

# The Impact of Illegal Logging Activities on Environmental Degradation and Flood Disasters in Wora Village, Wera District, Bima Regency, West Nusa Tenggara

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## ABSTRAK

Penelitian ini bertujuan menganalisis keterkaitan antara aktivitas illegal logging, degradasi lingkungan, dan peningkatan risiko banjir di Desa Wora, Kecamatan Wera, Kabupaten Bima, Nusa Tenggara Barat. Pendekatan kualitatif deskriptif dengan studi kasus digunakan untuk menggali hubungan antara perilaku manusia, tata kelola lingkungan lokal, dan dampak ekologis yang ditimbulkannya. Hasil menunjukkan bahwa penebangan liar yang didorong tekanan ekonomi, lemahnya pengawasan hutan, serta keterbatasan mata pencaharian menjadi penyebab utama degradasi hutan di wilayah perbukitan Wera. Hilangnya tutupan vegetasi meningkatkan erosi tanah, sedimentasi sungai, serta menurunkan daya resap air yang berkontribusi pada terjadinya banjir bandang 2 Februari 2025. Peristiwa ini menimbulkan kerusakan serius pada lahan pertanian, infrastruktur desa, dan kehidupan ekonomi masyarakat. Temuan ini menegaskan perlunya penguatan tata kelola lingkungan berbasis komunitas dengan mendorong inisiatif rehabilitasi dan pengawasan hutan partisipatif menuju pengelolaan lingkungan berkelanjutan.

## ABSTRACT

*This study examines the link between illegal logging, environmental degradation, and increasing flood disaster risk in Wora Village, Wera District, Bima Regency, West Nusa Tenggara. A descriptive qualitative case study was conducted to explore how human behavior, local environmental governance, and ecological impacts are interconnected. Findings indicate that illegal logging driven by economic pressure, weak forest supervision, and limited livelihood alternatives has become the primary cause of forest degradation in the upland areas of Wera. The loss of vegetation cover increased soil erosion, river sedimentation, and reduced water infiltration capacity, contributing to the flash flood that occurred on February 2, 2025. The disaster resulted in severe damage to farmlands, village infrastructure, and local livelihoods. The study highlights the urgency of strengthening environmental governance at the community level while supporting emerging initiatives such as community-based forest rehabilitation and monitoring to promote adaptive and sustainable environmental management grounded in local knowledge.*

## 1. INTRODUCTION

Bima Regency in the Province of West Nusa Tenggara (NTB) is one of the regions with a high level of vulnerability to ecological disasters, particularly flash floods and landslides. The increasing intensity and frequency of these disasters in recent years are closely related to illegal logging activities in protected forest areas and watershed regions (Ma'arij et al., 2021). Deforestation in this area accelerates surface runoff during the rainy season, reduces soil infiltration capacity, and increases sedimentation in waterways and rivers. The mountainous and steep topography of Wera District further exacerbates these impacts, especially in Wora Village, which has become one of the areas most prone to flooding in Bima Regency (Wikimedia, 2005).

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Ecologically, illegal logging not only reduces the forest's ecological function as a water catchment area but also damages soil structure and alters the local microclimate. Studies have shown that the loss of water-retaining vegetation can increase the risk of flooding up to threefold in regions with high rainfall such as NTB (Firmanto et al., 2022). In addition, data from the Ministry of Environment and Forestry (KLHK) indicate that Indonesia loses more than 650,000 hectares of forest each year, most of which occurs due to illegal logging activities outside licensed concession areas (Golar et al., 2024). This situation not only causes ecosystem degradation but also directly affects the economic sustainability of local communities that depend on forest resources.

From a social perspective, most residents of Wora Village depend on agriculture and forest products for their livelihoods. As forest resources continue to decline due to deforestation, the community faces an economic dilemma: on one hand, they rely on forests for survival, but on the other, excessive exploitation accelerates environmental degradation. This economic factor often becomes the root cause of illegal logging practices (Irawansah, 2023). However, previous studies have largely focused on legal and policy aspects, while research that deeply examines the socio-ecological linkage between illegal logging and the increased risk of flooding at the local level, particularly in eastern NTB, remains very limited (Tuzzahra & Anggara, 2024).

The problem becomes even more complex when weak forest supervision and poor coordination among government institutions allow illegally harvested timber to leave forest areas without strict monitoring (Yahya et al., 2024). Moreover, limited human resources and budget at the regional level often render law enforcement against illegal logging ineffective. Several reports have also revealed corruption practices in the licensing and monitoring processes, further weakening conservation efforts (Abdulah, 2023). As a result, policies that are intended to protect forests are often inconsistently implemented in the field.

Ecologically, forest degradation in Wera exhibits symptoms of an ecological tipping point, a condition in which the forest's ecological function can no longer recover naturally because the damage has exceeded its regenerative threshold. Field observations indicate that many upstream areas around Wora have lost 60–80% of their vegetative cover. The loss of tree root systems causes slope instability and increased soil erosion, which in turn aggravates river sedimentation and raises the risk of flash floods (Azizah et al., 2025). This phenomenon highlights the urgent need for scientific and evidence-based policy approaches to restore the ecological functions of forest areas.

The existing research gap lies in the lack of integration between ecological, social, and institutional approaches in understanding the impact of illegal logging on environmental degradation at the village level. Most previous studies have discussed deforestation issues from legal or macroeconomic perspectives without examining how local community dynamics influence the intensity of illegal logging and disaster risks in their area (Nguyen, 2025). This study aims to fill that gap by emphasizing the importance of a multidimensional analysis of the causes, impacts, and mitigation strategies suited to the local context of Wora Village.

The main objective of this study is to comprehensively analyze the relationship between illegal logging activities, environmental degradation, and the increased risk of flood disasters in Wora Village, Wera District, Bima Regency. By integrating ecological, social, and policy approaches, this research seeks to provide a holistic understanding of how human–environment interactions shape ecological vulnerability in disaster-prone areas. The results of this study are also expected to serve as a foundation for designing sustainable forest management policies and participatory, community-based disaster mitigation strategies.

Theoretically, the findings of this research will contribute to the development of literature on the interrelationship between illegal logging, environmental governance, and disaster risk in the tropical regions of eastern Indonesia. Practically, the results can be used as a basis for local policy to strengthen forest supervision, improve natural resource governance, and raise community awareness in preserving forest sustainability. Thus, this study is expected to contribute not only academically but also directly to sustainable development efforts in Bima Regency and other similar regions in Indonesia.

## 2. METHOD

This study employed a descriptive qualitative approach using an ecological–sociological case study design. This approach was chosen to gain an in-depth understanding of the relationship between illegal logging activities, environmental degradation, and the increase in flood frequency in Wora Village, Wera District, Bima Regency. Qualitative methods were used to interpret the phenomenon holistically within its natural context, in which the researcher served as the primary instrument for data collection and analysis (Sugiyono, 2020). Through this approach, the researcher explored the meanings, perceptions, and experiences of the local community regarding the environmental changes they directly encounter. As a case study, the research positioned Wora Village as a single unit of analysis representing the linkage between human behavior toward the environment and its ecological impacts. This approach aligns with the human–environment interaction paradigm, which views human–nature relationships as dynamic and mutually influential (Creswell & Poth, 2018).

The research location was set in Wora Village, Wera District, Bima Regency, West Nusa Tenggara Province. The site was selected purposively due to its significant forest degradation and its status as the most flood-prone area in Wera during the rainy season. Geographically, Wora Village lies in a hilly area that functions as an important watershed; therefore, the decline in forest cover directly disrupts its hydrological system. The study was conducted over four months, covering the initial observation phase, field data collection, and data analysis. The research coincided with the rainy season (November–February), allowing direct observation of flooding events and post-rainfall environmental changes.

Data in this study consisted of primary and secondary sources. Primary data were obtained through on-site observations, in-depth interviews with community members and village authorities, and visual documentation of ecological conditions in the research area. These data included community perspectives on environmental change, physical conditions of the area (e.g., erosion, sedimentation, vegetation cover), and socio-economic impacts of flooding. Secondary data were collected from governmental institutions such as the Environmental and Forestry Service (DLHK), the Central Statistics Agency (BPS), and the Meteorology, Climatology, and Geophysics Agency (BMKG), as well as scientific literature and topographic maps. The combination of both data types enabled cross-validation (triangulation), resulting in stronger accuracy and credibility of the findings (Sugiyono, 2020).

Data collection methods included observation, in-depth interviews, and document review. Observation was conducted to directly examine forest conditions, critical land, and flood-affected areas associated with illegal logging practices. The researcher utilized photographic documentation and basic spatial mapping to capture land-cover changes and water flow during heavy rainfall. In-depth semi-structured interviews were conducted with key informants, including the village head, community leaders, farmers, representatives from the Bima Regency DLHK, and residents affected by floods. This technique allowed flexibility to explore emerging contextual information (Creswell & Poth, 2018). Document review was used to obtain supporting written records and statistical data, such as village government reports, BMKG rainfall data, and local news archives concerning flood disasters in Wera.

The research subjects consisted of the inhabitants of Wora Village and relevant stakeholders involved in forest and environmental management issues. Purposive sampling was used to select informants based on predefined criteria aligned with the study's objectives (Sugiyono, 2020). Criteria included residents who have lived in the forest-adjacent area for at least five years, have direct experience with flood events, and have knowledge regarding natural resource management in the village. A total of 15–20 key informants were selected, including village officials, farmers, customary leaders, and local government representatives. This sampling strategy enabled the researcher to obtain deeper insights from individuals with direct knowledge of the studied phenomenon.

Data were analyzed using the interactive analysis model by Miles & Huberman (1994), consisting of three main components: data reduction, data display, and conclusion drawing. Data

reduction was performed by selecting and categorizing information into major themes such as ecological impacts, socio-economic factors, and community mitigation efforts. Data display was presented in thematic narratives and analytical matrices describing the relationship between illegal logging activities and flooding occurrences. Finally, conclusion drawing and verification were conducted by interpreting the emerging patterns and carrying out member checking with key informants to ensure the trustworthiness of the information (Sugiyono, 2020). This thematic analysis enabled a systematic explanation of the cause-and-effect mechanisms linking deforestation, ecosystem changes, and flood risk.

To ensure data validity, this study applied source and method triangulation. Source triangulation was carried out by comparing information obtained from different informant groups (community members, village government, and forestry authorities), while method triangulation was achieved by integrating observation, interviews, and documentation results. Additionally, peer debriefing with supervisors and environmental experts was conducted to maintain objective interpretation aligned with local contexts. Ethical considerations were also taken into account, including voluntary participation, confidentiality of informants' identities, and ensuring that the research outcomes contribute to scientific development and local environmental policy improvement.

Through this methodological framework, the study is expected to provide a comprehensive understanding of the relationship between illegal logging activities and environmental degradation in Wora Village. The findings are also anticipated to offer relevant strategic recommendations for disaster mitigation and community-based sustainable forest management. The methodological rigor ensures the resulting outcomes are scientifically valid, accountable, and beneficial for environmental policy development in Bima Regency and other regions in eastern Indonesia facing similar challenges

### **3. RESULT AND DISCUSSION**

#### **Result**

The findings of this study reveal that illegal logging activities in Wora Village have reached an alarming level and serve as the primary driver of environmental degradation in the area. Based on field observations and in-depth interviews with village authorities and local residents, intensive illegal logging has been carried out in the upper hill zones by some corn farmers seeking to expand agricultural land. These activities are conducted without adherence to soil and water conservation principles, resulting in severe damage to ecological support systems that previously functioned to maintain hydrological stability. Natural vegetation, which plays a crucial role in absorbing rainfall, has been replaced by open land that is highly vulnerable to erosion and landslides.

In addition to activities conducted by local communities, the research also identified the involvement of external actors targeting high-value timber species such as teak (*Tectona grandis*), mahogany (*Swietenia macrophylla*), and rosewood (*Dalbergia latifolia*) for trade outside the region. Field observations showed that areas with reduced vegetation density exhibited significantly higher sedimentation levels in river channels following heavy rainfall events. These findings strengthen the evidence that illegal logging accelerates soil degradation, increases surface erosion, and diminishes the forest's natural capacity to regulate runoff.

The ecological impacts culminated on February 2, 2025, when a major flash flood struck Wora Village after more than six hours of intense rainfall in Wera District. According to village government data and community testimonies, the event caused fatalities and severe damage to public infrastructure, residential houses, and lowland agricultural areas. The forceful water flow carried mud, rocks, and large tree trunks believed to originate from illegal logging sites in the upper hills. Post-disaster observations indicated that the natural water absorption system in the upstream area had lost its functionality due to the disappearance of forest vegetation cover. This condition reflects the ecological transformation of a watershed into a surface runoff zone, where high rainfall directly generates extreme water discharge without adequate infiltration.

The 2025 flood not only caused ecological losses but also severely impacted the social and economic conditions of Wora Village communities. Interviews revealed that dozens of hectares of lowland agricultural land suffered extensive damage due to thick sediment and rock deposits. Many farmers experienced complete crop failure, particularly for corn and rice—the main sources of local livelihoods. Additionally, the destruction of bridges and inter-hamlet access roads disrupted transportation and goods distribution for several weeks, paralyzing community economic activities. Numerous residents lost their homes and were forced to evacuate to safer temporary shelters with limited facilities, highlighting low social resilience and insufficient disaster response systems at the village level.

Furthermore, the study underscores that weak local forest governance and inadequate monitoring serve as key factors exacerbating widespread illegal logging. Interviews with village officials indicated limited human resources and budget availability to conduct routine patrols across the vast and difficult-to-access forest area. Insufficient institutional support from district-level authorities also hampers effective monitoring of illegal timber harvesting. The absence of strict legal mechanisms and poor interagency coordination have resulted in ineffective law enforcement, with most reports of illegal logging remaining at the administrative stage without concrete follow-up actions. This situation demonstrates that the forest monitoring system in Wora Village remains far from achieving effective and participatory principles of good environmental governance.

Overall, the findings show a strong interconnection between illegal logging, environmental degradation, and increased socio-economic vulnerability of the community. The situation in Wora Village illustrates a systemic failure in sustainable natural resource governance, where weak institutional capacity and economic pressures contribute to a recurring cycle of ecological degradation.

## Discussion

The findings of this study demonstrate a strong relationship between illegal logging practices and the level of environmental degradation in Wora Village. These results align with the findings of Yahya et al. (2024), who reported that forest degradation in Bima and Sumbawa directly weakens soil capacity to retain water, thereby increasing the risk of hydrometeorological disasters such as floods and landslides. This condition indicates that the loss of vegetation cover not only affects ecological systems but also has broader implications for the social and economic stability of the community.

Furthermore, this study confirms the social–ecological cycle theory proposed by Golar et al. (2024), suggesting that deforestation creates a negative feedback loop, in which environmental damage deteriorates social welfare and, in turn, socio-economic pressures accelerate natural resource exploitation. Thus, illegal logging is not merely an ecological issue, but a complex social phenomenon rooted in the community's dependency on forest resources without the application of sustainable conservation practices.

The flash flood that occurred on 2 February 2025 provides concrete empirical evidence of the link between deforestation and the increasing risk of hydrometeorological disasters. Firmanto et al. (2022) emphasized that the loss of forest cover transforms catchment areas into runoff zones, where heavy rainfall immediately becomes surface flow without being absorbed by the soil. The phenomenon in Wora Village reinforces the concept of systemic ecology, which asserts that disruption to one environmental component—in this case forest ecosystems—can trigger cascading effects on overall ecological balance. The absence of forest vegetation has led to increased erosion, river sedimentation, and disrupted hydrological functions that heighten community vulnerability to disasters.

Prior to the escalation of illegal logging practices, local residents admitted that large-scale flooding was almost never experienced. However, over the past five years, floods have become an annual threat. This fact indicates that ecological degradation in the upstream area has reached a critical level, requiring comprehensive restoration efforts including reforestation, land conservation, and stricter monitoring of tree-cutting activities in the upland region.

In addition to ecological impacts, this study highlights significant socio-economic consequences. Environmental damage caused by illegal logging increases the social–ecological vulnerability of rural communities. According to Ma'arij et al. (2021), communities highly dependent on forest resources are the most vulnerable when those ecosystems deteriorate, as they lose both economic sources and ecological protection simultaneously. In the context of Wora Village, declining agricultural productivity and rising post-disaster recovery costs exacerbate social inequalities, indicating a strong link between environmental degradation and structural poverty.

These conditions show that environmental issues cannot be separated from governance concerns. This finding supports Abdulah's (2023) perspective on environmental governance failure, wherein institutions are unable to manage natural resources sustainably due to weak supervision, coordination, and law enforcement. In Wora Village, human resource and budget limitations hinder regular forest monitoring, while institutional coordination remains inadequate. Consequently, illegal loggers often avoid strict sanctions, allowing their activities to persist.

Additionally, economic pressures worsen the situation. Many residents are compelled to cut trees to meet short-term needs without considering long-term environmental sustainability. This phenomenon illustrates that ecological degradation is a product of complex interactions among economic, social, and institutional factors. Therefore, addressing illegal logging requires not only law enforcement, but also economic empowerment programs and the provision of sustainable livelihood alternatives.

To respond effectively, a localized sustainable development approach is necessary—balancing economic, social, and ecological dimensions. Community empowerment through environmental education, green economic initiatives, and conservation-based resource management policies are strategic steps to break the chain of social–ecological vulnerability.

The case in Wora Village demonstrates the importance of multi-stakeholder environmental governance. Local governments, law enforcement, academics, and local communities must collaborate to build an adaptive monitoring system that places village communities as primary actors in forest conservation. Such a participatory approach not only strengthens the social legitimacy of environmental policies but also reinforces community ownership over ecosystem sustainability.

As a reflection, the 2025 flash flood became a turning point for ecological awareness among Wora residents. Community initiatives to conduct reforestation, forest patrols, and cross-stakeholder collaboration indicate the emergence of local-level social learning. This process aligns with the interactive analysis model of Miles and Huberman (1994), which highlights that sustainable social change can only be achieved through a continuous cycle of reflection, action, and evaluation.

Thus, the ecological crisis in Wora Village should not be viewed merely as a tragic event, but as momentum to establish a new paradigm of environmental management—one that is sustainable and socially just. The disaster serves as a valuable lesson for both the community and government in ensuring harmony between humans and nature—towards a resilient, greener, and sustainable future for Wora Village.

#### **4. CONCLUSION**

This study demonstrates that illegal logging activities in Wora Village, Wera District, Bima Regency, have caused severe disruption to forest ecosystem balance and local hydrological systems. Uncontrolled tree cutting by both local residents and external actors, without adherence to conservation principles, has resulted in the loss of natural vegetation that functions as a rainwater absorber and erosion barrier. This condition accelerates environmental degradation, including increased soil erosion, river sedimentation, and a decline in ecosystem carrying capacity. Ecologically, the forested upland area of Wera, which once functioned as a natural water catchment zone, has now transformed into a runoff-prone region highly vulnerable to flash flooding.

The major flash flood that occurred on 2 February 2025 serves as empirical evidence of systemic ecological failure triggered by extensive deforestation. The disaster caused significant material and social losses, including damage to agricultural fields, village infrastructure, and residential housing. These findings reinforce systemic ecological theory, which posits that disturbances to one environmental component—in this case the forest—trigger cascading effects on other components such as soil, water, and human livelihoods. The socio-economic impacts experienced by the local community illustrate their increased vulnerability due to economic dependence on forest resources and limited livelihood diversification.

Beyond ecological and social factors, this study also identifies weak monitoring and local forest governance as structural drivers exacerbating illegal logging issues. Shortages of human resources, limited budgeting, and weak inter-agency coordination hinder effective law enforcement against illegal loggers. This condition reflects environmental governance failure—an institutional inability to manage natural resources sustainably. Nevertheless, the emergence of local initiatives such as forest rehabilitation and community-based monitoring after the disaster indicates strong potential for a transition toward more adaptive and participatory environmental governance at the village level.

Overall, the findings of this research confirm that the relationship between illegal logging, environmental degradation, and flash flood disasters in Wora Village is causal and systemic. Deforestation is not merely an ecological problem, but a manifestation of socio-economic inequality and weak environmental governance. Therefore, mitigation efforts must be undertaken comprehensively through a socio-ecological approach that integrates conservation strategies, community empowerment, and consistent environmental law enforcement.

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