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A WORLD WITHOUT PALM OIL: A BETTER OR WORSE ENVIRONMENT?

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RESUME

The palm oil industry has received global attention for at least the last three decades. The fast growth of palm oil production is often associated with environmental issues such as deforestation, biodiversity loss, emissions, and other issues. This paradigm is used as the basis for various campaigns such as "No Palm Oil", "Palm Oil Free" and "Zero Deforestation" until basis policy such as European Union's RED II ILUC. These campaigns and policies are to phase out or create a "World Without Palm Oil." This raises the question of whether, in terms of environmental sustainability, the world would be better off without palm oil? Empirical evidence shows that the "World Without Palm Oil" condition will cause more extensive global deforestation, higher biodiversity loss, higher carbon emissions, increased soil and water pollutants, residual pollutants, and the exploitation of water resources (waste-full water). Thus, the "No Palm Oil" or "Palm Oil Free" movement and campaign to create a "World Without Palm Oil" condition is a movement towards worse global environmental damage.

INTRODUCTION

At least in the last three decades, the global palm oil industry has received public attention. The relatively fast growth of palm oil production, which is categorized as a tropical oil crop revolution (Byarlee et al., 2016), in addition to changing the structure of the global vegetable oil market, has also led to various economic, social, and environmental polemics.

On the environmental aspect, the rapid development of the global palm oil industry is often associated with land-use change (LUC), which is related to the issues of deforestation (Vijay et al., 2016; European Union, 2013), biodiversity loss (Fitzherber et al., 2009; Foster et al., 2011; Koh and Wilcove, 2008; Savilaakso et al., 2014; Austin et al., 2019), and other environmental issues.

The linking of global palm oil with the issues of deforestation and biodiversity loss has become the theme of a very intensive global anti-palm oil NGO campaign in various countries. This campaign has led the global community to live without palm oil through the campaigns "No Palm Oil", "Palm Oil Free", and "Zero Deforestation" (PASPI, 2015; Kumar et al., 2015). In addition to the anti-palm oil campaign, the European Union government is also designing a RED II ILUC policy to phase-out palm oil from biofuels from EU member countries no later than 2030 (European Commission, 2019). So, there will no longer be an EU biofuel industry that uses products made from palm oil in 2030.

This then raises an important question, namely whether, in terms of environmental sustainability, the world would be better off without palm oil. Can palm oil's contribution be replaced by other vegetable oils?

This article will discuss an important issue, namely what would happen to the environment if the world was without palm oil. The discussion will focus on five global environmental issues. Would the world's deforestation be reduced if the world were without palm oil? Would biodiversity loss be reduced if the world was without palm oil? Would emissions from global vegetable oil production be reduced if the world were without palm oil? Will soil and water pollution be reduced if the world was without palm oil? And would the use of water in vegetable oil production decrease if the world was without palm oil?

THE ADVANTAGES OF PALM OIL

In the global market, there are about 17 types of vegetable and animal oils that are used as food (edible oils) as well as feedstocks. The top-4 main vegetable oils account for more than 90 percent of the global vegetable oil production and consumption (PASPI Monitor, 2021[a]). They are palm oil, soybean oil, rapeseed oil, and sunflower seed oil.

Palm oil has various advantages (compared to other vegetable oils). **First**, oil palm plantations have relatively large stem sizes, grow quickly, and have a long life span (plant age of 25–30 years). With these characteristics, oil palm plantations have the ability to act as carbon sinks and carbon sequestration compared to other vegetable oils.

Second, the palm oil productivity per hectare (Figure 1) is about 8–10 times the productivity of other vegetable oils (soybean oil, rapeseed oil, and sunflower seed oil). Palm oil is not only the most efficient in land use but also the highest in oil productivity. The average productivity of palm oil (CPO+CPKO) reaches 4.3 tons per hectare. Meanwhile, the productivity of rapeseed, sunflower seed, and soybean in producing oil was only 0.7 tons per hectare, 0.52 tons per hectare, and 0.45 tons per hectare.

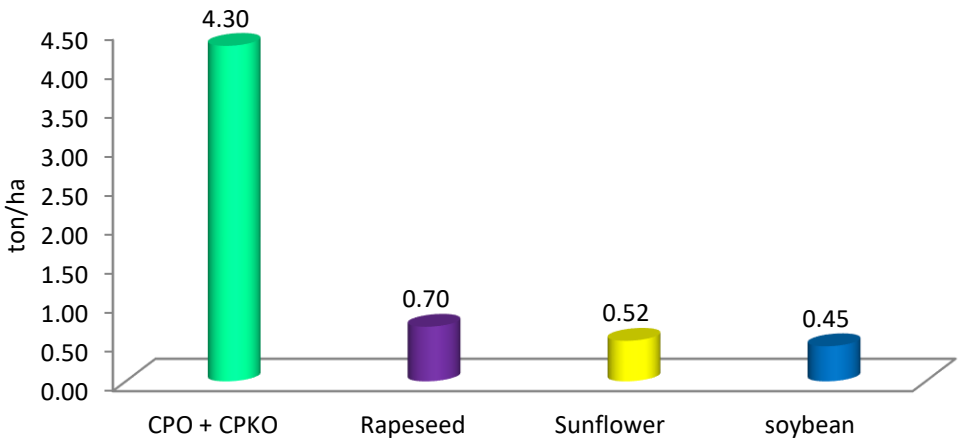

Figure 1. Comparison of Palm Oil Productivity with Other Vegetable Oils

Third, palm oil has a relatively large volume, even the largest in the global vegetable oil market. According to USDA (2021) data, volume of global palm oil (CPO+PKO) production reaches 84.2 million tons, accounting for approximately 40.3 percent of total vegetable oil production. Therefore, the dynamics of global palm oil supply will also havbe a significant effect on the dynamics of the global vegetable oil market.

Fourth, the supply of palm oil is relatively stable from month to month throughout the year. Palm oil is produced from oil palm trees that are 4 years old. With an ideal plant composition, oil palm can produce oil (CPO and PKO) at a stable volume every month throughout the year until the tree is 25 years old. The stability of palm oil supply provides certainty in the global vegetable oil market.

Fifth, global palm oil prices are more competitive (cheap) compared to other vegetable oils. With this advantage, coupled with large volumes and stable supply, palm oil can prevent excessive price increases for other vegetable oils. This fact was also confirmed by the studies of Kojima et al. (2016) and Cui & Martin (2017), which revealed that if there is an increase in the price of soybean oil, rapeseed oil, or sunflower seed oil, it will be accompanied by an increase in palm oil consumption to offset the excessive price increase of the three vegetable oils.

Sixth, palm oil is a raw material that is widely used for both oleo food complex products (cooking oil, margarine, shortening, chocolates, snacks, etc.) and oleochemical complex products (cosmetic products, soaps, detergents, grease, printer ink, etc.) and biofuel complex products (biodiesel, green fuel, etc.). The widespread use of palm oil in various aspects of life is not only used by almost all economic sectors but also occurs in almost all countries in the world. This shows that the global community is dependent on palm oil (Shigetomi et al., 2020).

DEFORESTATION IN A "WORLD WITHOUT PALM OIL"

With all the advantages that palm oil has, especially in terms of oil production, it has far-reaching implications for global environmental issues. One of implications is deforestation. Corley's study (2009) has shown the implications of increasing palm oil consumption on deforestation. In the following, the implications of the condition of a world without palm oil on global deforestation are presented.

During the period 2000–to 2020, the area of soybean planted increased from 75.5 million hectares to 127 million hectares. The area of rapeseed also increased from 24.7 million hectares to 35.5 million hectares. This was followed by an increase in the area of sunflower plants, from 19.7 million hectares to 27.6 million hectares. Meanwhile, the area of oil palm plantations has also increased, but not significantly, from 10 million hectares to only 24 million hectares.

What would happen to global deforestation if there was no palm oil? If the World Without Palm Oil (Table 1), the production of palm oil produced by oil palm plantations has been proportionally fulfilled or replaced by soybean oil, rapeseed oil, and sunflower seed oil. This means that, under these conditions (S1), there will be an additional 167 million hectares of world deforestation.

Tabel 1. Additional Global Deforestation If "World Without Oil Palm" Condition

Decription	A World with Palm Oil (S0)	A World without Palm Oil (S1)	
		Area	Additional Deforestation Area
Crop (million ha)			
Soybean	127.0	239.0	112
Rapeseed	35.5	65.5	30
Sunflower	27.6	52.6	25
Palm Oil	24.0	-	-
Total	214.1	357.1	167.0
Production of vegetable oils (million ton)	191	191	

Source: PASPI Monitor (2021g)

The world with palm oil (S0) is the actual condition in 2020, when the total area of the top-4 vegetable oil crops is 214.1 million hectares and total vegetable oil production is 191 million tons. Meanwhile, a World Without Palm Oil (S1) is a scenario where there is no palm oil. To achieve the global vegetable oil production in the S1 scenario, the global community must fulfill it proportionally, namely 54 percent from soybean oil, 25 percent from rapeseed oil, and 21 percent from sunflower seed oil.

With the S1 scenario, there is an expansion of global soybean plantations that has increased from 127 million hectares to 239 million hectares. The global rapeseed plantation area has also increased from 35.5 million hectares to 65.5 million hectares, and the sunflower plantation area has also increased from 27.6 million hectares to 52.6 million hectares.

The gap between scenarios S1 and S0 is the additional global deforestation as a result of the "World Without Palm Oil" condition. The additional area of global deforestation reached 167 million hectares, consisting of 112 million hectares of additional soybean expansion, 30 million hectares of rapeseed expansion, and 25 million hectares of sunflower expansion.

Thus, it is very clear that in a "World Without Palm Oil" condition, communities who produce soybean oil, rapeseed oil, and sunflower seed oil spread across various countries must carry out additional deforestation of 167 million hectares. This means that a "World Without Palm Oil" actually causes more deforestation in the world.

BIODIVERSITY LOSS IN A "WORLD WITHOUT PALM OIL"

A study conducted by Beyer et al. (2020) and Beyer and Rademacher (2021) regarding the biodiversity loss of vegetable oils by comparing land cover biodiversity after and before conversion to vegetable oil crops. The study measures the Species Richness Loss (SRL) per liter of oil produced to measure of biodiversity loss (Figure 2).

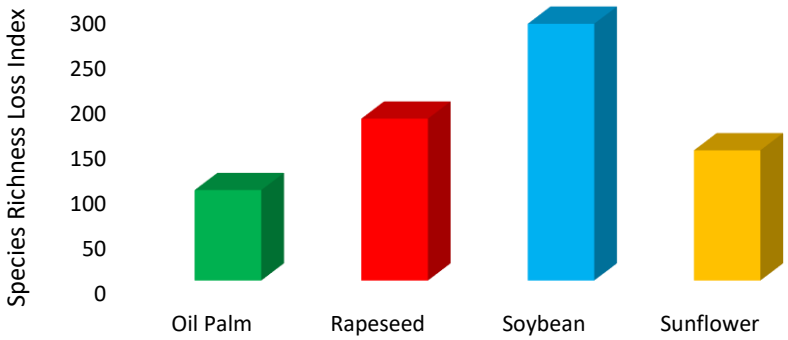

Figure 2. Species Richness Loss (SRL) Index of Palm Oil Versus Other Vegetable Oils (Source: Beyer et al., 2020; Beyer and Rademacher, 2021)

The results of the study used the SRL of palm oil as a comparison and revealed that the SRL of soybean oil was 284 percent above the SRL of palm oil, the SRL of rapeseed oil was 79 percent above the SRL of palm oil, and the SRL of sunflower seed oil was 44 percent above the SRL of palm oil. This means that, with SRL as an indicator of biodiversity loss, it shows that palm oil is the vegetable oil with the lowest biodiversity loss. Meanwhile, the vegetable oil with the greatest biodiversity loss is soybean oil.

The interesting thing about this study is that it also shows that the SRL of each of the world's main producing countries of vegetable oil is different (Beyer and Rademacher, 2021). For palm oil producers, the SRL in Indonesia, Malaysia, and Thailand is lower than the SRL in Nigeria. For soybean oil, the SRL of Brazil and Argentina is much higher than the SRL in the United States and India. Meanwhile, for rapeseed oil, the SRL was the lowest in Canada and Germany, while the SRL was the highest in India and Australia. For sunflower seed oil, the SRL is lowest in France and the United States. Then, followed by Russia, Ukraine, and China.

The study by Beyer et al. (2020) found that palm oil has the lowest biodiversity loss for for every liter of vegetable oil, compared to other major vegetable oil sources. Therefore, "a World Without Palm Oil" also means causing higher biodiversity loss globally.

CARBON EMISSIONS IN A "WORLD WITHOUT PALM OIL"

The linking of vegetable oil production, including palm oil, to carbon emissions is also a global environmental issue. Can a "World Without Palm Oil" condition reduce carbon emissions in the global vegetable oil production process?

The studies by Beyer et al. (2020) and Beyer and Rademacher (2021) found that at the global ecosystem level, the world's oil palm plantations are the lowest emitters of vegetable oil compared to other vegetable oil sources (Figure 3).

When compared to oil palm plantation carbon emissions per liter of palm oil, soybean oil emissions are 425 percent higher, rapeseed oil emissions are 242 percent higher, sunflower seed oil emissions are 225 percent higher, peanut oil emissions are 424 percent higher, coconut oil emissions are 337 percent higher, and olive oil emissions are 342 percent higher. Thus, from lowest to highest emission indicators for vegetable oils are palm oil, sunflower seed oil, rapeseed oil, olive oil, coconut oil, soybean oil, and peanut oil.

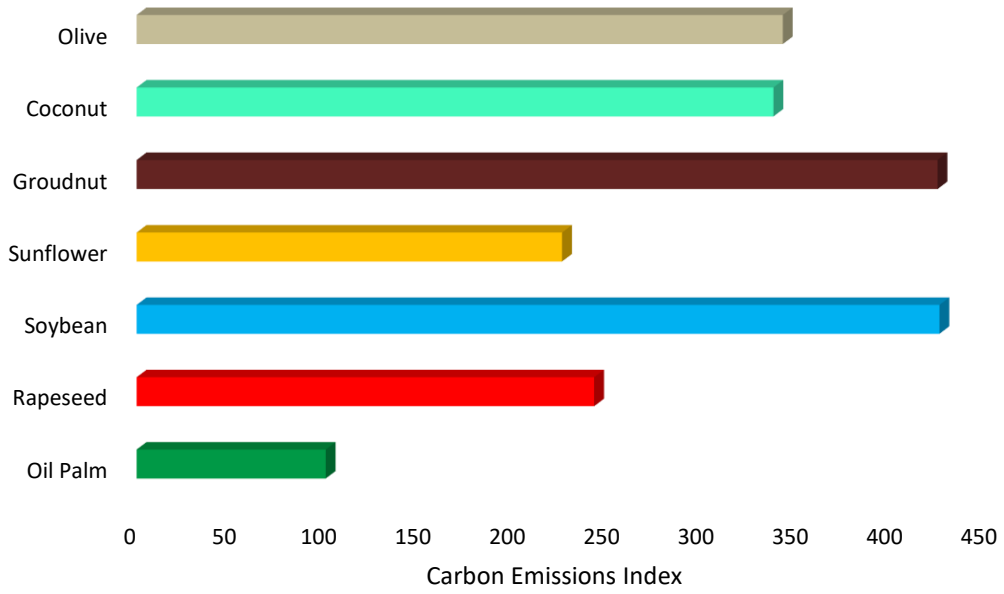

Figure 3. Carbon Emissions Index of Palm Oil Versus Other Vegetable Oils (Source: Beyer et al., 2020; Beyer and Rademacher, 2021)

It is also worthwhile to discuss the level of vegetable oil-producing countries. Carbon emissions for all palm oil-producing countries (except Nigeria) are lower than in other vegetable oil-producing countries. Indonesia, Malaysia, and Thailand are palm oil producers with the lowest carbon emissions. India has the lowest emissions of soybean oil. Among rapeseed oil producers, emissions are lower in France and Canada. And among sunflower seed oil producers, the lowest emissions are from the United States.

The study proves that the issue of palm oil producing higher carbon emissions is the wrong issue. On the contrary, the carbon emissions of other vegetable oils are higher than palm oil. The "No Palm Oil" or "Palm Oil Free" campaign, which aims to create a "World Without Palm Oil", will have a worse environmental impact on the global community, namely increasing carbon emissions in the global supply of vegetable oil.

SOIL/WATER POLLUTION IN A "WORLD WITHOUT PALM OIL"

The impact of the vegetable oil (including palm oil) production process on soil and water pollution has also become the focus of the public, especially environmental NGOs. The use of fertilizer and pesticide technology in the cultivation process produces residues in the soil and water. However, will a "World Without Palm Oil" condition reduces water and land pollution?

The production volume of the three vegetable oils in 2020 is 83.7 million tons of palm oil, 58.7 million tons of soybean oil, and 27.3 million tons of rapeseed oil. With this production of three vegetable oils, it is estimated that the pollutants are 2.5 million tons of nitrogen fertilizer (N), 1.8 million tons of phosphorus fertilizer (P2O5), and 1.6 million tons of pesticides (Table 2).

Table 2. Impact of "World Without Oil Palm" on World Water and Soil Pollution

Description	Palm Oil	Soybean Oil	Rapeseed Oil	Total
Pollutants "The World with Palm Oil" (million tons)				
Oil production	83.70	58.70	27.30	169.70
Polutant: N	0.42	1.88	0.27	2.57
Polutant: Phospor P_2O_5	0.17	1.35	0.35	1.87
Polutant: Pestisida/Herbisida	0.03	1.35	0.25	1.63
Sub total	0.62	4.58	0.87	6.07
Pollutants "World without Palm Oil" (million tons)				
Oil production	-	100.55	69.15	169.70
Polutant: N	-	3.22	0.69	3.91
Polutant: Phospor P_2O_5	-	2.31	0.90	3.21
Polutant: Pestisida/Herbisida	-	2.31	0.62	2.94
Sub total	-	7.84	2.21	10.06

Source: PASPI Monitor (2021[f])

Suppose the is "World Without Palm". In that case, proportionally, soybean oil production must increase to 100.6 million tons and rapeseed oil also needs to be increased to 69.2 million tons to cover oil palm that stopped production. With the additional production of soybean oil and rapeseed oil, nitrogen pollutants increased to 3.9 million tons or 56 percent. Phosphorus also increased to 3.2 million tons or 71 percent. Pollutants resulting from pesticides also increased to 2.9 million tons or 81 percent.

As a result, it is clear that any efforts to remove palm oil from the global market, such as the "No Palm Oil Free" campaign or the RED II–EU plan to "phase out palm oil," will have an impact on increasing pollution emissions of nitrogen, phosphorus, and pesticides. The increase in emissions or pollutants occurs in countries producing soybean oil and rapeseed oil. The increase in pollutants and emissions will endanger life in the territorial and marine environments.

In other words, a campaign aimed at "World Without Palm Oil" also means a campaign to increase emissions of nitrogen, phosphorus, and pesticide residues. This also means that the campaign can potentially threaten the terrestrial and aquatic life in the world.

SAVE WATER IN A "WORLD WITHOUT PALM OIL"

Apart from deforestation, biodiversity, carbon emissions, and water/soil pollution, the issue of using water in the vegetable oil production process is also often criticized by the public. The use of wasteful water is considered not environmentally friendly.

Gerbens-Leenes et al. (2009) revealed that the most water-consuming bioenergy-producing crop is rapeseed, followed by coconut, cassava, corn, soybeans, and sunflower plants. To produce every gigajoule of bioenergy (oil), rapeseed (European vegetable oil crop) requires 184 m^3 water. Meanwhile, coconut plants also require an average of 126 m^3 of water. Cassava (an ethanol feedstock) also leaches water by about 118 m^3 (Figure 4).

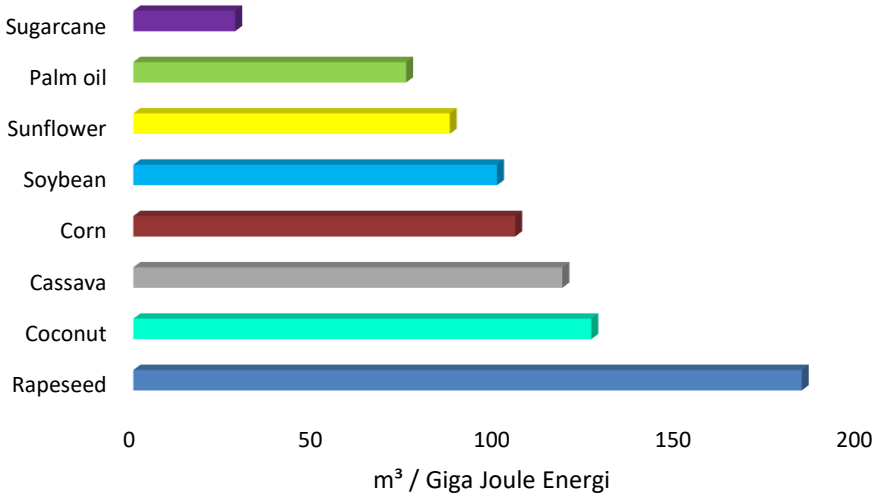

Figure 4. Water Requirement to Produce One Giga Joule of Bioenergy in Various Crops (Source: Gerbens-Lenes et al., 2009).

The study found that oil palm turned out to be the most efficient (after sugarcane) in using water for every gigajoule (GJ) of bioenergy produced. Oil palm only uses 75 m^3 of water, while soybeans require an average of 100 m^3 of water for each GJ of bioenergy produced.

Mekonnen & Hoekstra (2010) also researched the comparison of water demand for agricultural commodities using the "water footprint" concept. The definition of the concept is the total volume of freshwater used by agricultural commodities to produce a product. Wheat (15 percent), rice (13 percent), and corn (10 percent) were the top three agricultural commodities in terms of global water footprints from 1996 to 2005. Meanwhile, palm oil accounts for only 2 percent of the global water footprint.

The Water Footprint concept in Mekonnen & Hoekstra's (2010) research also uses three different definitions of water sources, namely: (a) Blue Water, which refers to surface water and groundwater consumed (evaporation); (b) Green Water, which refers to the rainwater consumed; and (c) Gray Water refers to the water requirements needed to assimilate pollutants based on existing water quality standards, where Gray Water is also used as an indicator of the volume of water pollution.

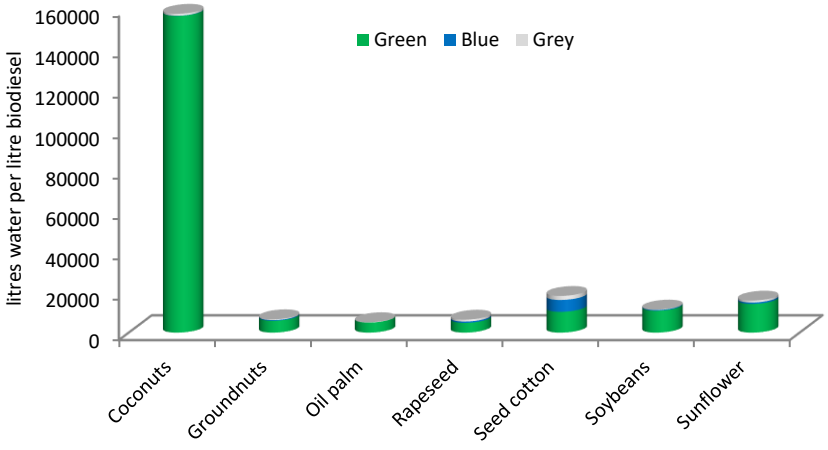

Figure 5. Comparison of Water Needs for Palm Oil and Feedstocks (Source: Makonnen & Hoekstra, 2010)

Makonnen & Hoekstra's (2010) research also provide information on water demand and biodiesel production. This study revealed that to produce 1 liter of biodiesel, the water requirement used by coconut as feedstock is 157,617 liters of water. Meanwhile, feedstocks widely used by the global biodiesel industry, such as sunflower, soybean, and rapeseed, also have a relatively high-water requirement to produce 1 liter of biodiesel, respectively 15,841 liters, 11,397 liters and 6,429 liters. Meanwhile, the amount of water required by palm oil to produce 1 liter of biodiesel is only 5.166 liters. This shows that besides environmentally friendly energy, palm oil also requires less water than feedstocks.

According to the global water footprint in the 1996–2005 period, the percentage of water consumption required by oil palm globally is only 2 percent or 1,097 m^3 per tonne. Cereal crops (such as wheat, rice, and corn) and soybeans have 5–15 percent water footprint. Another study result is that the primary water source needed in oil palm plantations is green water or rainwater. This shows that oil palm plantations do not exploit groundwater and compete with humans.

The research implies that if the conditions are "World Without Palm" through the "No Palm Oil" or "Palm Oil Free" movement, the global supply of vegetable oil will shift from water-efficient vegetable oil plants (palm oil) to water-intensive vegetable oils (soybean oil, rapeseed oil, and sunflower seed oil).

CONCLUSION

Oil palm plantations are vegetable oil crops with the highest productivity and efficiency in land use. In addition, palm oil also has a relatively long production cycle (life span with a plant age of 25 years) and producing oil with a relatively stable supply. In addition to the large and stable volume of oil production, oil palm plantations can also act as carbon sinks and carbon sequestration compared to other vegetable oil crops.

"World Without Palm Oil" condition will cause more extensive global deforestation with 167 million hectares. In addition to additional deforestation, other environ mental losses occurred are biodiversity loss and higher carbon emissions. This condition also increases the emission of pollutants nitrogen, phosphorus, and pesticides. The world's vegetable oil supply will shift from relatively water-efficient vegetable oil crops (palm oil) to relatively water-intensive vegetable oils such as soybean oil, rapeseed oil, and sunflower seed oil. Thus, the "No Palm Oil" or "Palm Oil Free" movement and campaign to create a "World Without Palm Oil" condition is a movement towards worse global environmental damage.

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