

Management of Silvicultural Tropical Forests in Central Kalimantan

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ABSTRACT

The purpose of this paper study is to formulate the problem of forest management activities. Likewise a study of the impact of timber harvesting resulted in damage to residual stands, openness of forest areas and damage to land. Discussion concerned on tropical forest, tropical forest biomass, and carbon dioxide emission. In conclusion, tropical forests have a very important role in suppressing global climate change.

KEYWORDS: Management, silvicultural tropical forest, timber harvesting, biomass, carbon dioxide

INTRODUCTION

Human activities have a very large role in increasing GHG emissions in the atmosphere, including the use of fuel oil for various human activities, especially in industrial processes, transportation, forest clearing, intensification of crop cultivation and waste production. Indonesia in 2020 committed to reduce GHG emissions by 26% on its own capacity and 41% with the assistance of international cooperation through Business As Usual (BAU) emissions and to place the forestry sector as the main target of emission reduction [1]. Forests have a very important role in suppressing the increase in GHG emissions, especially CO₂. Vegetable compilers of forest stands utilize CO₂ from the atmosphere and water from the soil with the help of sunlight to produce oxygen and carbohydrates through photosynthesis. The results of photosynthesis are then converted into biomass stored in stems, twigs, leaves, fruit and roots in the soil. On the other hand, forests are also a source of GHG emissions in the event of forest damage due to errors in forest management that have an impact on increasing GHG emissions.

The cause of forest destruction that occurred in Indonesia is deforestation and forest degradation activities. Deforestation activities include the conversion of forests into plantations, mining, industry, agricultural land and fisheries. While forest degradation activities include illegal logging, mistakes in forest management activities and forest fires. Purbawiyatna *et al.* [2] concluded that globally deforestation and forest degradation activities in Indonesia contribute around 17.4% of GHG emissions.

One of the activities that cause forest degradation in Indonesia is forest management activities carried out by companies holding Timber Forest Product Utilization Permit (IUPHHK). National Forestry Plan Data for 2011-2030 in Purbawiyatna *et al.* [2], around 34 million ha of forests in Indonesia are under the management of natural forest and plantation forest IUPHHK holders.

The purpose of this paper study is to formulate the problem of forest management activities carried out by IUPHHK-HA with a silvicultural system. Likewise a study of the impact of timber harvesting resulted in damage to residual stands, openness of forest areas and damage to land.

Tropical forest

Forests are plant communities that are controlled or dominated by trees that have different environmental conditions than those outside the forest [3]. Tropical forests are forests that are always wet or moist, can be found around the equator. According to Forest Watch Indonesia [4], Indonesia is a country that has the third largest area of tropical forest in the world after Brazil and Democratic Congo.

Tropical forests are climax ecosystems, plants that are in this forest never shed their leaves simultaneously. According to Forest Watch Indonesia [4], the characteristics of tropical forests are that they have high rainfall intensity, are exposed to sunlight at any time, have high humidity, consist of high trees

ranging from 40-60 m, have a wide canopy of vegetation and vegetation always green. Tropical forests have direct or indirect benefits. The direct benefits are as a producer of wood and non-timber forest products, while the indirect benefits are as environmental services, water regulators, aesthetic functions, oxygen providers and carbon sinks. Suhendang [5] found the potential for carbon storage in Indonesia's tropical forests is around 15.05 billion tons of carbon.

Impact of Timber Harvesting

Timber harvesting is one of the activities in forest management by utilizing forest products in the form of wood in production forests carried out by companies that have a Timber Forest Product Utilization Business License (IUPHHK). The stages of timber harvesting activities in tropical natural forests include planning, clearing of forest areas (PWH), felling, skidding, transportation and final landfilling [6].

Timber harvesting activities cause forest damage in the form of logged-over areas whose conditions vary. Ex-logging areas or secondary forests are forests that are undergoing a secondary succession process after timber harvesting. The Indonesian Selective Cutting and Planting (TPTI) silvicultural system in the Regulation of the Director General of Forestry Production Development [7], stands of forest compilers in logged-over areas are residual stands that must be carried out in guiding activities such as tidying, clearing, enriching, maintaining. Standing lives in logged-over areas based on their level of growth include seedlings, saplings, poles and trees.

The impact of wood harvesting activities on environmental damage is unavoidable. Elias [8], the component of timber harvesting activity that is estimated to be the most dominant against environmental damage (openness of forest, land, residual and hydrological stands) is PWH activities, especially in the construction of road networks, transportation, skidding and logging. The most dominant damage due to wood harvesting activities occurred in the residual stand which included damage to the tree, changes in the structure and composition of the stand, distribution of tree species, community similarity and diversity of species.

The degree of damage to the residual stand is very dependent on the wood harvesting and silviculture system used. Elias [9], damage to the residual stand with TPTI silviculture system for seedling rate of 30.02%, sapling 27.17% and mast level 24.60% and trees 21.96%. Damage to residual stands in natural forests due to timber harvesting activities with Conventional Logging system is caused by skidding activities, namely 88.32% felling trees, 4.47% skew, 4.47% stem / skin cuts, canopy, buttresses and stems 2, 74%. Some research results from damage to residual stands due to timber harvesting activities were 25-45% and area openness by 20-35% [8,10].

Timber harvesting activities in tropical forests affect the amount of carbon stored in the forest. Lasco [11], wood harvesting activities play a role in reducing carbon stocks above the soil surface at least 50% and in tropical forests in Asia the carbon stock decreases due to wood harvesting activities ranging from 22-67%.

Estimation of Tropical Forest Biomass and Carbon

Biomass is the total amount of living organic matter expressed in oven dry weight tons / ha [12]. Kusmana *et al.* [13], biomass is the weight of organic matter per unit area that exists in several components of the ecosystem at a particular time stated in general terms in terms of dry weight or some that give the term free ash dry weight. Forest biomass is the overall volume of living creatures of all species at any given time and can be divided into 3 main groups namely trees, shrubs and other vegetation [14].

Biomass can be divided into 2 categories, namely above ground biomass (below ground biomass) and below ground biomass. Kusmana *et al.* [13], aboveground biomass is the weight of organic matter per unit area above the soil surface at a certain time that is connected to a function of the productivity system, stand age and organic distribution. Hairiah *et al.* [15], aboveground biomass consists of trunks, trees, branches, leaves on surviving trees, creeping plants, climbing plants, undergrowth and epiphyte plants including litter. Below the surface biomass is all biomass from living plant roots, meaning this root applies to a certain diameter size specified. The method of estimating forest biomass consists of 4 main ways, namely (a) Sampling with harvesting / destructive sampling (b) Sampling without harvesting / non-destructive sampling with in situ data collection (c) Estimation through remote sensing and (d) Model making. Each of the methods above uses allometric equations to extrapolate the data snippet to a wider area.

Carbon is one of the natural elements which has the symbol C with an atomic value of 12 and is one of the main elements forming organic matter including living things [16]. Naturally, forest vegetation processes photosynthesis by utilizing CO₂ from the atmosphere and converting it into organic carbon (carbohydrates) and stored as biomass. Forest biomass plays an important role in the biogeochemical cycle, especially the carbon cycle. About 50% of the total forest carbon is stored in forest vegetation [15]. Tropical forests contain large

amounts of biomass so that it is a very large store of carbon in the world [5]. The carbon content stored in the forest at any time can be emitted due to natural processes (due to human activities) such as the fall of trees because they are old and then decomposed (the impact is not large), while the process due to human activity is the logging of forests / trees on a large scale (the impact very large) which will have an impact on forest degradation and deforestation [1]. Brown [12], forest carbon potential can be estimated by multiplying the value of biomass with a conversion factor of 0.5. The 0.5 factor means that forest biomass contains about 50% carbon.

Carbon dioxide emissions

Carbon dioxide (CO₂) is one of the greenhouse gases (GHGs) whose increase in the atmosphere is very rapid. Mudiyarso [17], in the last decade, CO₂ emissions have more than doubled from 1,400 million tons / year to 2,900 million tons / year. In addition, CO₂ has the highest contribution to global warming compared to other GHGs.

Sources of CO₂ gas emissions include the use of fuel oil for various human activities, especially in industrial processes, transportation, forest clearing, intensification of crop cultivation and waste production. Agus and Van Noordwijk in Hairiah [18], burning of natural forests on peatlands causes the release of 734 tons of CO₂ emissions / ha from C stored in vegetation of 200 tons / ha. Purbawiyatna et al. (2012), globally deforestation and forest degradation contribute 17.4% to GHG emissions. Carbon dioxide has a longer residence time in the atmosphere compared to other GHGs, which is around 5-200 years resulting in the accumulation of large amounts of CO₂ [17].

Conclusion

Tropical forests have a very important role in suppressing global climate change. Forest ecosystems are able to absorb greenhouse gases by transforming CO₂ from the air into carbon deposits in components of the forest ecosystem such as trees, plants and soil.

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