlife Reserve. Research shows that weak area governance, particularly in inter-agency coordination and law enforcement, is a major cause of recurring forest damage. Therefore, forest rehabilitation must be accompanied by improvements in the environmental governance system.

Strengthening environmental governance includes improving coordination between the BBKSDA (National Conservation Agency), Forest Management Unit (FMU), the Environment and Forestry Agency (DLHK), law enforcement officials, village governments, and environmental NGOs. Collaborative governance allows for a clear division of roles in forest rehabilitation, from technical planning and funding to implementation and oversight. Research by Admin OJS (2020) confirms that good environmental governance increases the effectiveness of forest rehabilitation and prevents conflicts of interest between stakeholders.

Furthermore, strengthening governance also includes transparency and accountability in the management of rehabilitation programs. A clear and participatory reporting mechanism allows the community to participate in monitoring forest rehabilitation implementation, thereby minimizing the potential for irregularities and increasing program sustainability.

5. Integrated Forest Rehabilitation Strategy

Based on research and literature reviews, forest rehabilitation strategies affected by illegal logging in the Bukit Rimbang-Bukit Baling Baling Wildlife Reserve must be implemented in an integrated manner. Ecological rehabilitation, adaptive environmental management, community empowerment, and strengthening environmental governance cannot operate in isolation but must support each other within a comprehensive rehabilitation strategy framework.

This strategic integration enables forest rehabilitation to not only restore ecological conditions but also strengthen the region's social and institutional resilience. Research by Tutrianto (2021) confirms that an integrated rehabilitation approach increases the success of forest restoration and prevents re-degradation. In the context of Bukit Rimbang-Bukit Baling Baling, this strategic integration is crucial given the complexity of the illegal logging problem and the involvement of many stakeholders.

In summary, the forest rehabilitation strategy for illegal logging in the Bukit Rimbang-Bukit Baling Baling Wildlife Sanctuary must be understood as a long-term process that is adaptive, participatory, and based on strong governance. Ecological rehabilitation forms the foundation of environmental recovery, adaptive environmental management ensures the strategy remains relevant to field dynamics, community empowerment strengthens social support, and strengthened environmental governance ensures the sustainability of forest rehabilitation. By implementing an integrated and consistent forest rehabilitation strategy, the Bukit Rimbang-Bukit Baling Baling

Wildlife Sanctuary has a significant opportunity to restore its ecological function while sustainably improving the well-being of surrounding communities.

5. CONCLUSIONS

Based on the research results and discussions outlined in the previous chapter, a comprehensive overview of the impacts of illegal logging and forest management and rehabilitation strategies in the Bukit Rimbang-Bukit Baling Baling Wildlife Sanctuary has emerged.

a. Illegal logging in the Bukit Rimbang-Bukit Baling Baling Wildlife Sanctuary has significant multidimensional impacts on ecological, economic, and social aspects. Ecologically, illegal logging activities cause a reduction in forest cover, degradation of wildlife habitat, disruption of ecosystem balance, and increased vulnerability to environmental disasters. Economically, forest destruction reduces the potential for sustainable natural resource utilization, reduces conservation-based economic opportunities, and weakens the long-term economic resilience of local communities. Socially, illegal logging triggers conflicts of interest, weakens local norms and wisdom, and reduces public awareness and concern for environmental conservation. Thus, illegal logging not only damages forest ecosystems but also threatens the socio-economic sustainability of communities surrounding conservation areas.
b. The strategy to mitigate the impacts of illegal logging in the Bukit Rimbang-Bukit Baling Baling Wildlife Sanctuary is implemented through an integrated approach encompassing law enforcement, supervision, community empowerment, and cross-sector collaboration. The government and forestry officials play a role in strengthening area oversight, increasing patrols, and consistently implementing regulations. Meanwhile, a non-repressive strategy is implemented through the involvement of local communities and NGOs in participatory monitoring, environmental education, and strengthening conservation awareness. An adaptive environmental management approach is a crucial foundation for adapting management strategies to the social and ecological dynamics on the ground. By integrating structural and participatory approaches, the strategy to mitigate the impacts of illegal logging is expected to reduce pressure on forest areas and prevent recurrence of damage.
c. The forest rehabilitation strategy for illegal logging in the Bukit Rimbang-Bukit Baling Baling Wildlife Sanctuary is implemented holistically and sustainably, emphasizing the restoration of ecosystem functions and strengthening environmental governance. Ecological rehabilitation is implemented through replanting native vegetation, restoring animal habitats, and protecting the area from further disturbances. This strategy is supported by the implementation of adaptive environmental management, which allows for evaluation and adjustment of the rehabilitation program based on field conditions. Community involvement in rehabilitation activities is a key success factor, both through direct participation and strengthening local wisdom. Furthermore, strengthening environmental governance through inter-agency coordination and partnerships with NGOs enhances the sustainability of rehabilitation outcomes. With this strategy, forest rehabilitation is expected to restore the ecosystem while improving the well-being of surrounding communities.

6. ACKNOWLEDGEMENT

The authors express their appreciation and gratitude to the Riau Natural Resources Conservation Agency (BKSDA), the Environment and Forestry Service, the Forest Management Unit, and the village government officials surrounding the Bukit Rimbang–Bukit Baling Baling Wildlife Sanctuary for their support in providing data, field access, and cooperation during the research. They also express their gratitude to the local communities, traditional leaders, and non-governmental organizations that participated and provided valuable information for the completeness and validity of this research.

REFERENCES

Arikunto, S. (2013). *Manajemen penelitian*. Rineka Cipta.

Benyamin Oulaana, B., Tang, M. I. P., Dony, P. M. T., Mailehi, B., & Lekai, D. Y. (2023). Hutan yang gundul di lereng Gunung Batu Nirwala Kelurahan Welai Timur, Kalabahi. *DIAJAR: Jurnal Pendidikan dan Pembelajaran*, 2(4), 420–428. https://doi.org/10.54259/diajar.v2i4.1899

Bungin, B. (2007). *Penelitian kualitatif*. Kencana Prenada Media Group.

Haryoko, S., Bahartiar, & Arwadi, F. (2020). *Analisis data penelitian kualitatif (konsep, teknik, dan prosedur analisis)*. Badan Penerbit Universitas Negeri Makassar.

Jikalahari. (2022). *CAT 2022: Pemulihan melambat, kerusakan di depan mata*. https://jikalahari.or.id/wp-content/uploads/2022/12/CAT-2022_Pemulihan-Melambat_Kerusakan-Di-Depan-Mata-1.pdf

Murhaini, S. (2012). *Hukum kehutanan: Penegakan hukum terhadap kejahatan di bidang kehutanan*. Laksbang Grafika.

Rahmawati, A. D., & Elias. (2025). Studi literatur metode rehabilitasi lahan hutan di Indonesia. *Jurnal ForestrIndo*, 2(1), 174–191.

Sitorus, R. (2025). Manajemen lingkungan dalam pembangunan kehutanan di Taman Nasional Gunung Leuser. *Langgas: Jurnal Studi Pembangunan*, 4(2), 84–95. https://doi.org/10.32734/ljsp.v4i2.21647

Sugiyono. (2018). *Metode penelitian kuantitatif, kualitatif, dan R&D*. Alfabeta.

Tresya, D., Firmansyah, R., Said, Z., Cetera, W. N. K., & Nathania, B. (2018). Five indications of *illegal logging* in Bukit Rimbang–Bukit Baling Wildlife Sanctuary. *World Resources Institute*. https://wri-indonesia.org/en/insights/places-watch-second-edition-five-indicated-illegal-logging-area-indonesia