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The Role of Forests in Providing Ecosystem Services for Environmental Resilience

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ABSTRACT

Increasing atmospheric CO_2 concentrations contribute to climate change, with industrial and economic activities accelerating greenhouse gas emissions. However, human-induced emissions also stem from deforestation, where forests act as carbon sinks through photosynthesis but release carbon when cut down. Forests play a crucial role in mitigating climate change by storing carbon, and their restoration can enhance their carbon-absorbing capacity. This research, based on a literature review, examines the role of forests in providing ecosystem services for environmental resilience, utilizing sources from Google Scholar, Elsevier, and Science Direct. Forests and agroforestry systems contribute to food and nutritional security, providing various products like food, medicine, and materials for construction and fuel. However, forest fires and logging disrupt these contributions. Forests support livelihoods by offering diverse products and ecosystem services. Managing forest gaps, which influence biodiversity and nutrient cycles, is crucial for forest ecology.

KeyWords: Climate change, Greenhouse gas emissions, Deforestation, Carbon sinks, Ecosystem services.

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INTRODUCTION

Indonesia is a country that has many types of forests in it. The role of forests in providing ecosystem services is indeed very strong. Forests are called the lungs of the world because of their enormous contribution to providing oxygen (Seymour & Busch, 2016). Regarding forests, the Government has issued regulations related to forest protection as stated in Government Regulation No. 24/2010 and Government Regulation No. 45/2004. Apart from that, the government has also passed other regulations in the form of Government Regulation No. 24/2010 concerning "the Use of Forest Areas" (Najicha, 2021).

Forests around the world play an important role in climate change. Of course, all Indonesian people need to know this to always maintain the integrity and preservation of forests. The role of forests in maintaining good ecosystem services can be achieved through protecting the forests themselves (Fitriandhini & Putra, 2022). In recent years, Indonesian forests have been subject to many problems such as forest fires, large-scale deforestation, and so on. This problem occurs because there are parties who are irresponsible and only want to gain personal gain. This arbitrary action is very detrimental to both humans and other living creatures. According to data from the Ministry of

Environment and Forestry, during the January-August 2023 period, indications of the area of forest and land fires in Indonesia reached 267,935.59 ha. Every year, Indonesia loses 684,000 hectares of forest due to illegal logging, forest fires, forest encroachment, and forest conversion (Revitch, 1994; Saputra et al., 2024). Massive deforestation and forest fires cause damage to the ecosystem within it. As a result of this, the role of forests to supply oxygen and act as an intensity to prevent disasters is hampered. Finally, Carbon Dioxide (CO_2) levels will also increase (Defita et al., 2022). Hansen et al (2008) argue that the increasing rate of tropical forest loss significantly reduces the likelihood of preventing excessive CO_2 concentrations in the atmosphere with the potential for irreversible increases in temperature along with massive declines in biodiversity.

Most people agree that increasing atmospheric concentrations of CO_2 contribute to climate change. Industrial and economic growth has caused greenhouse gas emissions, including CO_2, to increase rapidly. However, emissions caused by human activities are not limited to industrial or energy processes (Putra et al., 2021). Where photosynthesis binds CO_2 and stores it in plants in the form of carbon. Therefore, forests serve as carbon stores and play an important role in influencing our climate. When forests are cut down, they release carbon, which is one source of greenhouse gas emissions, and when forests are restored, they become carbon sinks (Josh & Tabita, 1996). Forest use can not only add to the problem of climate change but can also serve as a tool for determining ways to reduce it. Special attention is needed regarding existing problems to restore the role of forests in providing ecosystem services for environmental defense. Based on the background explained above, the author is interested in analyzing the role of forests in providing ecosystem services for environmental resilience.

METHODS

The research method used is a literature review (Aryantie et al., 2023). This method is carried out by analyzing several related journals and articles. Researchers use several keywords such as "forest, ecosystem, and environmental defense" in searching for reference sources. The sources used were obtained through trusted pages, namely Google Scholar, Elsevier, and Science Direct.

RESULTS

Forests are the largest oxygen supplier on earth. The existence of forests has a huge influence on human life. Forests have a strong impact when viewed in terms of health, finance, and so on (Cambi, 2015; Nytch et al., 2023). Where various kinds of living creatures are available in the forest. Ecosystems are also intertwined between one living creature and another. So, in this case, many living creatures benefit (Das et al., 2023;

Gustafson et al., 2023). As the years go by, forests often experience problems caused by nature and also by human actions. Talking about human actions, problems such as fires and large-scale deforestation are what disrupt the ecosystem. According to existing and latest data this year, forest fires often occur in various provinces in Indonesia. The following is a list of 10 provinces with indications of the largest area of forest and land fires for the period January-August 2023 below.

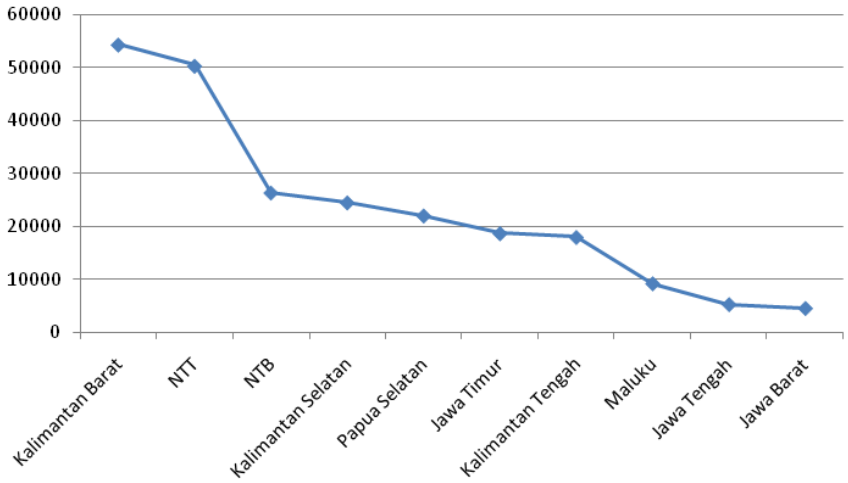

Figure 1. Forest fires in 2023

Based on existing data sourced from databooks.katadata.co.id (2023), the highest forest fires in 2023 will be in West Kalimantan province with 54,402 ha. On the other hand, the lowest data shows West Java Province with a count of 4,641 ha. With quite a large amount of land being burned, the forest ecosystem cannot function as it should. Apart from forest fires, there are other problems caused by the closure of forest land. The following is data obtained regarding forest closure that occurred in 2017-2021 below.

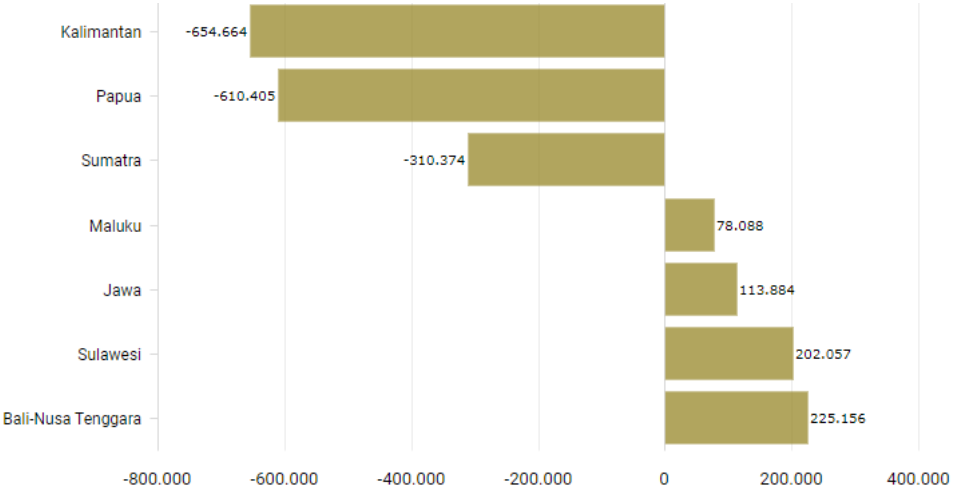

Figure 2. Reduction/addition of Indonesia's forest cover area (2017-2021)

Based on the data above, it can be seen that forest land cover is greater than forest

addition in Indonesia. Of course, if this data is calculated, it will produce unequal results. Husrin et al (2015) in his research stated that forests and other tree-based systems such as agroforestry contribute to food and nutritional security in various ways. Ghimire et al (02024) add, that with cases of forest fires and logging which resulted in forest closures, the contribution of food and nutrition was disrupted and affected by a decline. In agreement with this statement Mekie et al (2023), the role that forests and trees play in the lives of many people is clear through the many uses made of tree products, including food, medicine, animal feed, fiber and fuel, and for construction, fencing, and furniture. The next role of forests is to provide living creatures such as trees which make a major contribution to the livelihoods of other earth creatures (Singh, 2024).

Indeed, forests and other tree-based production systems such as agroforestry are estimated to contribute to the livelihoods of more people than the 1.6 billion people worldwide. The diversity of forest products available includes not only those from trees but a wide range of (often) "less visible" products from other plants, fungi, animals, and insects. "Natural" forests, agroforestry, and other tree-based production systems not only provide these products directly but contribute indirectly to supporting people's livelihoods through the provision of various ecosystem services (Rusetuka, 2023). From the literature review, the size of the gaps causes important changes in factors such as light intensity, soil moisture, and soil biological properties that influence the regeneration of tree species and differ in gaps of different sizes. While shade-tolerant species can occupy small gaps, shade-intolerant species need large gaps for successful regeneration. This review summarizes information that is useful for forest managers who design harvesting systems that mimic natural disturbances and should consider forest structure, forest climate, and the role of natural disturbances in their design.

Lussu et al (2024) stated that gaps play an important role in forest ecology, helping to conserve biodiversity and pedo, influence nutrient cycles, and maintain the complex structure of forests that are in the late stages of succession. It is widely recognized that increasing atmospheric concentrations of CO_2 are driving changes in climate patterns. However, emissions caused by human activities are not limited to industrial or energy processes alone. Photosynthesis binds CO_2 and stores it as carbon in plants. Therefore, forests act as carbon stores and play an important role in influencing the climate on Earth. When forests are cut down, they release carbon, and logging acts as one source of GHG emissions. When the forest is restored, the forest will absorb carbon and become a carbon sink. Forest use can add to the problem of climate change, but can also be a tool in formulating ways to mitigate it.

CONCLUSIONS

Increasing atmospheric CO_2 concentrations contribute to climate change, with industrial and economic activities accelerating greenhouse gas emissions. However, human-induced

emissions also stem from deforestation, where forests act as carbon sinks through photosynthesis but release carbon when cut down. Forests play a crucial role in mitigating climate change by storing carbon, and their restoration can enhance their carbon-absorbing capacity. This research, based on a literature review, examines the role of forests in providing ecosystem services for environmental resilience, utilizing sources from Google Scholar, Elsevier, and Science Direct. Forests and agroforestry systems contribute to food and nutritional security, providing various products like food, medicine, and materials for construction and fuel. However, forest fires and logging disrupt these contributions. Forests support livelihoods by offering diverse products and ecosystem services. Managing forest gaps, which influence biodiversity and nutrient cycles, is crucial for forest ecology. Increasing CO_2 levels and deforestation drive climate change, but forest restoration can mitigate these effects by enhancing carbon sequestration. Thus, forests are vital in both combating and adapting to climate change.

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