

ENVIRONMENTAL BENEFIT FROM OIL PLANTATION

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RESUME

Indonesia's oil palm plantations, which have been growing rapidly. Indonesia also has proven itself to be the largest palm oil producer in the world, all at once also the world's largest producer of vegetable oil. The consequence of becoming a global player is having to face competition from competitors, one of unfair competition is a negative campaign. One of the negative issues that is widely used to inhibit the trade in palm oil and its derivative products on the global market is that oil palm plantations are considered the main cause of deforestation in Indonesia.

Efforts to improve the image of palm oil plantation and national industry were carried out by the Indonesian government by issued Presidential Instruction about Moratorium and implementing ISPO to ensure that Indonesian palm oil able to fulfill the sustainability aspects. In addition, there is the idea that palm oil tree is categorized as a forest plant to suppress the development of the issue of deforestation. This can be seen based on the role and performance of oil palm plantations with the ability to absorb carbon dioxide, harvest solar energy, and water management functions, which will also be compared with the performance and role of forest in these three aspects.

When compared between oil palm and forest. In netto, each hectare of oil palm plantations absorbs about 64.5 tons of carbon dioxide annually and produces about 18.7 tons of oxygen. Meanwhile, forest in a netto able to absorb about 42.4 tons of carbon dioxide and produce about 7.1 tons of oxygen. It's menas capability of oil palm plantation in the functions are of absorbing carbon dioxide and producing oxygen, oil palm plantations are actually superior than forest.

Oil palm plantations when compared to forest have a better ability to generate energy, absorb carbon dioxide, and generate more oxygen into the atmosphere. But forest are better at storing energy (biomass). Meanwhile, in terms of water management functions, oil palm plantations generally have the same role in conservation and hydrological functions compared to forest. From these explanation, role of oil palm plantations that similar as a forest plants, so it's iportant to consider the idea of including they as a forest plants.

In terms of the role and performance of energy harvesting, oil palm plantations are superior to forest in terms of a higher radiation energy conversion efficiency of 1.7 g mj, while forest efficiency is only 0.9 g/mj. Oil palm plantations are also superior in terms of photosynthetic efficiency, incremental biomass and dry matter productivity. Meanwhile, forest is better at storing energy (biomass). However, if what is needed in forest area management is how to produce more efficient energy, absorb more carbon dioxide and produce more oxygen, then oil palm plantations are the answer to that question.

Meanwhile, in terms of water management functions, oil palm plantations generally have the same role in conservation and hydrological functions compared to forest. Oil palm plantations that have a fairly long production cycle of around 25 years (from planting to replanting) mean that this hydrological and conservation function lasts for at least 25 years. By including oil palm as a forest plant category, it is possible for palm oil tree to be planted in Industrial Plantation Forest (read: Hutan Tanaman Industri/HTI) or Social Forest (read: Hutan Sosial). In addition, the issue of oil palm plantations as the main cause of Indonesia's deforestation will be suppressed.

INTRODUCTION

Palm oil has become a strategic commodity, not only in the plantation sub sector and agricultural sector, but also in the economy development in Indonesia. Oil palm plantation areas in Indonesia have also experienced revolutionary developments, from only 294.5 thousand hectares in 1990 to 14.3 million hectares in 2020 (Directorate General of Plantation, 2020). Even based on the results of the work team reconciliation initiated by the Coordinating Ministry for Economy Affairs and stipulated by the Decree of the Minister of Agriculture No. 833/KPTS/SR. 020/M/12/2019 regarding the area of land cover of Indonesian oil palm plantations in 2019 reaching 16.38 million hectares.

With this plantation area, Indonesia has proven itself to be the largest palm oil producer in the world, by shifting Malaysia's position since 2006. Indonesia's share reaches 58 percent of the world's total palm oil production (USDA, 2020). Apart from being the largest producer of palm oil in the world, Indonesia is also the world's largest producer of vegetable oil.

The development of oil palm plantations also encourages the growth of the rural economy in Indonesia. Several activities that directly impact the components of the regional rural economy, such as the development of rural community resources, construction of public infrastructure such as land roads, school and health facility, absorption of local labor, and increasing income and welfare. This proves that palm oil is strategic commodities in Indonesia that are inclusive, where the benefits of oil palm plantations are not only enjoyed by plantation owners, but also by the surrounding community.

In addition to the benefits felt by local communities, the development of oil palm plantations also generates enormous multiplier benefits at the national level both for increasing income, job opportunities, added value and output through the development of its downstream industries. Even in the midst of the Covid-19 pandemic and the threat of an economic recession, palm oil and its derivative products succeeded in becoming foreign exchange

heroes that created a surplus in Indonesia's trade balance by providing export foreign exchange of USD 11.9 billion during the January-July 2020 period (PASPI, 2020^a).

It does not stop there, the contribution of palm oil is also felt by the global community through the provision of affordable food products as well as oleochemical-based products and energy products that are affordable and also eco-friendly.

Although Indonesian palm oil products have made a large positive contribution to Indonesia and globally, the national palm oil industry has always been hit by negative issues. Environmental issues are a part of the anti-palm oil campaign to hinder the development of the national palm oil industry both at the national and global levels. Those who are anti-palm oil consider the existence and development of oil palm plantations to be a contributing factor to deforestation, loss of endemic biodiversity and various other crucial environmental problems.

Negative issues, especially the linkage to oil palm plantations which cause various environmental problems, have been denied by palm oil researchers through various journal articles and scientific meetings. The government is also currently working on improving the image of the palm oil industry, especially with regard to environmental issues through governance policies such as the Presidential Instruction about Moratorium and certification of Indonesian Sustainable Palm Oil (ISPO).

Indonesia's efforts to combat the issue of palm oil as a cause of deforestation have also continued with the emergence of the idea that oil palm should be categorized as a forest plant. Oil palm, which is categorized as a forest plant, allows oil palm to be planted in Industrial Plantation Forest (read: Hutan Tanaman Industri/HTI) or Social Forest (read: Hutan Sosial). The idea of oil palm being included as a forest plant does require the understanding of many related parties, but with this the issue of oil palm plantations as the main cause of Indonesia's deforestation will be suppressed.

This paper will discuss the role of oil palm plantations from the perspective of the role and performance of forest if the idea of

oil palm as a forest plant. The performance of oil palm plantations analyzed includes the ability of oil palm to absorb carbon dioxide, harvesting solar energy, and the function of water management compared to forest. So that, it's expected that it can be considered by palm oil's stakeholders regarding this idea.

CARBON SINK

Every second the earth's atmosphere is packed with carbon dioxide waste from human activities on planet Earth. Humans, animals, motor vehicles and factories around the world emit excess carbon dioxide (biggest emitter's greenhouse gas) into the earth's atmosphere, which has triggered global warming and environmental change. To reduce the concentration of greenhouse gases, especially carbon dioxide, in the earth's atmosphere, one of which can be done by reducing greenhouse gas emissions by minimizing the use of sources that can produce carbon emissions, such as fossil fuel. Other than that, it's also necessary to re-absorption of these carbon dioxide gas.

The role of carbon dioxide gas absorption is owned by every plant, both forest plants, including oil palm plants, which have the ability to absorb carbon dioxide from the earth's atmosphere.

Through photosynthesis carried out by plants, the carbon dioxide in the earth's atmosphere is absorbed by plants.

The mindset of the community has always considered natural forest that are protected by their natural as the "lungs" of the ecosystem, so that if there is forest destruction or forest function conversion, it is considered that it will reduce nature's ability to absorb carbon dioxide gas. This mindset is also the basis for those who are anti-palm oil to reject the development of oil palm plantation in Indonesia. Therefore, it's necessary to provide information regarding a comparative study of the role of oil palm plantations and forest in absorbing carbon dioxide gas.

Through the plant's metabolism, carbon dioxide is broken down into carbon and oxygen. The carbon is then processed and converted into plant bodies (roots, stems, leaves) and plant production for human needs. Meanwhile, oxygen is released into the earth's atmosphere for human life, which we breathe when we inhale. Because plants have the ability to absorb carbon dioxide from the earth's atmosphere and produce oxygen (supply oxygen) to the earth's atmosphere, green plants, including palm oil tree, are also known as "lungs" of the ecosystem (Figure 1).

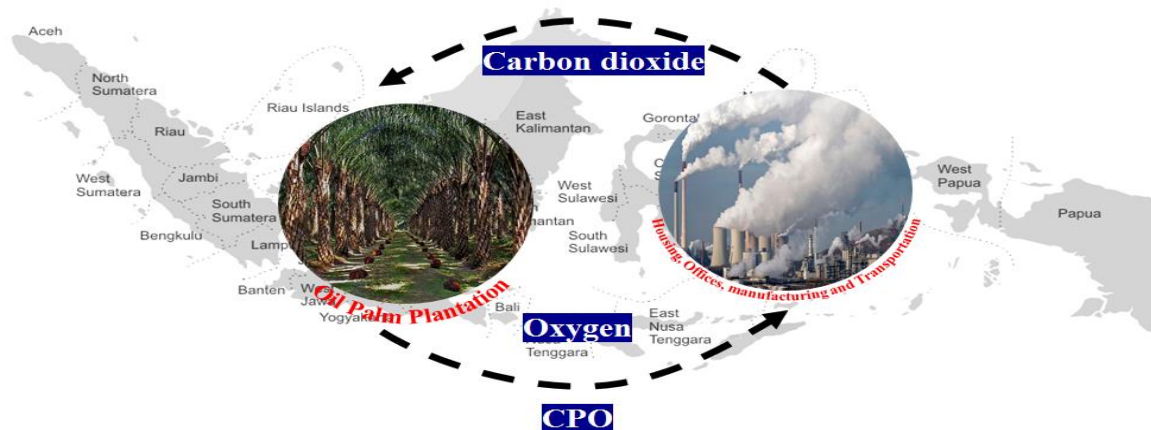


Figure 1. Oil Palm Plantations As The "Lungs" Of The Ecosystem

When compared between oil palm and forest (Table 1). In netto, each hectare of oil palm plantations absorbs about 64.5 tons of carbon dioxide annually and produces about 18.7 tons of oxygen. Meanwhile, forest in a netto able to absorb about 42.4 tons of

carbon dioxide and produce about 7.1 tons of oxygen. Thus, for the function of absorbing carbon dioxide from the earth's atmosphere and producing oxygen, oil palm plantations are actually superior than forest.

Table 1. Carbon dioxide absorption and oxygen production of oil palm plantations and tropical forest

Indicators	Tropical Forest	Oil Palm Plantation
Gross assimilation (tons CO ₂ /ha/year)	163.5	161.0
Total respiration (ton CO ₂ /ha/year)	121.1	96.5
Net assimilation (tons CO ₂ /ha/year)	42.4	64.5
Oxygen production (O ₂) (tons O ₂ /ha/year)	7.1	18.70

Source: Henson (1999)

HARVESTING SOLAR ENERGY

The main source of energy for human life on earth is from solar energy. Plants harvest solar energy through the process of photosynthesis. Plants will convert solar energy into chemical energy that produces food, wood and other biomass. Thus, both forest and oil palm plantations are "harvesters" of solar energy for life on earth.

The idea that oil palm will be categorized as a forest plant needs to be studied in terms of the ability of oil palm plantations to harvest solar energy.

Indicators used to measure the ability of oil palm to harvest solar energy include leaf area index, photosynthetic efficiency, radiation conversion efficiency, total biomass, incremental biomass, and dry matter productivity.

Based on the calculation, the results show that oil palm plantations are relatively superior in indicators of photosynthesis efficiency, radiation energy conversion, dry matter productivity and incremental biomass (Table 2).

Table 2. Comparison of solar energy harvesting effectiveness between oil palm plantations and tropical forest

Indicators	Tropical forest	Oil palm plantation
Leaf area index	7.3	5.6
Photosynthesis efficiency (%)	1.7	3.2
Radiation conversion efficiency (g/mj)	0.9	1.7
Total biomass in the area (tons/ha)	431.0	100.0
Incremental biomass (tons/ha/year)	5.8	8.3
Dry substance productivity (tons/ha/year)	25.7	36.5

Source: Henson (1999), PPKS (2004, 2005)

The photosynthetic efficiency of oil palm plantations reaches 3.2 percent, while forest are only 1.7 percent. Oil palm plantations also have a higher radiation energy conversion efficiency of 1.7 g/mj, while forest's efficiency only 0.9 g/mj. In the incremental biomass indicator, oil palm plantations reach a value of 8.3 tonnes/ha/year, while forest are only able to reach a value of 5.8 tonnes/ha/year. In addition, oil palm plantations also have dry matter productivity that is better than forest productivity. Oil palm plantations have a productivity of 36.5 tonnes/ha/year, while

forest are only capable of producing 25.7 tonnes/ha/year of dry matter.

However, although oil palm plantations are superior in several indicators such as the photosynthetic efficiency, energy conversion efficiency, incremental biomass and dry matter productivity. While, forest has two assessment indicators is better than oil palm plantations. The relative advantage of forest is in the indicators of leaf area index and total biomass stock. The forest leaf area index has a value of 7.3, while oil palm plantations are only 5.6. In addition, forest have a much greater total biomass than oil

palm plantations, namely 431 tonnes/ha, while oil palm plantations are only 100 tons/ha.

Thus, it can be concluded that oil palm plantations are superior to forest in harvesting solar energy. However, for energy storage (biomass), forest are superior to oil palm plantations. If we needed in forest area management is how to produce more efficient energy, absorb more carbon dioxide and produce more oxygen, then oil palm plantations are better than forest. However, if what is needed is higher biomass storage or carbon stock and biodiversity conservation, then forest are better than oil palm plantations. This is certainly evidence that can be used to build the image of oil palm plantations in the face of anti-palm oil parties.

WATER CONSERVATION

Assessment of the role of oil palm plantations is not only in the absorption of carbon dioxide and its ability to harvest solar energy, but also its role in the function of ecosystem water systems. Oil palm, like other plants in the ecosystem, plays a role in conserving water systems. Through the evapotranspiration mechanism, plants evaporate water into the atmosphere which in turn will fall to the earth through rain. In addition, the function of plants also plays a role in soil and water conservation through various mechanisms such as holding water reserves in the topsoil, protecting soil from direct hit by rainwater and maintaining air humidity (microclimate).

When compared between oil palm plantations and forest (Table 3), in general, oil palm plantations have the same role in conservation and hydrological functions. This is reflected in the indicators of evapotranspiration, groundwater reserves, rainfall continuation, infiltration rate and humidity. Oil palm plantations that have a fairly long production cycle of around 25 years (from planting to replanting) mean that this hydrological and conservation function lasts for at least 25 years.

Table 3. Comparison of water management functions between oil palm plantations and tropical forest

Indicator	Tropical forest	Oil palm plantations
Evapotranspiration (mm/year)	1,560-1,620	1,610-1,750
Groundwater reserves up to depth of 200 cm (mm)	59-727	75-739
Deflecting rainfall from soil surface (%)	85	87
Rate of <i>solum</i> layer infiltration 0-40 cm (ml/cm ³ /minute)	30-90	10-30
Air humidity (%)	90-93	85-90

Source: Henson (1999), PPKS (2004, 2005)

Coster's study (1938) which has comparison evapotranspiration of several planrs states that water requirements in palm oil plantations are only 1,104 mm per year (Figure 1). Meanwhile, the amount of water requirements in bamboo and lamtoro plants that are greater than 3,000 mm per

year shows that both of these forest plants are classified as water-wasteful plants. Then followed by acacia plants 2,400 mm per year of water per year, the sengon tree that used 2,300 mm per year, Pine and rubber that need around 1,300 mm per year.

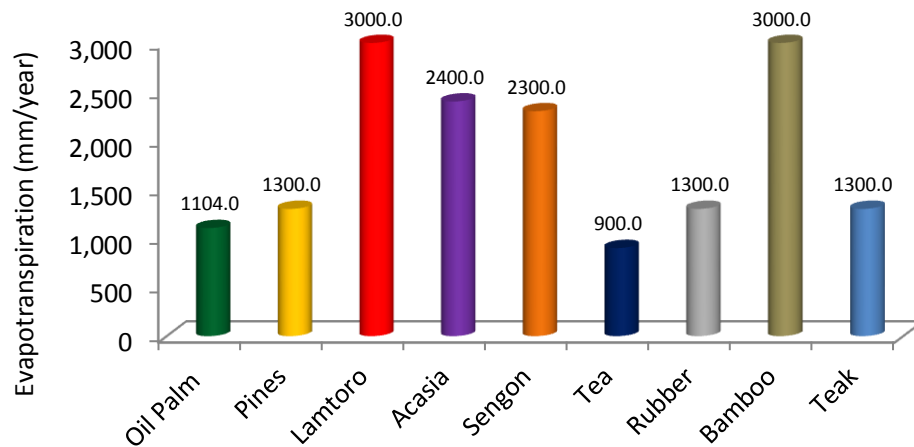


Figure 2. Comparison in Water Need of Oil Palm and Other Forestry Plants (Source: Coster, 1938)

Pine, acacia, and sengon plants are popularly used as forest plants both in reforestation programs and industrial plantations as timber estate development. These forestry plants are relatively wasteful of water. While, oil palm which have been alleged to be wasteful of water, it turns out to be more efficient in consumption of water than forestry plants. Oil palm are even more efficient in water consumption than rubber plants.

have the same role in conservation and hydrological functions compared to forest. From these explanation, role of oil palm plantations that similar as a forest plants, so it's important to consider the idea of including they as a forest plants.

CONCLUSION

Indonesia's oil palm plantations, which have been growing rapidly, but must experience various negative issues, one of which is deforestation. Oil palm plantations are considered to be the main cause of deforestation in Indonesia. Efforts to improve the image of palm oil plantation and national industry were carried out by the Indonesian government by issued Presidential Instruction about Moratorium and implementing ISPO to ensure that Indonesian palm oil able to fulfill the sustainability aspects. In addition, there is the idea that palm oil tree is categorized as a forest plant to suppress the development of the issue of deforestation.

Oil palm plantations when compared to forest have a better ability to generate energy, absorb carbon dioxide, and generate more oxygen into the atmosphere. But forest are better at storing energy (biomass). Meanwhile, in terms of water management functions, oil palm plantations generally

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