

# Brief Review: Plant Diversity Loss in Indonesia as an Impact of Oil Palm (*Elaeis guineensis* Jacq.) Plantation Expansion

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**Abstract**—Biodiversity is something that must be preserved. The decline in biodiversity is now a common issue worldwide, one of which is in Indonesia. One of the issues related to the decline in biodiversity found in Indonesia is the decrease in plant diversity due to the expansion of oil palm lands. This short article discusses how the expansion of oil palm lands can harm plant diversity in Indonesia, as evidenced by several studies that have been summarized and some of the solutions that can be offered to preserve plant diversity.

**Keywords**—Expansion, Loss, Oil palm, Plant diversity.

## I. INTRODUCTION

Biodiversity is a term used to describe the richness of life on earth, including plants, animals, microorganisms, the genetics of these organisms, and the ecosystems in which they live.<sup>[1]</sup> A living system will be formed by the interaction between each component of the biodiversity in an area. Biodiversity can be grouped into ecosystem diversity, species, and genes.<sup>[2]</sup> Kristanto et al. (2008) stated that biodiversity can be caused by differences in characteristics, including shape, number, color, texture, and size, which are biological in the composition of the community structure.<sup>[3]</sup> One form of diversity that can be found daily is plants' diversity.

Plant diversity can be defined as the diversity of plant species that occupy an ecosystem.<sup>[4]</sup> Plant diversity shows various variations in the shape, body structure, number, color, and other characteristics of plants in an area. Plants have various benefits for the life of other organisms, especially humans. Apart from acting as food or decoration in the yard, plants are also useful in healing and medicine.<sup>[5]</sup> However, today's plant diversity must face various threats. Deforestation due to the expansion of oil palm (*Elaeis guineensis* Jacq.) land is one of the threats to plant diversity that has attracted attention.

Oil palm is a type of plant with a classification that includes the kingdom Plantae, division Spermatophyta, subdivision Angiospermae, class Monocotyledoneae, order Palmales, family Arecaceae, subfamily Coccoidea, genus *Elaeis*, and species *Elaeis guineensis*.<sup>[6]</sup> Palm oil plays a role, among others, in the food and oil industries. The variety of products also increases, so the palm oil industry has become multipurpose.<sup>[7]</sup> Oil palm is the third largest oil-producing crop in planted areas after soybean and rapeseed oil.<sup>[8]</sup> Using oil palm on a large scale triggers land expansion, further

eroding the diversity of existing plants.

Cholchester et al. (2011) explained that oil palm plantations could cause biodiversity loss, increase greenhouse gas emissions, deforestation, depletion of soil nutrients, drought, and water pollution due to toxic waste.<sup>[9]</sup> The impacts of oil palm cultivation range from changes in microhabitat and microclimate to large-scale changes, such as changes in landscapes that can affect climate at a regional level.<sup>[10]</sup> This paper discusses how the expansion of oil palm lands can impact plant diversity.

## II. DISCUSSIONS

One of the global issues often encountered is the conservation of biodiversity, where this issue cannot be separated from problems that occur in the local sphere.<sup>[11]</sup> Every region in the world has problems related to its biodiversity, including Indonesia. Indonesia is known as a country that has experienced a high decline in biodiversity.<sup>[12]</sup> The main causes of loss of biodiversity are habitat destruction, climate change, over-exploitation, environmental pollution, accidents/accidents and the arrival of alien species.<sup>[13]</sup> Biodiversity, one of which is plant diversity, must be considered to minimize the negative impacts of decreasing this diversity. Plant diversity must not disappear from the face of the earth because plants are one of the supports of life, which plays a very important role in life.

The production of palm oil has resulted in various impacts that have been documented and published, some of which are habitat loss and damage, decreased populations of species that occupy areas that are used as oil palm plantations, and various other impacts that are not obvious.<sup>[8]</sup> Oil palm plantations harm the ecology. Clearing and converting land into oil palm plantations are thought to reduce and eliminate biodiversity due to destructive land-clearing systems.<sup>[14]</sup> Oil palm plantations are assumed to originate from clearing in primary forests.<sup>[9]</sup> Drinan et al. (2013) declared that homogenization carried out in terrestrial ecosystems could even impact water areas because the conditions in these areas are related to the stability of the vegetation surrounding them.<sup>[10]</sup>

Ecologically and structurally, oil palm plantations have less diversity ecologically and structurally than tropical rainforests. Hence, converting forests to oil palm plantations causes a significant decrease in species diversity. The diversity of trees and various other crops was greatly reduced, with

some areas planted with oil palm showing more than a 99% reduction in tree diversity compared to natural forests.<sup>[8]</sup> Studies related to the decrease in plant diversity due to the expansion of oil palm plantations have been carried out, including by Nahlunnisa et al. (2017)<sup>[9]</sup>, Rembold et al. (2017)<sup>[15]</sup>, and Dharmayanthi et al. (2018)<sup>[16]</sup>.

Nahlunnisa et al. (2017)<sup>[9]</sup> examined the decline in the diversity of tropical plant species caused by the opening of oil palm plantations by six companies (PTN, PT KPR, PT SAR, PT AMA, PT MUP, and PT IMT) in Riau Province. In this study, data collection began with the interpretation of Landsat imagery carried out on land owned by the six oil palm companies investigated to know changes in land cover before and after the land was cleared for oil palm plantations, then continued with an inventory of plant diversity which will be analyzed later. Using the Margalef Wealth Index and Community Equality Index. The conclusion from the research results is that PT KPR, PT SAR, and PT AMA decreased the diversity of plant species in the range of 60.56-93.33%. In contrast, the decrease in plant species diversity was not found in PTN, PT MUP, and PT IMT because there are High Conservation Value (HCV) areas in the form of secondary forests that existed before the formation of oil palm plantations. The existence of these HCV areas can maintain the diversity of plant species in oil palm plantations.

Rembold et al. (2017)<sup>[15]</sup> examined the impact of forest conversion on monoculture plantation land in Sumatra, which was carried out in four locations: rain forest, rubber plantations with agroforestry systems, rubber monoculture, and oil palm monoculture. The results showed that in the oil palm plantations that were assessed, only two types of trees were classified as non-oil palm species. If undergrowth in the oil palm area is also counted, 63 tree species are found, with a total of 451 individuals. If a comparison is made with the observed forests, the oil palm plantations have very low plant diversity compared to forests with 557 tree species, with 6,499 individuals.

Dharmayanthi et al. (2018)<sup>[16]</sup> examined the impact of converting paddy agricultural land to oil palm plantations in Jatibaru Village, Bunga Raya District, Siak Regency, Riau Province. The conclusion from the research results is that there has been a decrease in plant diversity on rice farms that were converted into oil palm plantations. This is implied by the results of observations showing that there are more plant species on rice farms than on oil palm plantations. On oil palm plantations, only plants that can live in damp places, such as ferns and mosses, are found. The grass is difficult to find in these oil palm plantations because of its nature which tends to be damp and covered, so sunlight is difficult to penetrate the soil surface. The presence of weeds in the oil palm plantations is also insignificant.

The expansion of oil palm plantations is proven to reduce the diversity of plant species. The existence of oil palm plantations in the Barumun River Basin has the potential to erase traces of riparian vegetation in the area.<sup>[17]</sup> In addition, the diversity of plants in an area can be disrupted by the presence of biomass produced by the palm oil industry. Excessive biomass production due to palm oil production can

pollute the environment in the industrial area, so a way is needed to convert this biomass into products with economic value.<sup>[6]</sup> In addition, deforestation due to the expansion of oil palm land also has an impact on humans themselves. The community around the forest can utilize the diversity of plants found in the forest. This is to the research of Setiadi et al. (2018)<sup>[18]</sup> that the opening of an oil palm plantation in Lampasio Village, Toli-Toli District, reduces the biodiversity that is utilized by the local community, for example, rattan.

Considering that palm oil is a commodity that has a large role in the Indonesian economy, solutions are needed to maintain plant diversity while maintaining the stability of the productivity of the palm oil industry. One solution that can be offered is to increase the creation of HCV areas. HCV areas in oil palm plantations have been found to exist in the biodiversity conservation framework in the study of Nahlunnisa et al. (2017)<sup>[9]</sup>. HCV areas can be defined as areas or areas designated to protect biodiversity and environmental, social, economic, and cultural services of the community to minimize the negative impacts of the presence of oil palm plantations.<sup>[19]</sup> HCV areas can be used as land to preserve native plant diversity.

Another solution that can be offered is updating individual palms. Old palm oil can be immediately replaced with new superior seeds to maintain the productivity of the palm oil industry. In simple terms, this is referred to as palm rejuvenation. Planting oil palm on land previously used for oil palm cultivation is one way of planting oil palm based on land use, in addition to clearing new land and planting on conversion land.<sup>[20]</sup> The direction of replacing individual oil palms is to minimize the need for land expansion which can erode plant diversity in an area.

### III. CONCLUSION

Plant diversity is an aspect of biodiversity that must be considered because it has the potential to experience a drastic decline due to land clearing for industrial purposes, one of which is oil palm plantations. Various studies have proven that expanding oil palm land can reduce plant diversity in an area. Therefore, solutions (including the application of HCV areas) are needed to conserve various plant species and preserve biodiversity.

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