

Research/Review

The Impact of Deforestation on Community Socio-Ecological Resilience: A Review of the Effectiveness of Decentralized Forestry Policies

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Abstract: Indonesia, as one of the world's megabiodiversity countries, possesses vast tropical forests rich in biodiversity and natural resources. Recognizing their ecological and socio-economic importance, the Indonesian government has introduced various forestry policies to preserve forest ecosystems and improve community welfare. One of the key strategies is decentralized forest management, designed to encourage participatory, inclusive, and locally contextual governance. This study adopts a literature review method, drawing from previous research, scientific articles, and relevant policy documents. The objective is to deepen the understanding of deforestation reduction efforts, particularly in the context of limited awareness regarding community activities that may harm both social life and environmental sustainability. The primary focus is on assessing the impacts of deforestation on socio-ecological resilience, with special attention to the effectiveness of decentralized forestry policies. Findings indicate that deforestation exerts significant and multifaceted effects on resilience, especially in communities highly dependent on forests for livelihoods and living space. From an ecological perspective, deforestation contributes to biodiversity loss, degradation of ecosystem services, declining soil quality, and weakened ecosystem resilience against environmental change. Such ecological disruptions threaten environmental balance and increase the risks of disasters and natural resource crises, which can have long-lasting implications. Socially, deforestation can undermine local livelihoods, exacerbate poverty, and weaken traditional knowledge systems. These combined effects reduce a community's capacity to adapt to environmental challenges. Therefore, strengthening forestry governance—particularly through decentralization and enhanced community participation—is essential to curb deforestation and safeguard socio-ecological sustainability at the local level. Effective implementation requires aligning policy frameworks with local needs, empowering community institutions, and ensuring equitable access to forest benefits.

Keywords: Community Participation; Decentralization; Deforestation; Forestry Policy; Socio-Ecological Resilience;

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1. Introduction

Indonesia as a megabiodiversity country has a very large tropical forest area and is rich in natural resources. However, in recent decades, deforestation has become a serious challenge that threatens the socio-ecological resilience of communities, especially local communities that live dependent on forest ecosystems. Deforestation not only reduces forest cover, but also leads to the degradation of ecological functions such as the hydrological cycle, carbon storage, and biodiversity. In addition, forest destruction has weakened the social resilience of communities through land conflicts, loss of livelihoods, and disruption of local socio-cultural structures.

The Indonesian government has implemented various forestry policies, including decentralized forest management policies, in an effort to encourage more participatory and contextual governance. Through this approach, local governments, as well as local communities, are given a greater role in the management of forest resources. However, the effectiveness of these policies is still subject to evaluation, especially since there are still high rates of deforestation recorded, both inside and outside forest areas.

Indonesia's forests are often referred to as one of the world's forests that provide oxygen to living things directly, which can absorb carbon dioxide, which is harmful carbon and produce the oxygen gas that humans need. Forests are a fundamental aspect of life that is important for all aspects of life, including economic, social, cultural, and environmental aspects (Widodo & Sidik, 2020). An increasingly irregular forest can cause various types of problems, such as having an effect on the gases in the room.

Land damage that occurs in Indonesia is largely triggered by deforestation activities and land conversion into plantation areas. One of the industries that contributes greatly to the country's foreign exchange is the palm oil industry, which not only opens up a large number of job opportunities but also encourages a significant increase in the area of oil palm plantations. Oil palm plantations have strategic value in supporting national economic growth, but on the other hand they also cause various negative impacts such as environmental damage and social conflicts. It is estimated that about 57% of deforestation in Indonesia is caused by the conversion of forests to oil palm plantations, while about 20% comes from the pulp and paper industries. Every year, Indonesia also faces forest fire disasters. In 2015, forest fires swept through about 1.7 million hectares of land and caused a smog disaster that had a wide impact on the education, air transportation, public health, economy, and environmental sectors. Therefore, in economic development, there needs to be serious attention to the principles of sustainable development by considering social, economic, and environmental aspects.

Deforestation is a condition of decreasing forest area caused by land conversion for infrastructure development, settlements, agricultural activities, mining, and plantations. The conversion of forests to non-forest land also contributes to the increase in global warming, one of which is due to forest fires that often occur. Deforestation activities are often related to illegal logging or illegal logging, which can threaten the survival of living things and trigger global warming through forest fires (Rimbakita, 2020). Global warming itself is a crucial issue caused by various economic activities carried out without paying attention to their impact on the environment, resulting in an increase in the earth's temperature in recent years. In Indonesia, forest destruction continues to increase from year to year, causing a significant reduction in forest area and causing negative impacts, both nationally and globally. Based on data from Greenpeace, Indonesia is recorded as the third largest carbon emitter in the world after the United States and China, with about 80% of these emissions coming from forest burning. This burning activity also has a detrimental impact on human health, such as causing prolonged respiratory distress.

Data from the Ministry of Environment and Forestry (MoEF) shows that although the rate of deforestation had decreased from 462,400 hectares in 2018–2019 to 104,000 hectares in 2021–2022, the figure increased again to 175,400 hectares in 2024. Most of this deforestation occurs legally within industrial concession areas, demonstrating the weak monitoring and complexity of forest governance within a decentralized framework. On the other hand, community involvement efforts through social forestry and customary forest programs have not been able to fully address the structural problems faced by local communities in maintaining their socio-ecological resilience.

This condition shows that decentralized forestry policies are not yet fully effective in addressing the challenges of deforestation that have a direct impact on ecosystem sustainability and community welfare. Therefore, a critical review of the impacts of deforestation and an analysis of the effectiveness of existing forestry policies are important to formulate a more adaptive, inclusive, and sustainable forest governance strategy.

The author conducted an assessment of the existence of these problems by writing an article related to the impact of deforestation on the socio-ecological resilience of the community: an analysis of the effectiveness of decentralized forestry policies.

2. Literature Review

Deforestation of Indonesia's forests

Deforestation, which is the loss of forest areas, is one of the environmental problems that is quite complex and difficult to solve. Therefore, adequate understanding and collaboration from various parties are needed to encourage community involvement in efforts to reduce deforestation activities or support programs that aim to address this problem together (Forest Watch Indonesia, 2020). The rate of deforestation in Indonesia in the period from 1985 to 1998 was recorded to reach between 1.6 to 1.8 million hectares per year (Education, 2017). The high rate of deforestation that occurs every year results in large-scale forest loss, which has a negative impact on environmental sustainability and also social life, both directly and in the long term. Furthermore, by 2000, the deforestation rate increased to about 2 million hectares. Based on data from the Ministry of Environment and Forestry (MoEF), since the Reformasi era until now, deforestation rates show a downward trend. This can be seen from data in 2016 and 2017 which recorded a deforestation rate of 0.48 million hectares.

The latest data from the Ministry of Environment and Forestry (MoEF) shows that the deforestation rate fluctuates from year to year. In the 2013-2014 period, deforestation was recorded to decrease to 0.4 million hectares, whereas in the previous year the figure was still in the range of 0.73 million hectares per year. However, the trend increased again in 2014–2015, with deforestation reaching 1.09 million hectares. Then, there was a decrease in the 2015–2016 period to 0.63 million hectares per year, and again decreased in 2016–2017 to 0.48 million hectares per year. These variations suggest that the rate of deforestation can increase or decrease depending on human activities. Therefore, strong collaboration and collective awareness from all elements of society are needed in supporting efforts to reduce deforestation. This is very important because reducing deforestation not only has a positive impact on environmental sustainability, but also on public health at large.

Furthermore, in the 2014-2015 period, the deforestation rate increased again to reach 1.09 million hectares per year. However, from 2016 to 2017, deforestation decreased again, at 0.48 million hectares per year. The problem of deforestation in Indonesia is very serious. Data shows that from 1990 to 2017, the average forest area lost each year reached around 0.5 million hectares (Publish What You Pay, 2020). In 2018–2022, there was a significant decline from 462,400 ha (18–19) to 104,000 ha (2021–22), marking the smallest period in the entire era of satellite monitoring. In 2023–2024 deforestation began to increase again. In 2024, it will reach 175,400 ha, the highest since 2021–22. Most (97%) of deforestation in 2024 will occur within legal concessions, not illegal logging. Reducing the deforestation rate certainly has a positive impact on the environment, because reducing forest destruction will help preserve ecosystems and support the survival of humans and other living things.

Deforestation is a decrease in forest area caused by land conversion for infrastructure development, settlements, agricultural activities, mining, and plantations. Some of the main factors that trigger deforestation include agricultural land conversion, forest fires, wood exploitation, and the use of wood as fuel (Fund, 2020). In addition, the opening of concessions for industries such as palm oil, pulp & paper, and mining, as well as the growing nickel mining and forest and land fires, especially in El Niño seasons, remain a driver of deforestation, despite the government's effective mitigation efforts since 2015. These activities have a serious impact on life, both for humans, plants, and wildlife. Therefore, it is necessary to carry out various targeted deforestation reduction efforts, by prioritizing the optimization of conservation measures and increasing the collective awareness of the community to preserve the environment in Indonesia.

Social-Ecological Resilience

Socio-ecological resilience is a concept that describes the ability of a system consisting of interaction between humans and the environment to maintain functions and structures in the face of external and internal pressures, as well as adapt to changes that occur (Folke et al., 2020). This concept integrates social and ecological aspects holistically, so natural resource management must be carried out taking into account the balance between human needs and ecosystem sustainability.

Socio-ecological resilience refers to the capacity of social and ecological systems to absorb disturbances, reorganize themselves, and learn from change without losing basic identity and function (Walker et al., 2020). This includes the ability of people and ecosystems to adapt

to threats such as climate change, deforestation, land degradation, and socioeconomic pressures. According to Cinner et al. (2020), socio-ecological resilience prioritizes the reciprocal relationship between humans and the environment where the success of social adaptation is highly dependent on the condition and function of the ecosystem. Thus, maintaining socio-ecological resilience is maintaining a balance between environmental conservation and the social welfare of the community.

Ecological resilience focuses on the ability of ecosystems to maintain their essential functions and structures despite disturbances, including deforestation and other environmental changes. These dimensions include:

- Biodiversity: Genetic, species, and ecosystem variations that increase the stability and adaptability of ecosystems to change (Oliver et al., 2020).
- Ecosystem services: Natural functions such as carbon storage, hydrological cycles, and the provision of habitats that support life (TEEB, 2020).
- Ecosystem resilience: The capacity of ecosystems to recover from disturbances and maintain key ecological functions (Folke et al., 2020).

Ecological resilience is essential to ensure that ecosystems remain able to provide essential natural resources and environmental services to communities. Social resilience refers to the ability of communities to face and overcome pressures and changes, maintain livelihoods, social structures, and cultural values that support the sustainability of natural resource management (Adger, 2020). These dimensions include:

- Economic resilience: Diversification of livelihoods and the ability of the economy to survive external pressures such as loss of forest resources (Cinner et al., 2020).
- Socio-cultural resilience: The sustainability of local value systems, norms, and knowledge that support sustainable management of natural resources (Berkes, 2020).
- Adaptive capacity of society: The level of participation and ability of community organizations in responding to change and managing conflict (Folke et al., 2020).

Social resilience is an important key to inclusive and effective decision-making in forest resource governance. In the context of forest management, socio-ecological resilience can be measured using several indicators, including:

- Forest cover level and quality, as indicators of ecological function and resource availability (MoEF, 2020).
- Sustainability of local communities' livelihoods, especially those that depend on sustainable forest products and social forestry activities (World Bank, 2020).
- The level of social conflict related to land and forest resource management (Forest Watch Indonesia, 2020).

Community participation in decision-making and forest management, which demonstrates social adaptive capacity (Agrawal & Ostrom, 2020). Strengthening these indicators is important to ensure that decentralized forestry management can have a positive impact on socio-ecological resilience.

Decentralized Forestry Policy

Decentralized forestry policy is a mechanism for transferring forest management authority from the central government to local governments and local communities. The goal is to increase local participation and accelerate adaptive decision-making to regional social and ecological conditions (Sari & Hidayat, 2021). The decentralization of forestry in Indonesia is supported by a number of regulations, including Law Number 23 of 2014 concerning Regional Government. This regulation gives local governments the authority to manage natural resources, including forests, by paying attention to the principles of sustainability and social justice (Nurhadi et al., 2020).

This policy aims to empower local governments and communities in forest management to improve the effectiveness of governance and community welfare. The benefits include increasing community participation, accelerating decision-making processes, and protecting forest resources from destruction (Putra & Wulandari, 2020). The implementation of this policy involves granting management rights to local governments, strengthening the role of indigenous peoples and social forestry, and coordination between related institutions. The success of implementation is highly dependent on regional institutional capacity and active participation of the community (Putra & Wulandari, 2020).

The main obstacles to policy implementation include the unpreparedness of human resources in the regions, the overlap of authority between the central and regional governments,

and the potential for social conflicts related to access and management of forest resources (Hidayat & Suryanto, 2020). To overcome these challenges, it is necessary to strengthen the technical and institutional capacity of local governments, harmonize regulations, and improve participatory mechanisms and transparent supervision in forest management (Sari & Hidayat, 2021).

3. Method

This research method is a literature review or *literature view*. The instrument used is by using data collection techniques that are carried out by trigulation or merging by analyzing qualitative data. The method of collecting qualitative data in this study is qualitative analysis by conducting case studies from literature review of field study research results analyzed with a qualitative descriptive approach. This research uses sources from various previous studies with written materials or literature studies that can answer the results of research on efforts to reduce forest deforestation which is considered necessary to be researched because of the many misunderstandings of community activities that can have a negative impact on life and the environment. The data analysis technique is identified by grouping literature based on themes. Next, compare the results of the research between sources. Furthermore, it brings together the findings that build a complete framework of thought. Then further critically analyze the gaps, advantages and disadvantages of the research. The focus of this research is to look at the impact of deforestation on the socio-ecological resilience of communities: an examination of the effectiveness of decentralized forestry policies.

4. Results and Discussion

• The Impact of Deforestation on Ecological Resilience

Deforestation significantly disrupts ecological resilience by degrading the function and structure of forest ecosystems. A study by Putra and Lestari (2021) found that deforestation causes a decline in biodiversity which results in a weakening of ecosystems' ability to provide environmental services such as carbon sequestration, water cycle regulation, and natural habitat provision. This is reinforced by Santoso et al. (2021) who report that ecosystems affected by deforestation experience degradation of soil quality and microclimate change, thereby worsening ecosystem resilience to natural disasters and global climate change.

This decline in ecological resilience threatens the natural resources that underpin the livelihoods of local communities, especially for those who depend on forest products for their livelihoods. Disturbances in the ecosystem also cause a decrease in the recovery capacity of the ecosystem, making it vulnerable to long-term degradation (Putra & Lestari, 2021). The decline in ecological resilience also has a direct impact on communities that depend on forest ecosystem services. For example, reduced clean water supply due to disruption of the hydrological cycle and degraded soil quality can affect agriculture and the livelihoods of local communities (Santoso et al., 2021). Therefore, deforestation not only damages the environment, but also threatens the socio-ecological sustainability of the communities living around the forest.

Overall, deforestation has a profound negative impact on ecological resilience by reducing biodiversity, disrupting ecosystem services, causing soil degradation and microclimate change, and lowering ecosystem resilience. This impact not only damages the environment, but also threatens the sustainability of human life that depends on forests as a major natural resource.

• The Impact of Deforestation on Social Resilience

Social resilience reflects the ability of communities to maintain social structures, cultural values, and livelihoods in the face of external changes and pressures. In the context of deforestation, forest destruction not only has an ecological impact, but also significantly affects the social structure, economic well-being, and social dynamics of local communities. The social impact of deforestation is strongly felt by communities that depend on forest resources. Wibowo and Prasetyo (2021) revealed that reduced public access to non-timber forest products, such as honey, rattan, and medicinal plants, leads to a decrease in income and threatens the livelihoods of local communities. This creates economic vulnerability that has an impact on social welfare.

In addition, Dewi and Hartono (2021) found an increase in social conflicts between local communities and companies or local governments due to the struggle for

land and forest resources. These conflicts are often caused by unclear access rights and non-transparent governance, thereby reducing social cohesion and weakening people's ability to adapt to environmental changes. This weakened social resilience has made it difficult for communities to maintain traditional cultural values and social systems that have supported sustainable forest management. As communities lose access to forest resources, they become more dependent on government or private sector assistance. This dependence weakens the community's independence and makes them more vulnerable to political manipulation, economic exploitation, and non-inclusive decision-making (Wibowo & Prasetyo, 2021).

Deforestation has serious social impacts by weakening local economic structures, eliminating cultural wisdom, increasing social conflicts, and lowering people's adaptive capacity and independence. This impact has made people who were previously independent and adaptive to nature into a vulnerable, marginalized, and dependent group on outsiders. Therefore, the protection of forests is not only an ecological issue, but also an important part of efforts to maintain the social resilience of local communities.

- **The Effectiveness of Decentralized Forestry Policies in Reducing Deforestation**

Indonesia's decentralized forestry policy is part of the post-1998 forest governance reforms, which aim to give local governments and local communities greater authority over forest management. Its main goal is to reduce the rate of deforestation, improve the well-being of local communities, and promote sustainable forest management. However, the effectiveness of these policies varies depending on the institutional context, regional capacity, and community participation. Decentralized forestry policies that shift forest management authority to local governments and local communities have the potential to reduce the rate of deforestation. Santoso et al. (2021) show that social forestry programs that involve local communities directly in forest management are able to significantly reduce the rate of deforestation in the East Kalimantan region. Community participation in decision-making strengthens local oversight and maintains forest sustainability.

However, Putra and Lestari (2021) emphasized that the effectiveness of this policy is still limited due to the institutional capacity of local governments that have not been optimal. The lack of competent human resources, budget limitations, and poor coordination between institutions make the implementation of decentralized policies not optimal. In addition, some regions still experience overlapping authority between the central and regional governments, which makes it difficult for policies to be implemented consistently. In general, decentralized forestry policies have a strong potential to reduce deforestation if supported by adequate institutional capacity, coordination between levels of government, and inclusive community engagement. Santoso et al. (2021) recommend strengthening the role of community groups in decision-making, as well as improving spatial data-based monitoring systems. Putra & Lestari (2021) emphasized the need to simplify regulations between levels of government so that implementation is more efficient and not contradictory.

The effectiveness of decentralized forestry policies in reducing deforestation depends largely on the quality of implementation on the ground. If local institutions are strong, communities are actively involved, and regulations do not overlap, then these policies can be an effective instrument to curb the rate of deforestation and promote sustainable forest management.

- **Challenges in the Implementation of Decentralized Forestry Policies**

The results of the study reveal several key challenges in the implementation of decentralized forestry policies. According to Wibowo and Prasetyo (2021), the overlap of authority between the central and regional governments causes unclear forest resource management. This hinders effective decision-making and supervision processes. In addition, Hidayat and Suryanto (2020) reported that limited technical and managerial capacity at the local government level is the main obstacle in implementing the decentralization program. Many regions do not have adequate human resources to manage forests sustainably and implement social forestry effectively.

Conflicts of interest between community groups and private companies or government officials are also an obstacle, especially when short-term economic interests trump sustainability goals (Dewi & Hartono, 2021).

- **Recommendations for Strengthening Decentralized Forestry Policies**

To address these obstacles, this study recommends strengthening the institutional capacity of local governments through technical and managerial training, as well as providing sufficient funds to support sustainable forest management (Santoso et al., 2021). Increased coordination between central and regional government agencies is also very necessary so that decentralized forestry policies can run more effectively and harmoniously.

In addition, there is a need to increase active community participation in decision-making and monitoring of forest management to increase transparency and accountability (Putra & Lestari, 2021). The approach to community empowerment through social forestry programs should be expanded so that more local communities benefit and are directly involved in preserving forests.

Strengthening regulations and policies that support fair and sustainable forest governance is also important to create a balance between conservation interests and the socio-economic needs of the community (Wibowo & Prasetyo, 2021).

- **Impacts of Deforestation or Weakness of Forestry Policies**

The following are the impacts of deforestation or weaknesses of forestry policies, including:

Table 1. Impacts of deforestation or weaknesses of forestry policies

Aspects	Key Findings
Environmental impacts and disasters	Floods, landslides, droughts, greenhouse gas emissions, loss of biodiversity.
Social and economic impact	Land conflicts, loss of livelihoods for local communities
Enforcement and regulation	Weak laws, corruption, policy overlap
Community participation	Minimal, less inclusive
Technical and operational	Limited resources and technical facilities.

Source: Rachmawati, (2020)

5. Conclusions

This study shows that deforestation has a serious impact on the socio-ecological resilience of communities, especially in areas that depend on forests as a source of life and living space. From an ecological perspective, deforestation causes the degradation of biodiversity, damage to ecosystem service functions, a decrease in soil quality, and weakening the resilience of ecosystems to environmental changes. This impact disrupts the ecological balance which ultimately increases the risk of ecological disasters and natural resource crises.

Meanwhile, from a social perspective, deforestation worsens the social conditions of communities by reducing economic welfare, triggering land conflicts, eroding local wisdom, and weakening people's adaptive capacity in dealing with change. Indigenous peoples and vulnerable groups are the most affected by the loss of access and control over forests.

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