Environmental and Social Impacts from Palm based Biofuel Development in Indonesia

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ABSTRACT

This paper reviews oil palm biofuel development and analyzes social and environmental impacts of oil palm plantations in Indonesia. Three plantation study sites were selected in West Papua (Manokwari), West Kalimantan (Kubu Raya) and Papua (Boven Digoel) and used as case studies to illustrate likely impacts of biofuel plantations. These plantations are being developed or expanded in the aftermath of the 2006 National Energy Policy and managed by companies with supply connections to biodiesel industry. Household surveys, focus group discussions, and key informant interviews were employed to gauge respondent perceptions about social, economic and environmental impacts. Concurrently, spatial analysis was used to assess the changes in forest cover.

The development of oil palm in all three sites has caused deforestation and is likely to lead to further loss of forest as expansion continue to take place. Some communities did enjoy economic and social benefits from oil palm plantations such as more stable and reliable income, road access, better healthcare services. In Kubu Raya, some communities benefited both from employment opportunities and from sales of smallholder oil palm harvests. In Kubu Raya and Boven Digoel sites, some indigenous communities and migrants developed good inter-ethnic relations, although this was not the case in Manokwari. Other communities experienced increasing restrictions on traditional land use rights and outright land losses. Conflicts over land between indigenous communities and oil palm companies were observed in all three sites. Communities in all three sites experienced additional adverse environmental effects such as water pollution and flooding.

The findings call for plantation policy makers to revisit the principles governing large-scale land allocation for plantations. They need to pay particular attention to whether and to what extent the free, prior, and informed consent principle is being applied during the land acquisition process. The smallholder and nucleus oil palm schemes need improvements in efficiency and profitability. Finally, stringent sanctions are needed against companies failing to implement legally binding environmental monitoring and management plans.

Keywords: biofuel, oil palm, environmental, social impact, forest, Indonesia

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INTRODUCTION

In recent years, many countries around the world have been taking steps to secure stable sources of energy by tapping renewable resources. This tendency has been spurred by high fossil fuel prices, rising demand for energy, and increasing concerns about the implications of the use of fossil fuels on global climate (FAO, 2008a). The EU and USA are currently the leading markets for and producers of biofuels, but Brazil and the emergent economies of China and India are not far behind (UNCTAD, 2006). The growth in biofuels has been achieved primarily by introducing fuel blending obligations and government subsidies (FAO, 2008). Following the initial excitement about biofuel potential as a clean source of energy, over the last 2 years increasing concerns have emerged about possible environmental and social costs of biofuels – especially in developing countries (Cotula et al, 2008; Danielsen et al, 2008; Sheil et al, 2009; Gibbs et al, 2010). As a result, some major markets, such as EU, have adopted production and trade safeguards (RED, Renewable Energy Directive) and are considering that any products supplied to the EU need to meet sustainability standards (EU, 2006; Ernsting, 2009).

Indonesia is potentially a key supplier of biofuels, especially palm oil-based biodiesel, to the world markets. In 2006, the country possessed about 4.1 m ha of oil palm plantation, 31% of the world total (Koh and Wilcove, 2008). In 2008, the plantation area increased to about 7.9 m ha of oil palm plantations, making Indonesia a major producer of palm oil or CPO which supplies approximately 46 % of the world market (FAO, 2008a; USDA FAS, 2009; Teoh, 2010). Because of the vast feedstock supply base and a considerable potential for both intensification of the current estates as well as expansion into new plantation projects, biodiesel production in Southeast Asia is expected to grow, dominated by Malaysia and Indonesia. Currently, Malaysia is the regional leader in biodiesel production with an output of 540 million liters in 2009. Production is projected to increase at a rate of about 10 percent annually, reaching 1.1 billion liters by 2017. It is expected that by 2017, Indonesia will be the largest producer of biodiesel, increasing its production to 4 billion liters (FAO, 2008a; USDA FAS, 2009a). However, the above targets are often difficult to confirm and there is some amount of uncertainty as to the extent they will actually be implemented, reflecting different interests in a highly polarized game (Adnan, 2010).

The foundation for the development of biodiesel in Indonesia was established in January 2006, when the Government of Indonesia issued Presidential Decree No. 5 establishing the National Energy Policy which aims to secure the domestic energy supply by setting blending targets for biofuels. The overall goal is that biofuels constitute 5% of national energy consumption by 2025. This policy was followed by several supporting regulations seeking to accelerate the supply and use of biofuels and the creation of a national taskforce for biofuel development. The taskforce has since developed a blueprint for national biofuel development (Timnas BBN, 2007) and set several targets, including the development of 5.25 million ha of new biofuel plantations, most of them from oil palm.

The promise of biofuels has become the subject of political and environmental debates in the country. Some see palm based biodiesel as a commodity playing an important role in mitigating climate change, providing alternative sources of energy, and contributing to economic development and poverty alleviation (Basiron, 2007; World Growth, 2009; Basiron, 2010). However, others are concerned about unintended social, economic and environment implications (ICTSD, 2008; UNEP, 2009). Oil palm development has often been found to adversely affect local land and resource rights, as well as livelihoods (Telapak, 2000; Orth, 2007; Marti, 2008; Sirait, 2009; FoE, 2010; Conchester, 2010). Skeptics point in particular to the linkage between increasing demand for biodiesel and deforestation in countries like Indonesia (Oxfam, 2008; Cotula et al., 2008; Sheil et al., 2009; RFA, 2010). One study indicates the carbon debt that results from converting tropical forest to oil palm would only be repaid in 93 years, and that if deforestation takes place on peat soils, the payback period could be up to 600 years (Danielsen et al., 2008).

The ongoing debate about biofuel impacts is an important one, and one which will likely determine the future of first-generation biofuels. However, most of the current arguments in favor and against biofuels are based on limited data and untested assumptions, and reflect vested interests either of the biofuel industry or the environmental movement. This paper seeks to shed light on the local social, economic, and environmental impacts of biofuel development in Indonesia, with a focus on oil palm plantations. While biofuels are sourced from a variety of feedstocks such as oil palm, jatropha, sugarcane and cassava, this research focuses on oil palm plantations since the scale of plantations in Indonesia and the magnitude of impacts are expected to be most significant among available feedstocks.

The analysis of impacts of biofuel feedstock production focuses on plantations being developed or expanded in the aftermath of the 2006 National Energy Policy, or plantations managed by companies with supply connections to biodiesel industry. Based on these criteria and logistical considerations, three oil palm companies were selected in three regions: West Papua, West Kalimantan and Papua Provinces. These plantations are used as case studies to illustrate possible economic, social and environmental impacts of biofuel plantations as these areas continue to expand. The paper is structured in six sections. First, we describe the rationale for and development trends in the biofuel sector in Indonesia. Subsequently, we introduce the research sites and methodology. In the next two sections, we present the findings related to the social and environmental impacts and discuss their implications. In the concluding section, we highlight key findings and offer recommendations for key decision-makers for achieving sustainable and equitable outcomes from the sector.

Background and Rationale

Evolution of biofuels in Indonesia

Since 2006, biofuels have increasingly attracted the Indonesian government's interest due to their potential to reduce the country's reliance on imported fossil fuels. Fossil fuel consumption that year reached 1,252 thousand barrels/day, and has since increased to

1,344 thousand barrels/day (Beyond Petroleum, 2010). The Ministry of Energy and Mineral Resources reported that at the current rate of extraction and utilization, Indonesian oil reserves will last for only 25 years, while natural gas supplies will be sufficient for the next 150 years (MoE, 2007).

Because Indonesia has long been dependent on fossil-fuel energy for revenues and to finance development, it has become increasingly urgent to conserve the remaining oil reserves and look for alternative sources of energy. In 2005, revenue from the oil and gas sector was about US$ 19.2 billion (24% of Indonesia's GDP). Production levels of Indonesian oil have declined over the past decade while consumption has increased. Oil and condensate production in 2009 was 1.02 million barrels/day, while consumption was nearly 1.1 million barrels per day.[2] As a net oil importing country, Indonesia is highly affected by fluctuations in global prices of fossil fuels. The spike in the global price of oil in 2008 had important implications for the Indonesian economy, with the cost of fuel subsidies doubling from US$ 4.4 billion in 2005 to Rp. 7.4 billion in 2006, almost 10 percent of the total state budget (Dillon et al., 2008). Currently, biofuels would require a state subsidy of about USD 0.20 per liter in order to compete with fossil fuels. Eventually, however, it is expected that biofuels will become viable economically and will help reduce Indonesia's dependence on fossil fuels.

The use of biofuels was made mandatory by the 2006 National Energy Policy. Accordingly, the Ministry of Energy, for instance, has set the guidelines for the mandatory use of biodiesel by heavy industries and other commercial sectors of 5% in 2005, 10% in 2010, and increasing to 25% by 2025. The Government has actively encouraged investors to apply for land and industrial licenses. It was expected that by 2010, the biofuel industry would have created 3.6 million jobs in rural areas and led to a 16% reduction of poverty (Timnas, 2006; Dillon et al., 2008; Oxfam, 2008; Sheil et al., 2009). While it remains to be seen to what extent these targets will have been achieved by the end of this year, the current situation in the biofuel industry does not provide a basis for optimism. The number of jobs in plantation and processing industries will likely be far below the projections due to the reduced production. The employment supported by the plantations sector will likely be far more significant, but difficult to attribute to the biofuel sector per se.

In early 2007, the national biofuels team, or Timnas BBN, announced that 60 agreements had been signed by investors for biofuel projects worth about USD 12.4 billion[3]. These promising investment prospects were supported by government policy measures and a host of economic incentives, among these the simplification of licensing procedures, tax breaks, government subsidies, land allocation for biofuel feedstock production, assistance with land acquisition, and mandatory usage of biofuels by certain sectors. It was also expected that the low cost of labor, increasing productivity of oil palm and relative availability of land for plantations would further encourage the development of the biofuel sector. While biofuel demand is driven

[2] Energy Information Administration website: http://tonto.eia.doe.gov/cfapps/ipdbproject/IEDIndex3.cfm?tid=5&pid=54&aid=2

[3] http://www.energy.focusreports.net/index.php#state=ReportDetail&id=52 accessed at June 17, 2010

largely by government blending mandates, there is also potential for exporting biofuel to key markets in Europe and North America.

Until mid 2007, the first year that Indonesia's biofuel policy went into effect, investments in the production of biofuels had been significant. In addition to private sector actors, banks and government institutions were also involved in supporting the growth (Timnas, 2006). However, in August 2007, 17 biodiesel companies were reported by the Indonesian Association of Biofuel Producers (APROBI) to have reduced their production or temporarily suspended operations. In 2008, only five mills continued operating. This caused the production to fall by 60% (Sugiyono 2008). This decline occurred because of the decline in the prices of fossil fuels on the international market, which made CPO-based biofuels uncompetitive. The second reason is the high cost of the main feedstock (CPO). In 2007, the price of CPO continued to rise on international markets, reaching a peak in March 2008 at USD 1410 per ton.[4] Other constraints on CPO-based biofuel development in Indonesia stem from the tendency for most CPO production to be channeled towards the domestic food market and exports. About 25.7 % of CPO produced annually in Indonesia is consumed as cooking oil and other edible fats, while approximately 6% is used for biofuels. Most of the remaining CPO is exported.[5]

In 2007, there were 8 CPO biodiesel refineries in operation in Indonesia with a combined annual capacity of 765,000 tones. Because of the aforementioned increase in CPO prices, in mid 2007 the blending target in Indonesia was temporarily reduced from 5% to 2.5% [6],[7]. By mid 2008, only five factories remained active, two producing for the domestic market and 3 mainly for export, most operating at 10 to 15 % of capacity[8]. In 2009, total biofuel production was only 104,100 kiloliters, a 96 percent fall from the 2.56 million kiloliters produced in the previous year.[9] In that same year, it was reported that only one producer continued to actively produce biofuel, but at production levels well below plant capacity[10]. In 2010, with the global economic recovery under way, there are hopes for a revival of biodiesel production in Indonesia. The re-emergence is expected to follow on the back of the government initiative to take a more balanced approach to Indonesia's food and energy security needs through integrated plantation estates (Jakarta Post, 2010b).

[4] Malaysian Palm Oil Board (www.mpob.gov.my). accessed at June 18, 2010
[5] Paper presented by Sinar Mas
[6] http://www.indonesia.go.id/en/index.php?option=com_content&task=view&id=7654&Itemid=701, accessed june 18,2010
[7] HS Dillon, et all (2008), Biofuel –at what cost?; Government support for ethanol and biodiesel in Indonesia, GSI-IISD, Geneva, Switzerland
[8] Indonesia Biofuel Annual Report 2008, http://www.thebioenergysite.com/articles/222/indonesia-biofuels-annual-report-2008, accessed at June 19, 2010
[9] Renewable Energy Producers to Get Tax Breaks. See: http://www.thejakartaglobe.com/business/renewable-energy-producers-to-get-tax-breaks/375280
[10] The installed capacity was approximately 1.5 million tons/year, but production reached only 7,000 tons per month (USDA FAS, 2009b).

The social and environmental impacts of biofuels in Indonesia

In 2010, Indonesian oil palm plantation reached 7 million ha. The Ministry of Agriculture projects this number to increase to 26 million ha by 2025 (Klute, 2007). While numerous adverse impacts of oil palm plantations have been documented (Telapak, 2000; CIFOR, 2009; Sirait, 2009; Gibbs et al, 2010), positive effects of oil palm on rural livelihoods and economic development have also been noted (Basiron, 2010; Rist et al., 2010; World Growth, 2009). However, *little is known about the impact of oil palm cultivated for biofuels, as these are a relatively recent phenomenon in the economy of Indonesia*. Most of what is known pertains to oil palm generally, which has been planted mostly for food (Casson, et al., 2007; McCarthy and Cramb, 2009; McCarthy 2010; ICTSD, 2008; UNEP, 2009). Dillon et al (2008) predict that biofuels may result in several negative consequences in Indonesia, including deforestation, uncertain economic benefits, land speculation, and land expropriation. On the other hand, government agencies (e.g. Ministry of Agriculture) highlight a range of likely benefits. This review seeks to shed light on what is known from existing studies on the social and environmental impacts of oil palm, the key biofuel feedstock in Indonesia.

Social impacts

It is generally accepted that oil palm plantations are an important driver of economic development in Indonesia through their contribution to state revenues and employment provision in rural areas (Bunyamin, 2008; World Growth, 2009; Feintrenie 2010). Based on a study assessing the impacts of the nucleus model of oil palm plantations in West Kalimantan, Bunyamin (2008) found a steady increase in the sector's contribution to provincial GDP and farmer incomes. Other studies also indicate economic benefits for smallholders from oil palm cultivation in Indonesia (Feintrenie et al., 2010). However, these benefits seem to accrue to those above a certain threshold of agricultural skill and income, as oil palm cultivation requires a significant investment and a certain amount of experience. Thus, oil palm development in Kalimantan is likely to be more beneficial for migrant smallholders with prior exposure to oil palm rather than for indigenous people with no prior experience, such as native Papuans (Adianto, in prep; Kesaulija et al., in prep).

In some cases, oil palm can also be detrimental to local livelihoods. Orth (2007) shows that oil palm development in Central Kalimantan has adversely affected the shifting cultivation practices of the local Dayak communities, causing food insecurity. Oil palm plantations, especially large-scale estates, have frequently been associated with negative social impacts on rural communities and indigenous people (Telapak, 2000; FoE, 2010; Marti, 2008; Sirait, 2009). Marti (2008) found many cases of human rights abuse by plantation companies, especially during land acquisition and plantation development operations. Other studies indicate that most conflicts between plantation developers and communities occur due to lack of recognition of customary rights, breached agreements, and disregard for the environment (Colchester et al., 2006; Sawit Watch, 2006, cited in Down-to Earth, 2007). Colchester (2010) reports that in 2010 no less than 630 land

disputes between palm oil companies and local communities have taken place in Indonesia.[11]

Environmental impacts

Deforestation is one of the key issues the oil palm industry is facing, especially in Indonesia where lowland rainforests contain high levels of biodiversity and peatlands are home to globally significant carbon reserves. [12] While it is generally agreed that oil palm plantations have resulted in deforestation in Indonesia (Zakaria et al., 2007; Ministry of Environment, 2009; Gibbs et al., 2010), the actual extent, and whether or not oil palm has been the prime driver, is subject to debate. For example, the Indonesian Oil Palm Research Institute (IOPRI) claims that only 3% of all oil palm plantations have been established in primary forests, while 63% have been developed in secondary forests and scrubland (IFCA, 2008). One study indicates that biofuels account for approximately 6.5% and 2.8% of all deforestation occurring in Indonesia and Malaysia, respectively (Gao et al., in prep).

Based on official government statistics, in 2008 there were around 22.7 million ha of forestlands available for conversion under the HPK forest land category. From 2005 to 2008, the Ministry of Forestry approved the release of 360,000 ha of forests for conversion to other land uses, mostly oil palm, for 32 company units (MoF, 2008). Dillon et al. (2008) reported that only two million ha of the total 22.7 million ha were actually cleared and planted with oil palm. Large areas of forest seem to have been cleared but not planted, due to a number of reasons. Some companies have cleared forest but eventually decided to cease operations due to conflicts with local communities. Other companies have simply not been managed well and either stagnated or went bankrupt. Still other companies' major objective was to benefit from timber and they were never serious about establishing oil palm plantations Estimates by Casson et al. (2007) suggest that up to 18 million ha of forest may have been cleared but not planted.

The conversion of natural forests for oil palm plantations has been associated with the loss of biodiversity, including a decline in populations of iconic species such as Orangutan and the Sumatran Tiger (Brown and Jacobson, 2005*;* Yaap et al., 2010). Oil palm is considered a relatively poor replacement for natural tropical forest. Recent studies indicate that it ranks behind planted forest, agroforest and community woodlots in terms of the number of species it is able to support (Fitzherbert, 2010). Forest conversion and plantation development as currently practiced are also significant sources of GHG emissions. Deforestation and land conversion contribute 15 to 25% of global carbon emissions, and converting lowland tropical rainforest to oil palm plantations is estimated to result in a carbon debt of 610Mg of CO2 ha^{-1}, which would

[11] Based on a n interview with Norman Jiwan, the head of social and environmental risk mitigation department of Sawit Watch Indonesia. He confirmed the number of conflicts and indicated the actual number of disputes may be higher. According to the *Badan Pertanahan Nasional* (the National Land Bureau) there are currently some 3,500 land disputes related to palm oil in Indonesia.

[12] http://deforestationwatch.org/index.php/Key-Papers/Greenpeace-and-World-Rainforest-Movement-Misguided.html

take between 86 years and 93 years to repay (PEACE, 2007; Fargione et al., 2008; Danielsen et al., 2008). For plantations established in peatlands, the carbon debt would be much higher – i.e. 6000 Mg of CO2 ha^{-1} which would take over 840 years to repay (Fargione et al., 2008) An estimated 1.7 million ha of oil palm plantations in Indonesia have been established on carbon-rich peatland (Kompas, 2010). The potential for adverse environmental impacts can also be seen from the proposal by the Ministry of Energy to use some of the 14 million ha of conversion forests in Kalimantan, Maluku and Papua for biofuel feedstock cultivation, primarily oil palm (Timnas BBN, 2007; Legowo, 2008).

Oil palm plantations and the palm oil milling process can also cause serious pollution problems if not properly managed. Air pollution can arise during the conversion of land to oil-palm plantations, as burning[13] is the cheapest and most efficient means for clearing (Vayda 2006; Zakaria et al., 2007). Oil palm plantations have been associated with elevated concentrations of sediment, agro-chemical and nutrient runoff in waterways, causing adverse effects on fish and other aquatic flora and contaminating drinking water (Wakker, 2004; Hayashi, 2007; Kesaulija et al., in prep).

Oil palm plantation and land area targets for biofuels

The latest national statistics indicate that by the end of 2010, the area of oil palm plantations in Indonesia will reach 7.8 million ha (Ditjenbun, 2009; USDA, 2010), an area which is projected to continue to expand. In 2006, Bisinfocus (2006) estimated that the annual expansion rate would reach 400,000-500,000 ha annually from 2006 to 2020. As the lands suitable for oil palm have become increasingly scarce in Sumatra, most of this expansion is expected to occur in Kalimantan and Papua, where suitable land is still abundant.

Between 2010 and 2015, the government plans to develop 1.5 million ha of new oil palm plantations in order to reach 6 million tones of biodiesel annually. Between 2016 and 2025, the plantation area for biodiesel is to increase by an additional 4 million ha, with biodiesel production reaching an estimated 16 million tons annually.[14] It is estimated that the biofuel sector will by then absorb 7.25 million people as direct employees and another 167,000 people through indirect knock-on effects.

Key strategies developed by the national taskforce to support the biofuel sector include assessments of investment and financial schemes, pricing mechanisms, improvement in feedstock supply and production infrastructure, establishment of a biofuel trading system, acceleration of land acquisition processes, development of special biofuel zones and promotion of energy self-sufficient villages (Timnas BBN, 2007). In order to achieve the land targets, the national taskforce has produced land suitability maps to

[13] Since 1997, burning for land preparation for plantations has been banned in Indonesia. In June 2002 Indonesia signed an anti-haze treaty with the ASEAN countries, but that does not prevent fires and haze from occurring every year in the dry season.

[14] Based on the projected figures for the development of biofuels by 2010. Sources: Indonesia's road map for biofuel development. http://www.indobiofuel.com/Timnas%20BBM%204.php and http://www.indobiofuel.com/Timnas%20BBM%206.php

clarify how these expansion targets would be met. These maps identify three major biofuel feedstocks (oil palm, jatropha and sugarcane) and four types of lands considered suitable for biofuels:

a. Forestlands which have been legally released for non-forestry purposes, but for which plantation business permits (or so-called *Ijin Usaha Perkebunan)* have not been issued;
b. Abandoned lands (*lahan terlantar*)[15], and critical or degraded lands[16];
c. Lands where plantation business permits are no longer active; and
d. Convertible forestlands (*Hutan Produksi Konversi*-HPK)[17].

The first three land types cover 5.4 million ha nationally, comprising 2.7M, 0.3M and 2.4M ha, respectively. Available land from the fourth land type (d) is mostly located in the eastern part of the country (Maluku and Papua) (Timnas BBN, 2006; Timnas BBN, 2007; MoF, 2008).

The areas of forested land available for conversion into biofuel feedstock plantations will almost certainly be reduced due to the recent USD 1 billion agreement between the governments of Indonesia and Norway on reducing emissions from deforestation and forest degradation (REDD), which will take effect in January 2011.[18] This agreement will likely place approximately 40% of Indonesia's forest cover under a 2-year conversion moratorium. The effects this will have on oil palm development are uncertain due to disagreement and uncertainty about the possible limits on plantation expansion and their effects on forests. The scope of the proposed moratorium on forest conversion is still not clear as some sources report it to be limited to peatland and primary forest, whereas other sources indicate it will be broader. Questions also remain about the degree to which the above targets will be met and the potential effectiveness of this moratorium, as existing licenses will not be revoked and new licenses will be issued until the end of 2010 (The Jakarta Post, 2010a).

[15] *Lahan terlantar* (abandoned land) is an area which has been exploited and subsequently abandoned. It is usually an open area covered with grass or scrub. Despite being abandoned, *lahan terlantar* is often under landuse permits (HGU, concession). Most of the time, the owners only possess partial legal documentation necessary to undertake long term operations. This may happen due to a lengthy bureaucracy process (Ardiansyah, Fitri, et all, 2009, Identification of Responsible Cultivation Areas for Biofuel Crop, Presentation to ELTI-NUS Biofuel Conference, Singapore)

[16] *Lahan kritis* is degraded land based on bio-physical fatures (DG of forest and Land Rehabilitation Decree no. 41/kpts/V/1998 on Compilation of RTL-RLKT Water Basin Guidance)

[17] Law 41/99 on Forestry states; Indoneisan Forest land is divided into three major categories: Production Forest (*hutan produksi*), Protection Forest (*hutan lindung*) and Conservation Forest (*Kawasan konservasi*). HPK- Convertible production forest is a Production forest zone which is slated for conversion to other uses such as agriculture, estate crops and urban areas. The decision to release HPK from the forest estate is subject to ministerial approval in Jakarta.

[18] The Letter of Intent between the Government of the Kingdom of Norway and the Government of the Republic of Indonesia on "Cooperation on reducing greenhouse gas emissions from deforestation and forest degradation". See - http://www.norway.or.id/PageFiles/404362/Letter_of_Intent_Norway_Indonesia_26_May_2010.pdf

Learning from recent experience with biofuels in Indonesia, it is unlikely that the above targets will be achieved (Caroko *et al* 2010). Moderate oil prices on the global market, comparatively high CPO prices, concerns over competition with food, and limitations on peatland and forest conversion will most likely contribute to a slower growth of biofuels. By 2020, trade models project that not more than 8 billion liters of biodiesel will be traded globally (OECD/FAO, 2010). Most of this will go to the EU. However, Indonesia's biodiesel is unlikely to be accepted in EU under RED (Renewable Energy Directive) requiring that all biofuel products have a minimum life-cycle carbon emission savings of 35% compared to fossil fuels and are not produced on the land high in biodiversity and carbon stocks (Bowyer, 2008). Consequently, the targets set by the Indonesian government for biofuel development are likely to be unrealistic. Nevertheless, some expansion will undoubtedly occur as new plantation licenses continue to be issued under the old rules until the end of 2010 and plantation holders continue to bring new areas under cultivation within already granted concessions.

RESEARCH SITES

Regional focus

In recent years, among the areas most active in oil palm plantation development have been the provinces of West Kalimantan, Papua and West Papua. As mentioned above, Indonesia is expected to establish 5.5 million ha of new oil palm over the next 15 years and Papua and Kalimantan are being actively promoted as the main destinations for biofuel projects. Of the 3.5 million ha of new oil palm plantation proposals submitted to the government by 2009, 70% were located in West Kalimantan, Papua and West Papua (Kardono, 2009[19]).

Papua has emerged as an important destination for biofuel investment because of the active support from provincial government. In 2008, the governor issued a policy encouraging pro-poor palm oil development which should be aimed at biofuel production. The main consideration in this policy was the need to boost the regional economy, spur local demand for biofuels and increase regional revenues (USAID, 2009). However, Papua is also one of Indonesia's flagship provinces in its effort to tackle climate change. As such, Papua's governor also actively promotes the province's commitment to a low carbon economy and emphasizes the limitations on forest conversion to plantation estates (Suebu, 2009).

Between 1991 and 2005, the area of oil palm plantations in Papua has shown slow but steady growth, rising from 11,367 ha to 50,000 ha (USAID, 2009). Since 2005, proposals have been submitted for up to 4.6m ha of new estate crop plantations, mostly oil palm.[20] Of this, approximately 400,000 ha have so far been granted (Elson, 2009). The drive to acquire land for plantations is facilitated, among others, by government

[19] Kardono, 2008. *Potensi pengembangan biofuel sebagai bahan bakar alternatif* [Biofuel: its potential as an alternative fuel]. Paper presented to the National Seminar on Agriculture Techonology. Gadjah Mada University, Yogyakarta, 18-19 November 2009.

[20] Based on the data from the Papua Provincial Office for Estate Crops (Dinas Perkebunan Provinsi Papua)

policies allowing companies to apply for double the allowable maximum size of 100,000 ha that is permitted in other parts of Indonesia. [21]

Most proposals for plantations in Papua focus on land in the southern lowlands (Merauke and Boven Digoel Districts). Facilitated by district level authorities in Merauke, in 2007 36 national and international companies committed to invest in a total of 2 million ha of oil palm and timber plantations. In the same year, China's National Off-shore Oil Corporation (CNOOC) expressed its commitment to support biofuel plantation development in Papua with funding of up to US$5 billion.[22] In 2008 and the first half of 2009, as a result of the global financial crisis and economic slowdown, the above investment plans were postponed and the Chinese funding was suspended. In late 2009, the 2 million ha investment project was revived and redefined as Merauke Integrated Food and Energy Estate (MIFEE). In its current form, the MIFEE plan comprises 32 investor companies and is to cover 1.2 million ha of land. The investing companies are dominated by three major industrial groups: Medco, Korindo and Kertas Nusantara.[23]

The introduction of oil palm to West Kalimantan province commenced in the 1980s. The first large-scale oil palm plantation was established by government-owned company PT Perkebunan Nusantara XIII. In addition, major oil palm plantations in the province are controlled by large national and multinational groups such as Sinar Mas, Wilmar, Golden Hope, Cargill and Lyman. Official statistics indicate that there are 337 oil palm plantations as of 2009, covering a total of 3.6 million ha (Disbun Kalbar, 2010). As of 2010, WWF Indonesia recorded a total of 370 oil palm concession holders throughout West Kalimantan[24].

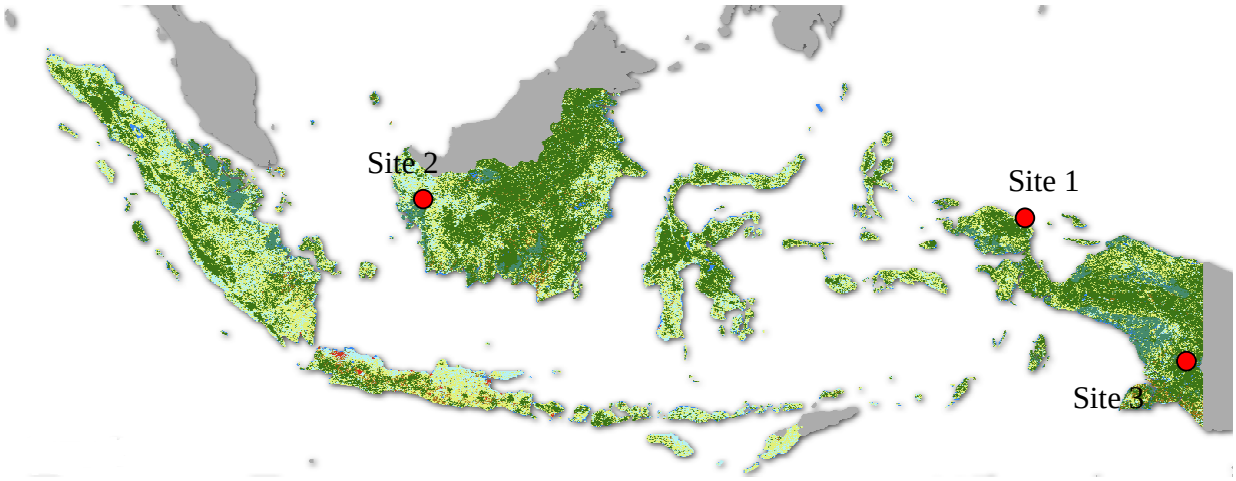
Introduction to Research Sites and Corporate Actors

[21] Government Regulation No. 18/2010 (Article 8) stipulates the maximum area allowed for plantation in Indonesia is 10,000 ha, except for Papua where plantation can be up to 20,000 ha. The Ministry of Agriculture Decree No. 26/2007 (Article 12) stipulates the maximum area that can be granted per company to for oil palm plantation in Indonesia is 100,000 ha. This can be doubled for companies seeking to establish the plantations in Papua.

[22] Indonesia: Papua's forests and global warming. See: http://www.rainforestportal.org/shared/reader/welcome.aspx?linkid=85527

[23] This is based on "*Peta Rencana Investasi Areal Perkebunan pada Kawasan Hutan Kabupaten Merauke*" [Investment map for forestland in Merauke] published by Merauke District in connection to MIFEE large-scale agriculture program.

[24] http://assets.wwfid.panda.org/downloads/kebun_kalbar.jpg.



Three sites were selected for further analysis of social and environmental impacts, two in Papua and one in West Kalimantan. Existing plantations and planned expansion of oil palm are controlled by major players such as Korindo, PT Perkebunan Nusantara and Wilmar, respectively. Research was conducted in three districts: Manokwari District, West Papua; Kubu Raya District, West Kalimantan; and Boven Digoel District, Papua provinces. The three districts are located in different geographic and land cover settings. While all research sites were selected due to potential connections to bioenergy, the research site in West Kalimantan was chosen also because of the potential impacts on peatlands. The two sites in Papua were also selected because of their advanced development in the province and presence of different oil palm business models for the purpose of comparison. Oil plantation projects in Indonesia are developed through a number of models. Under *Perkebunan Inti Rakyat* (PIR) or Nucleus Estate and Smallholders (NES) model, plantation developers prepare both large scale plantation (also known as *Inti* or Nucleolus) as well as plots of land for smallholders nearby. Within three to four years following the planting, these plots are transferred to the smallholders (known as *Plasma*), who take lead in the management and harvesting activities. Smallholders cultivate 60-80% of the total plantation area and deliver harvested fresh fruit bunches to the company mill for processing. *PIR transmigrasi or* transmigration NES scheme integrates transmigration program and development of oil palm plantations. A similar scheme which proved useful for expanding oil plantations in Indonesia is PIR KKPA (*Kredit Koperasi Primer untuk Anggota*, or Basic Co-operative Credit), under which transmigrants are eligible to obtain subsidized bank loans (Potter and Lee, 1998). Table 1 below provides a summary of the research sites.

Table 1. Summary of research sites

Parameter	**Manokwari, Papua**	**Kubu Raya, West Kalimantan**	**Boven Digoel, Papua**
Company	PTPN II	PT. BPK	PT. TSE
Status	State-owned	Private	Private

Group	PTPN	Wilmar	Korindo
Size of concession	12,049 ha	13,605 ha[25]	34,000 ha[26]
Planted area	10.207 ha	5,350 ha	18,804 ha
Date of establishment	1982	1994	1998
Business model	Nucleus estate smallholders	Nucleus estate smallholders	Private developer
Land type	Mineral soil	Peat land (0.5 to 6 m deep)	Mineral soil
Land cover	Secondary forests	Secondary forests	Primary forests

Site 1 - PT PN II Prafi in Manokwari

PT PN II is a subsidiary of the PT Perkebunan Nusantara, a state owned company, controlling 8.5% oil palm plantations nationwide. The company established its first plantations in Papua in 1982 in Keerom and Manokwari districts. Prior to plantation development, these areas were under logging concession management by another state owned company, PT. Inhutani. PT PN II was given a 12,000 ha concession, 11,000 ha of which had been planted by 2007. [27] Around 99% of the planted area has reached the production stage. In addition to managing its own plantation, the company also established a joint management with local government-owned smallholder plantations. The company owns a processing mill with installed capacity of 60 tons of fresh fruit bunches (FFB) per hour, although currently they are operating at around 50% of the capacity producing 1,800-2000 ton of CPO per month. The company is reported to have links to a wider PT Perkebunan Nusantara industrial network which includes the production of biodiesel.[28]

One of the main issues facing PT PN II is ownership transition. The West Papua local government is reported to be acquiring the rights of this plantation, with the blessing of the central government authorities.[29] In the immediate vicinity of PT PN II, there also is a new oil palm plantation project by PT Medco Papua Hijau Selaras covering around

[25]This size is based on the official statistics from Dinas Perkebunan (Plantations Bureau) (2010). Out of 13,605 ha, around 6,800 ha have been issued as a HGU license, which is divided into 4,800 ha managed by the company and 2,000 ha which is managed by smallholder farmers.
[26] A monthly report prepared by the company for the provincial government (issued in 5 April 2010) indicates that 14,461 ha possesses HGU permit and 7,657 ha is being processed for HGU.
[27] According to Rumaropen (2007), the planted area of 10.206,99 ha comprises 3,000 ha under KKPA scheme and 7,209 ha under NES scheme (2,807 ha managed by the company, and 4,400 ha by smallholder farmers).
[28] Together with other state owned estate companies, PTPN II planned to establish a biodiesel production plant. See: http://www.kbri-canberra.org.au/brief/2007/05/050407-11.htm
[29] The State Minister for State-owned Corporation indicated his approval for the transfer of ownership of PT PN II palm oil plantation to the local government of West Papua. See: http://www.inilah.com/news/read/ekonomi/2009/09/16/156677/menneg-bumn-setuju-pemda-papua-beli-ptpn-ii/

14,000 ha. In 2005, the company, which is part of the Medco Group - an Indonesian oil and gas conglomerate seeking to diversify into renewable energy[30] - was granted this plantation permit. Given the possible lack of capacity of local government to manage PT PN II plantation, high demand for the land for plantations, and Medco's desire to diversify into bioenergy, it is likely that PT Medco Papua Hijau Selaras is seeking to expand through possible acquisition of. PT PN II Prafi site and other areas.

While in theory all land in Indonesia is controlled by the government, most of the land is *de facto* under customary land system, or *'ulayat'* (collectively owned areas). The major ethnic group inhabiting site 1 are the Arfak, which is divided into sub-groups or clans such as Meyakh, Sougb, Moule and Hatam (Laksono et al., 2001). The boundaries of clan lands, marked by natural features, are jointly agreed by clan members. Each clan is controlled by a leader, or a "big man", who has the authority over the use and allocation of land and other resources.[31] A sale and purchase of land is not recognized, and customary rights holders are only familiar with a system of use rights (or lease) in which compensation is given to of a temporary exclusion of certain areas of land from the clan domain. In order to release the land for temporary use, compensation must first be paid to each clan controlling the land. *Ulayat* rules are clear that only certain forest types can be released in such a manner and converted. The Arfak people recognize the following types of forest that can be released for lease: *Bahamti* (primary forest), *Nimahamti* (moist forest dominated by mosses) and *Susti* (secondary forest and ex-cultivation area). According to customary rules, only the third type of land may be used for oil palm.

Site 2 – PT BPK in Kubu Raya, West Kalimantan

Timnas BBN considers West Kalimantan to be one of the key areas for the development of feedstock plantations for biofuels. Most of the current producers of biofuel (biodiesel) in Indonesia – Wilmar, Same Darby and others, have concessions in this province. These plantations supply both their parent refineries and other CPO-based biodiesel mills. At least four Wilmar plantation subsidiaries supply CPO for PT Wilmar Energy for biodiesel, while eight subsidiaries of Malaysia's IOI Corp. have been supplying CPO to the world's largest biodiesel refinery operated by Neste Oil.[32,33] PT Bumi Pratama

[30] Medco's plan in Papua is two-pronged. First, it focuses on the production of wood pellets for export. To this end, the company has formed a joint venture with LG Corp. of South Korea (http://papuaforesteye.blogspot.com/2010/05/medco-group-plantation-impacting.html#more), which has taken a 32% stake in Medco Papua unit, to produce and market wood pellets overseas. The partner companies built a USD 70 million wood pellet mill in Boepe, Merauke, and plan to produce 100,000 metric tons of wood pellets in 2010 and 300,000 tons annually by 2012. Second, Medco is taking steps to invest in other energy crops, especially oil palm and sugarcane. The company is preparing to plant 40,000 ha with oil palm in Merauke district and is also securing financial resources from Japan for processing facilitates which will allow it to produce 60 tons of bioethanol per day (http://www.korantempo.com/korantempo/koran/2008/05/16/Ekonomi_dan_Bisnis/krn.20080516.130961.id.html)

[31] See: Mansoben, J .R. (1994). Sistem Politik Tradisional di Irian Jaya, Indonesia: Studi Perbandingan. Leiden: Universitas Leiden

[32] Malaysian IOI Group to Buy Stakes in 3 Indonesian Oil Palm Companies, http://www.soyatech.com/news_story.php?id=4736

Khatulistiwa (PT. BPK), owned jointly by Sheringham International Ltd. and the Wilmar Group, was selected for the analysis of impacts due to its connection with CPO based biodiesel and the concession's location on peatland.

PT. BPK concession area is partly located on coastal peatland with some secondary forest cover (Anshari et al., in prep). PT BPK plans to invest USD500 million to expand biodiesel production facilities in East Java Province. The plan includes two new biofuel plants with a combined capacity of 400,000 tons. The CPO supplies for these refineries will come mainly from Wilmar plantation subsidiaries in Kalimantan. PT BPK initiated operations in 1994, at which time they began acquiring land from local communities. Over the last few years, additional areas have been cleared and added to the estate (Anshari et al., in prep). The concession area covers approximately 14,000 ha. Up to 2004, a total of 6,153 ha had been planted (PT. Bumi Pratama Katulistiwa, 2004). The company is operating a CPO mill with processing capacity of 30 tons of fresh fruit bunches (FFB) per hour.

The plantation area includes two villages – Mega Timur and Sungai Enau – inhabited by Madura, Chinese and Javanese ethnic groups. An indigenous community, the Dayak Ahe, live some distance from the plantation. For subsistence needs, the majority of people in these villages work as small-scale farmers. A number of Chinese work as traders and shop keepers. The most visible segment of society in the oil palm sector is the settlers, or transmigrants. They reside in nearby towns and villages and they have adjusted well to the presence of oil palm and other market opportunities. The indigenous community has been less adaptive and faced difficulties coping with rapid social and environmental changes.

Site 3 - PT TSE in Boven Digoel District, Papua

Korindo is a South Korean-Indonesia joint venture focusing on logging, plywood production and oil palm plantations in Central Kalimantan and Papua provinces. The company controls over 1 million hectares of forest and plantation concessions in Indonesia. In 2007, Korindo was part of the consortium of South Korean companies given a total of 500,000 ha in new land concessions in Central Kalimantan and Papua for bioenergy (AgroIndonesia*, 2008;* AgroIndonesia, 2010). In Papua, Korindo-linked affiliates (PT Berkat Cipta Abadi, PT Papua Agro Lestari, PT Bio Inti Agrindo and PT Ulilin Agro Lestari) acquired in total 200,000 ha for oil palm.[34] At the same time, Korindo's existing oil palm company, PT Tunas Sawa Erma (PT TSE) began intensifying its oil palm operations in Boven Digoel District. In 1998, PT TSE was granted a 34,000 ha oil palm concession in Boven Digoel.[35] The concession is covered with primary dry land forests, secondary dry land forests, and primary swamp forest (TBI, 2010). In the late 1990s, the company established the POP A plantation block

[33] Neste buys 250,000t palm oil for biodiesel, 20 March 2009, http://www.palmoiltruthfoundation.com/index2.php?option=com_content&do_pdf=1&id=1421

[34] Personal communication with varioous staff of PT Bio Inti Agrindo

[35] Based on the Ministry of Forestry's letter No. 171/Kpts-II/1998 concerning forest area release permit covering 34,270 ha (Papua Provincial Forestry Office, 2006).

(14,609 ha) on the eastern side of the Digoel River near Asikie and Butiptiri villages. This was followed by the POP B plantation block (19,731 ha), which was established in 2005 on the western side of the Digoel River near Getentiri and Ujung Kia villages. These two plantation blocks were selected for analysis. The POP B plantation block is particularly interesting as its development came at the time of Korindo group's engagement in land acquisition for bioenergy.[36] By 2008, 18,804 ha – 11,853 ha in POP A and 6,951 ha in POP B – were planted with oil palm (Andrianto et al., in prep).

The field research was carried out in villages adjacent to the concession area. The land currently under POP A belongs to 5 Mandobo clans, [37] while the POP B site is claimed by 11 Jair and 25 Awyu clans[38]. Similar to site 1 in Manokwari, these two ethnic communities are structured on the big man concept which is basis for the allocation and reallocate of clan resources. All customary land in this area belongs to clans. Individuals or groups of people from these clans can use these lands for hunting, gathering, fishing and farming. However, collective approval from the clan head and other clan members must be obtained if an area of land is to be transferred.

METHODOLOGY

Social and economic impacts

For the analysis of socio-economic impacts, the research team and partners followed the generic methodology using pre-designed and field-tested questionnaires in which standardized questions were adapted to local realities, household surveys were carried out to interview the following five different stakeholders groups: (a) employees, (b) former landowners and lessors, (c) customary users, (d) investing households, and (e) affected neighbors. Additional steps were taken to triangulate the collected information in order to minimize uncertainty and error.

While all stakeholder groups are found in site 1 and site 2, the investing households group is missing in site 3. The employees group includes mostly unskilled workers employed in plantation nurseries, fruit harvesting, machinery operators, and others. In site 1 and site 2, most of them live in surrounding villages, while in site 3 they live in the barracks on the plantation estate. The former landowners and customary users groups are respondents who previously owned or used the land and were compelled to transfer the ownership or access to the oil palm plantation. As described earlier, the communities in site 1 and 3 follow the big man concept, in which clan members are not free to speak and act freely about customary land matters. This has had implications for the way how respondents, particularly former landowners and lessors, were selected. In order to obtain reliable information, in site 3 the research team selected clan heads or

[36] In 2007, Korindo acquired about 200,000 ha of new concessions for bioenergy throughout Indonesia, including in Merauke district
[37] See: http://www.ethnologue.com/show_map.asp?name=IDP&seq=120
[38] See: http://www.ethnologue.com/show_map.asp?name=IDP&seq=120

males assigned by clan leaders to be their representatives.[39] In site 1, where local norms for the big man are less pronounced due to a relatively high degree of interactions with the outsiders, the research team has been able to interview other clan members as well. The investing households are differentiated into plasma growers, investing in oil palm through company's schemes, or as independent growers, who voluntarily invest in oil palm. The affected neighbors are respondents who do not belong to any of the mentioned groups above, yet they are affected by the oil palm plantation. A total of 386 respondents were interviewed in all sites. **Error! Reference source not found.** shows the distribution of each respondent groups for any given research sites.

Table 2.Number of respondents of each group

	Employees of the oil palm plantations	Former landowners, lessors and customary users	Investing households	Former land users and affected 'neighbors'
Site 1	38	41	30	28
Site 2	30	60	30	30
Site 3	47	15	NA	35

Key informant interviews were conducted with members of the communities affected, company officials, local government officers, and NGOs. Using open-ended questions, focus group discussions (FGD) were also held to help verify the information collected from individuals and households and to gather additional relevant data. Every attempt was made to engage as diverse a group of people as possible in order to reflect the existing diversity in terms of wealth, age, ethnicity, gender, and the nature of impacts. Separate discussions were held with men and women who were former land owners and investing households. Locally influential residents (leaders) were asked to assist in identifying individuals to be invited to FGDs. This ensured that a group with a diversity of experience and different stakes in plantations was engaged in the analysis.

Environmental impacts

Environmental impacts were analyzed using two different techniques. In order to understand land cover changes in research sites over a period of time, a time series of landsat images covering each site were analyzed (**Error! Reference source not found.**). The first image illustrated the sites prior to area prior plantation operations in order to ascertain the original land cover. The second series of satellite images illustrates plantation operations at the middle point in the life time of the plantation projects. The third series of satellite images illustrates the most recent period available. If a plantation concession was obtained in 1990, the first image would be from just before 1990, the second image would be from 2000, and the third image would be as

[39] In site 3, landowners interviewed are those households whose customary lands were transferred to oil palm plantation. The research team in this site also selected 'affected neighbors' respondents, which include people not working on the plantation and clans members whose who did not transfer land to plantations.

close to 2010 as possible. The time series analysis is intended to show land use and forest cover changes as a result of oil palm plantation development.

Table 3. Landsat images used for spatial analysis

Site	Year plantation operations started	Land cover map, Period 1		Land cover map, Period 2		Land cover map, Period 3	
		Landsat type; path/row	Date of acquisition	Landsat type; path/row	Date of acquisition	Landsat type; path/row	Date of acquisition
1	1982	Landsat MSS; 105/61	11 December 1982	Landsat 5 TM; 105/61	13 May 1995	Landsat 5 TM; 105/61	10 December 2008
2	1994	Landsat 5TM;121/60	29 June 1989	Landsat 7 ETM;121/60	22 June 2001	Landsat 7ETM;121/60	11 May 2009
3	1998	Landsat 5 TM; 100/65	31 May 1997	Landsat 7 ETM; 100/65	28 October 2002	Landsat 5 TM; 100/65	23 December 2008

Some landsat data were downloaded freely from the USGS website while remaining images were purchased from the Geoscience Australia through its provider in Indonesia. The oil palm plantations data were obtained from the Forestry Planning Department (BAPLAN). This datawere used to calculate the area previously forested and subsequently cleared for plantations. No ground-thruthing was undertaken because of limited time and resources.

Additional information on environmental impacts was collected through questionnaire based household surveys seeking to analyze the respondent perception of environmental changes taking place and their causes.

FINDINGS

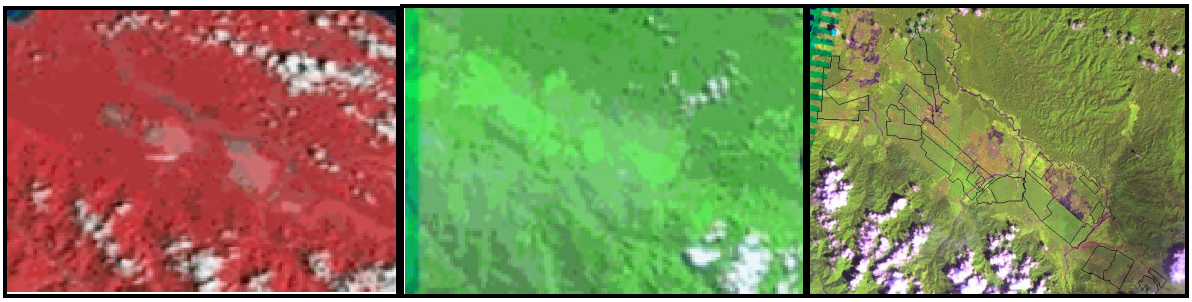
Environmental impacts

The analysis of time series of satellite images shows that oil palm plantations in all three research sites have led to deforestation. In site 1, most of the original forest cover has been cleared for plantation establishment. The analysis of recent land imagery indicates that forests presently cover only 34% of the total area of the Prafi site.

The analysis of time series of satellite images in site 2 (**Error! Reference source not found.**) shows that prior to oil palm establishment, 84% of the concession area was covered with secondary peat swamp forest, 12% with dry agricultural land, while the rest was swamp (**Error! Reference source not found.**). In 2000, 6 years after the plantation establishment, secondary peat swamp forest within the concession was reduced to 42%, while the oil palm area increased to 34 percent. The most recent landsat imagery available (2009) indicates that oil palm currently covers 39% of the concession, while secondary peat swamp forest covers 40%of the area. Oil palm still

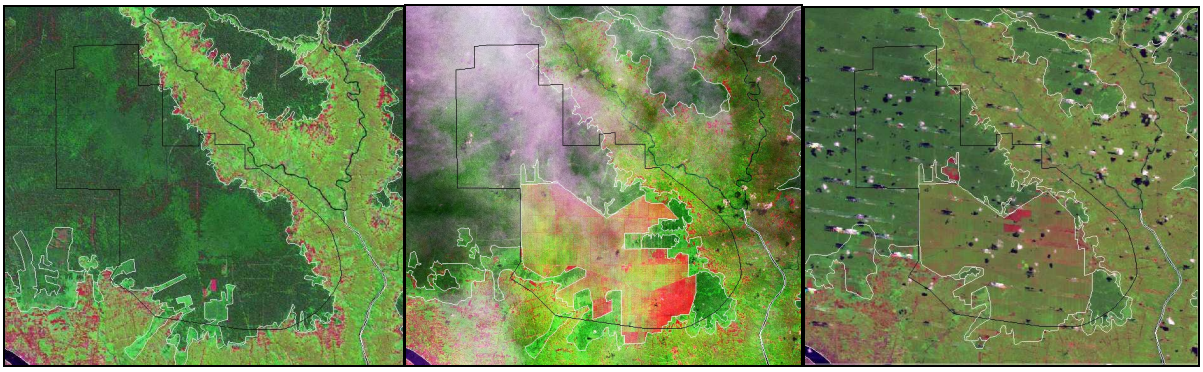
covers only about 7,700 ha of the 13,600 ha concession, indicating that further expansion is likely to adversely affect the remaining secondary peat swamp forest.

Site 3 (**Error! Reference source not found.**) is a tropical rain forest zone covered mostly with primary forest. In 2005, 7 years after the oil palm company started operations, we find that more than 1.900 ha of forest was cleared. Over the next 3 years, until2008, they converted more than 9.400 ha. Based on field survey carried out in March 2010, the plantation company reported only about 17.000 ha oil palm planted in POP A and POP B. This indicated that after 12 years in operation, the company used less than 60% of the total concession area. Detailed land cover maps showing the progression and impacts of the oil palm development will be developed as soon as the necessary satellite images are available availability.



(a) (b) (c)

Figure 1. Land cover in site 1 at three points in time: (a) 1982 (prior to plantation establishment)[40]; (b) 1995 (showing plantation development in light green color)[41]; and (c) 2008 (showing mature oil palm plantation in green).

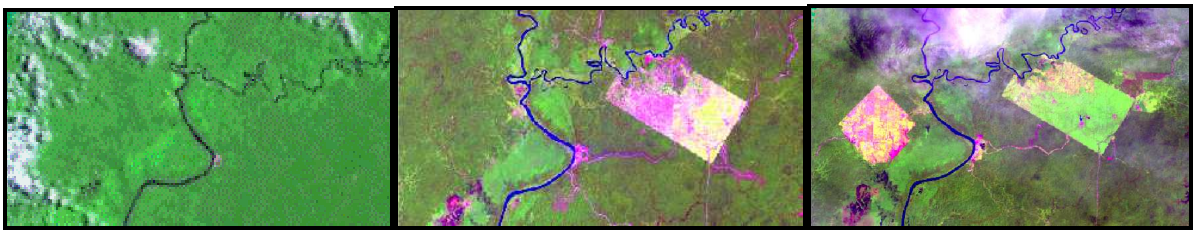


(a) (b) (c)

Figure 2. Land cover in site 2 shown in three different time periods: (a) 1989 (prior to plantation establishment in 1994); (b) 2001 (showing land clearing in red) and (c) 2009

[40] The original landsat data is currently being ordered, and will be used to create land cover maps for journal submission.

[41] The original landsat data is currently being ordered, and will be used to create land cover maps for journal submission.



(a) (b)

Figure 3.Land cover in site 3 in three time periods: (a) 1997 (prior to plantation establishment)[42]; (b) 2002 (showing land clearing in POP A); and (c) 2008 (showing land clearing in POP B).

Table 4. Land cover change in site 2 (in hectares)

land cover	site 2		
	1990	2000	2009
Secondary swamp forest	16731.2	8316.9	7950.33
Other forest	0	4772.97	4268.07
Non forest	3202.2		
Land clearing		6843.51	7714.98
Forest cover change/deforestation	8294[a]	23682[b]	

[a] 6,821 ha was a result of land clearing in the concessionaires area
[b] 274 ha was a result of land clearing in the concession area

According to field observations and key informant interviews, oil palm plantations also caused degradation in adjacent forest areas by displacing timber extraction activities for construction and fire wood use, and by concentrating these activities in remaining forest areas. Different stakeholder groups have divergent opinions about the severity of observed environmental impacts (**Error! Reference source not found.**). Decreased forest cover was the main environmental impact experienced by all respondent groups at all research sites. This environmental impact was most salient for former land owners and land users, as forestry activities are an important component of their livelihoods and have been adversely impacted by deforestation. As a result of these changes, they have been forced to cover much greater distances to collect forest products and prepare their swiddens. In site 3, the effects of shrinking forest cover was experienced by all groups, particularly former land owners and those living adjacent to plantations. Deforestation led to the siltation of waterways and swamps used as the sources of fresh water for domestic needs.

Table 5. Environmental impacts observed by all stakeholder groups in each research sites (% of respondents reporting issues of concern)

Parameter	**site 1** (n=137)	**site 2** (n=150)	**site 3** (n=97)
decreased water quality	32%	50%	58%

[42] The original landsat data is currently being ordered, and will be used to create land cover maps for journal submission.

decreased water quantity	18%	79%	50%
decreased forest cover	69%	70%	53%
increase in crop pests	5%	22%	22%
air pollution	7%	28%	37%
soil erosion	53%	5%	33%
soil stabilization	15%	23%	8%
increase in human disease	24%	27%	31%
flooding	0%	44%	0%

In site 1, decreased forest cover, soil erosion, subsequent siltation and declining water quality and quantity are perceived to constitute important environmental impacts of plantation development. Air pollution due to burning of the oil palm waste was also experienced by respondents residing near the plantation in site 1, while soil erosion and sedimentation of rivers was seen as an important environmental problem among employees and outgrowers. The removal of the original land cover in and around oil palm cultivation areas has resulted in soil erosion, particularly in the riparian areas where increased water flows during rainy season cause abrasion. Flash floods also caused significant damage inside the oil palm estate by making parts of it inaccessible, thus delaying and reducing harvest.

In site 2, the environmental impacts that stakeholder groups perceive to be taking place vary, both in type and degree. Flash floods leading to declining water quality and quantity and deforestation are perceived to be important environmental impacts for all respondent groups. The destruction of natural drainage through waterways caused low-lying areas to become water logged. The company tried to remedy the problem by building canals along the perimeter and inside of the plantation. However, these canals were not sufficient to handle the massive amounts of water seen during the rainy season. Besides the frequent flood incidents during the rainy season, respondents also experienced declining water quantity during the dry season. Former landowners and customary users also reported smog from forest fires as one of the most significant and undesirable environmental impacts during plantation establishment. Respondents also reported a worsening of crop pests and various skin diseases, which is reported to be caused by oil palm-induced microclimatic changes and extreme weather events (Anshari et al., in prep).

In site 3, water and air pollution were perceived as significant environmental effects of oil palm expansion. As the companies use significant amounts of pesticides and herbicides, they advised workers not to use the water from rivers and instead constructed wells for their use. The neighboring communities and former land owners also expressed concern about air pollution from dust and smoke coming from the plantation and mill site. They also mentioned soil erosion as a major problem, which the employees attribute to plantation-induced changes in micro-climate. This problem was particularly acute in the 2009-2010 period due to increased rainfall. Expanding waterlogged areas due to higher rainfall was also blamed for increased incidence of malaria and yellow fever.

Socio-economic impacts

Impacts from the loss of forest products and services

The group most affected by land use change, former landowners and customary land users, indicated that decreased forest cover resulted in greater difficulty in accessing forest products and practicing shifting agriculture (**Error! Reference source not found.**). They have to walk further to collect forest products or to open new fields for shifting cultivation. Households relying on forests resources for income and food had to shift to other sources of livelihood. Those involved in logging and sawmill employment had to abandon their former livelihood activities entirely due to dwindling forest resources. According to household survey results, all respondent groups reliant on forest products and services had to shift to on-farm activities (for those who still owned land) or off-farm work.

Table 6. Perceived livelihood impacts of oil palm plantations according to former landowners and customary users (% of respondents)

	Site 1 (n=41)			**Site 2 (n=60)**			**Site 3 (n=15)**		
Local indicator	negative	no impact	Positive	negative	no impact	positive	negative	no impact	positive
Time to access forest products	50	33	17	86	14	4	100	0	0
Ease of accessing land for swiddens	25	44	31	71	27	10	67	33	0
Time taken to access swiddens	42	28	31	9	78	13	67	33	0

In Site 1, those under the customary land system or *'ulayat'* (collectively owned areas) felt that oil palm expansion – through the government plantation business permits, or HGU – has resulted in a significant reduction of *'ulayat'* lands. While not all forest related livelihood activities have stopped as a consequence, people now have to go further into the forest to access forest resources and open new swiddens. Former landowner and outgrowers have different perceptions about these changes. Former landowners, mostly indigenous people owning *'ulayat'* land, reported mostly negative changes as they need to go further into forest to open new swiddens. The outgrowers, who are mostly migrants, have not been affected by these changes as they are still able to utilize the land allocated to them by the government under the transmigration scheme and are not dependent on forest swiddens.

In site 2, beside the negative impact on the availability of forest products, respondents also perceived negative changes in terms of much greater time needed to locate forest resources in remote areas and find appropriate land for swiddens. In this area, where not many customary landownership structures remain in place, the respondents feel the pressure of increasing land scarcity due to oil palm plantation development and indicated the land prices have increased significantly, which attract local and migrant land speculators. Local village heads and other local elites were regularly approached by outsiders about land purchases, which led to growing community agitation and animosity. Most respondents previously dependent on forest resources, indicated they now have to purchase forest products they need – e.g. wood for construction, fruits etc, -- instead of collecting them. This added to their economic burden.

In site 3, the situation is similar to findings from site 1. All respondents still depend on forest for livelihoods. Following the establishment of oil palm plantation, they realized their traditional livelihoods are in danger due to the loss and irreversible changes affecting their customary land. Their staple food, sago, has become scarce, forcing local communities to become more dependent on rice, which they have to purchase. Similarly, hunting and fishing have become more difficult as plantations expand, reducing household sources of protein as well as an important item for sale. The local people have to travel far greater distances now to procure food for their families

Socio-economic impacts of oil palm development

The following section describes how the development of oil palm in three research sites in Indonesia has impacted local stakeholders, including employees, former landowner and customary users, investing households, and affected neighbors.

Socio-economic impacts for employees

A total of 115 employees were interviewed during field research. In site 1, the vast majority of respondents were migrants from outside of Papua as well as migrants from other parts of Papua. Only 8 percent were native Arfak. Similarly, in site 2, most of the respondents were migrants from Madura, and only a few were local Dayak. In site 3, the respondents were mostly migrants from Papua and outside Papua, with few native Papuans.

81 percent of employees stated they had to forego former livelihood activities, i.e. on farm related activities and other paid labor, when seeking formal employment on plantations. In most cases, workers had to reduce their previous livelihood activities due to the heavy work load and long time spent on plantations. Very few people managed to maintain both sets of activities. Other family members have in most cases had to help to generate supplemental income to compensate for the forgone benefits associated with forestry, agricultural and other livelihood activities. Yet despite these economic costs of employment, the majority of employees perceived net positive impact on their livelihoods as a result of the plantation employment.

Most of the positive impacts were attributed to higher income as well as more regular income flows (**Error! Reference source not found.**). With 7 – 8 years of education on average, most employees had not completed their junior high school. With such education levels, formal employment opportunities are restricted to odd jobs with low incomes. Income from plantation employment, which ranges from 800,000 rupiah (USD 80) per month in site 2 to Rp 1.3 million (USD 130) in sites 1 and site 3, is considered satisfactory for their education level. In 2010, the provincial minimum wage in site 2 is Rp 741,000 (USD 75), while in site 1 and site 3 it is Rp 1.2 million (USD 120).

Table 7.Perceived livelihood changes for employee group

Variable	Site 1 (n=38)	Site 2 (n=30)	Site 3 (n=47)	Average
increased income	84%	73%	60%	71%
more reliable income	63%	73%	68%	68%
ability to invest in other income generating activities	55%	20%	21%	32%
increase in purchasing power	32%	33%	49%	39%
increase in consumption	32%	37%	56%	43%
availability of public facility	3%	40%	17%	18%
Positive livelihood changes	32%	75%	30%	46%
Mixed livelihood changes	53%	7%	24%	28%
Negative livelihood changes	15%	18%	46%	26%

Besides the aforementioned benefits, worker perception of impacts differed when it comes to overall livelihood condition changes as a direct result of the plantation employment. In site 1, employee opinions about the impact of oil palm were largely similar, regardless of the length of service, with 32 percent saying they enjoyed better livelihoods and 15 percent experiencing mostly negative impact. Employees stated that income from work on oil palm plantations has been declining. This was mainly due to the old age of the plantation (25 years), where palm trees higher than 5 meters reduced fruit harvest output per unit of time. Those with a positive overall experience with oil palm are for the most part transmigrants, who are better off compared to native inhabitants due to their ability to maintain other livelihood portfolios, such as cultivation of rice fields, cash crops, hired labor, etc.

In contrast to site 1, 75 percent of workers in site 2 experienced better livelihood conditions due to palm oil plantation. Most of the employees in site 2 indicated that they are still able to obtain complementary income from farming activities. They also stated the company provided assistance to partially cover their health expenses.

About half the respondents indicated that oil palm had mixed implications for their livelihood in site 3. The plantation company provides basic facilities such as housing, water, electricity, health care, transportation to the work place, and school for the children. However, these facilities are of the lowest possible quality. Still, because there are no alternatives, it is seen as better than nothing. During recruitment, they were

promised higher salary and better facilities, which did not materialize. They now have no choice but to continue to work on plantations as they have relocated their families to plantation sites. Some plan to return to their places of origin as soon as they have sufficient financial means. The remaining households were evenly divided between those claiming to enjoy improved living conditions, and those experiencing negative livelihood outcomes. Employees who indicate positive change are usually team leader, which received not only regular salary, but also output based premium.

More than 80 percent of plantation employees are hired on a temporary basis and can lose their jobs at any moment. Their wages are paid based on work output. They must work 26 work days per month and 8 hours per day in order obtain full wages. Their income will be reduced, if they do not fulfill the target due to sickness or other reasons. Official incomes are further eroded by company requirement that workers purchase their own work tools such as boots, machetes (*parang*), pull carts, etc.

Socio-economic impacts for former landowner and customary users

A total of 116 respondents of former landowners and customary users were interviewed. In both sites in Papua most of the respondents are native Papuans, i.e. 77 percent respondents in site 1 and all respondents in site 3. In site 2 in West Kalimantan, a significantly more mixed ethnic composition was found.

Former landowner and customary user groups reported negative livelihood impacts of oil palm in all three research sites. The negative impact was attributed to changes of their livelihood activities and reduction of land owned. Some respondents became landless, forcing other family members to contribute to income generation in order to reach income levels similar to what it was prior to land transfer. Regarding former livelihood activities, on average 26 percent of respondents who formerly engaged in agricultural activities indicated mixed livelihood impacts. New roads improved access to urban markets to sell agricultural products. However, greater access to markets and consumer goods also increased the outflow of cash earned. About 21 percent of former forest dependents respondents reported negative livelihood impact. They had to forgo partially or entirely their former income from forest resources and had to travel greater distances to access forest resources.

The main positive social-economic impacts observed by the respondents were centered on improving infrastructure, such as schools, health clinics, or religious centers. Once constructed, these facilities are usually accessible not only to plantation employees but also to other community members. The satisfactory income level was associated with land compensation, regular income from ‘plasma’ plantations, and extra income from agricultural activities. In site 1, some land compensation was paid in monthly installments. Positive impact was also attributed to road development that facilitates broader access to nearby markets with more economic opportunities.

Land lost and regained

The development of palm oil in all the three sites was carried out gradually in stages. However, each stage involved the conversion of thousands of hectares of forestland with significant implications for customary land owners. Former land owners and customary users experienced a similar situation in all research sites during and after the land transfer. In two of the selected research sites, the oil palm plantations were established more than fifteen years ago. As a result, not all respondents are able to recall precisely former land ownership titles, resources lost, and the amount of land regained. Most respondents were only able to give rough estimations.

In Site 1, prior to the establishment of the plantation, several tribal chiefs were invited to visit oil palm plantations in Sumatra to see plantation results first-hand. Promises were made by the plantation company to compensate communities in site 1 for the loss of customary land with permanent housing, clean water facilities and a health clinic. While it was not entirely clear to whom such payments would be made, the promises raised expectations among affected communities. It appears that these expectations were never met. Research results suggest that 92 percent of respondents never received any land compensation. Most informants claim the company failed to fulfill other promises as well. The housing provided was mostly semi-permanent, without clean water. Health services were only available for company employees, with local communities granted limited access on a case-by-case basis.

Household surveys and focus group discussions in site 1 indicate that around 20,000 ha of 'ulayat' land were transferred for oil palm plantations. Cash compensation of 3 billion rupiah (US$ 300,000) was paid for 14,800 ha of land, while the remaining 5,500 ha were acquired without direct compensation. Only 10 percent of respondents reported receiving the 'plasma' scheme as part of compensation. Finally, some 'ulayat' land owners received land compensation in the form of monthly payments from transmigrant "plasma" growers.

In site 2, where land ownership is based on title deeds held by household heads, 80 percent of respondents claim that plots of land were transferred to the company. However, less than 20 percent remember the amount. From focus group discussions, it is clear that approximately 1,000 ha of land were transferred to the company in return for 230 million rupiah (US$23,000). However, this compensation was paid as wages for land clearing, not for land transfer. Following the land loss, 16 household heads from the Dayak community were unable to regain any of the land lost to the company due to increasing land prices and low household income. These households became landless and had to lease land or work for other households to generate income.

In site 3, where customary land ownership is based on clans, a total of 22,000 ha were transferred to the plantation company. One billion rupiah (US$ 100,000) was paid as part of the compensation for 14,000 ha of 'ulayat' land formerly occupied by five clans of the Mandobo tribe. The remaining 8,000 ha was acquired with compensation paid only for sago groves and timber, at a rate of 5,000 rupiah (50 cents) per sago tree and 10,000 rupiah (US$ 1) per cubic meter of timber. This area originally belonged to 11

clans and 40 households. Based on interviews with one clan leader, we generated an estimate for the losses incurred as a result of the land transfers. Based on forestry stock data, 400 ha in this area is reported to contain about 7,000 m3 of wood and 17,000 sago trees. Based on these numbers, 8,000 ha of land in this area should generate compensation of around 3 billion (US$ 300,000) for sago and timber alone.

Perceived livelihood impact

Stakeholder groups are divided here into two main categories, i.e. those with plasma allocated as part of compensation from oil palm companies, and those with limited compensation payments in the form of labor fees for land clearing and/or compensation for timber and sago trees. Plasma holders, through a cooperative (KUD/KKPA), receive regular payments for the harvest of fresh fruit bunches on land managed by the companies. They receive monthly payments ranging from 200,000 – 1,600,000 rupiah (US$20 – US$ 160) depending on the total harvest in allocated plots. This group benefited both from the plasma (regular income) and ability to continue other livelihood activities, such as farming. The second group reported limited compensation in the form of fees for land clearing in Site 2 and compensation for timber and sago trees in Site 3, both one-time payments made at the beginning of plantation establishment. This kind of compensation is uncertain and is the subject of constant disputes. The group that did not get the plasma, resented those who did. Problems were also reported about the consultation processes leading to the land transfer. According to the information obtained, the consultation process was not properly conducted. Not all former landowners or customary users were consulted, which resulted in different compensation payments. This lead to tensions and simmering conflict.

About 47 percent of respondents in all three research sites reported negative livelihood changes as a direct result of the land transfer to oil palm (**Error! Reference source not found.**). The most negative changes were observed in site 3 where 86 percent of respondents indicated adverse livelihood changes. These changes were attributed to the decline of income from forest products, reduced access to the sources of food. About 30 percent of respondents indicated mixed livelihood changes, and 23 percent reported positive changes following the land transfer, attributing it to better infrastructure.

In site 1, most household livelihoods have improved despite land loss. Yet this was not entirely due to oil palm, as these households had income from other off and on farm activities. Their prior experience with oil palm has enabled them to adjust. They received compensation for communal land taken over by the plantation and were given plots of oil palm land in exchange for land with ownership certificates. Problems in this site are expected to intensify as the plantation permit gets closer to the expiration date in September 2012. Former land owners and customary users are eager to get their land back and are already staking claims. According to local customary law, any land to be acquired by a company for plantation or transmigration must be released through a ritual ceremony involving appropriate compensation. Because consultation and compensation were not done properly, discontent is rife. The parties involved tried to

seek resolution on several occasions but without success. In both sites in Papua, compensation, when paid, was given to tribal chiefs or 'ulayat' heads, who subsequently were expected to distribute the funds among appropriate community members. Internal conflict ensued due to lack of transparency in the distribution of these funds.

In Site 2, the company began acquiring the land from local communities in 1994 with a promise to establish plasma plantations, roads, and other infrastructure (e.g. schools and religious centers). In addition, the company promised to provide employment opportunities for local residents, offer appropriate compensation for the land acquired, and pay for land clearing. After several years, the company has paid wages for land clearing and developed 'plasma' for several communities. Employment promises were only partially fulfilled, mostly in the form of jobs for unskilled workers. More than half of those losing land to the company experienced a decline in their livelihood, while 31 percent of respondents indicate some livelihood improvement. Respondents who indicated livelihood improvement are mostly smallholder growers. Those who reported declining livelihoods did so mainly due to the loss of income from the forest and exposure to negative environmental impacts from plantation operations.

In site 3 only 7 percent of respondents experienced positive changes in their livelihoods following plantation expansion. The remaining 93 percent of respondents regretted the establishment of oil palm plantations. With 20,000 ha of land occupied by the plantation, their livelihoods showed a significant decline mainly due to decreasing opportunities for hunting, fishing, collection of sago and other forest resources. Even though formal employment on plantations is an option for them, most people in this group are not able to work consistently due to their reluctance to give up traditional ways of life.

Table 8. Attributes of the social-economic impacts for former landowner and customary users group

	Site 1 (n=41)			Site 2 (n=60)			Site 3 (n=15)			Average		
variable	neg	no impact	Pos	neg	no impact	pos	neg	no impact	pos	neg	no impact	Pos
income level	16%	13%	71%	32%	43%	25%	88%	13%	0%	29%	23%	32%
quality of housing	15%	37%	53%	31%	58%	12%	38%	25%	38%	27%	39%	33%
Quality of social networks of importance to your livelihoods	8%	65%	32%	22%	22%	56%	75%	25%	0%	35%	37%	29%
access to food	3%	21%	76%	9%	47%	44%	100%	0%	0%	37%	23%	40%
access to social infrastructure	42%	0%	58%	8%	23%	69%	13%	0%	88%	21%	8%	72%
Positive livelihood changes	39%			31%			0%			23%		
Mixed livelihood changes	61%			14%			7%			30%		
Negative livelihood changes	0%			55%			93%			47%		

Socio-economic impacts for investing households

The investing households group reported mostly positive livelihood impacts due to oil palm development. This group, which only exists in sites 1 and 2, attributed the positive impact to higher income, broadening social networks, access to infrastructure and better housing (**Error! Reference source not found.**). Negative impact was associated with concerns over land speculation and ease of assessing new land. In the case of investing households, there are similarities between sites 1 and 2, where plantation companies implemented the plasma-nucleus scheme; most plasma farmers reported an improvement in livelihoods, suggesting the beneficial nature of these schemes.

Table 9.Attributes to livelihood impact for investing households group[43]

	site 1 (n=30)			site 2 (n=30)			Average		
variable	neg	no impact	pos	neg	no impact	pos	neg	no impact	Pos
income level	14%	32%	55%	21%	0%	79%	18%	16%	67%
access to food	14%	41%	45%	11%	29%	61%	12%	35%	53%
Quality of social networks of importance to livelihoods	13%	39%	48%	0%	21%	79%	7%	30%	64%
Quality of housing	22%	22%	57%	7%	52%	41%	15%	37%	49%
Access to social infrastructure	17%	39%	44%	0%	25%	75%	9%	32%	60%
Ease of accessing new agricultural land	27%	32%	41%	80%	16%	4%	54%	24%	23%

In site 1, 85 percent of households claims to have former land uses (forest products and agriculture) displaced by oil palm. In terms of forest products, the items that were displaced include timber and medicinal plants, while agricultural portfolio includes secondary crops, fruit trees, and cassava. Only a limited number of respondents were able to quantify the displaced harvests. Hopes for higher income are the main reasons behind the change from former land uses and livelihood activities to oil palm. After 10-15 years, more than 85% of plasma farmers have repaid their loans taken for small holder plantation establishment. Now the land and oil palm plots belong to them. This is important because oil palm ownership certificates can be used as bank guarantees to secure loans for further business ventures. Negative impacts were primarily observed in plasma areas near the nucleus estate, mostly in the form of conflicts with former land

[43] Surveys were not included net livelihood impact for this group.

owners demanding the return of their land. These conflicts occur because the current plasma holders received their land through government sponsored transmigration program which ignored local customary ulayat realities. The Papuans who are traditional land owners now demand that their land be returned. The issue is difficult to resolve and numerous mediation attempts by local government institutions have so far not been successful. The Papuans perceive the government as biased towards transmigrants. They are also are resentful of the incomes the latter gain from oil palm, which Papuans think are rightfully theirs. In the Manokwari area, where most of the plasma holders are transmigrants, the current arrangements is a compensation for customary ulayat landowners in the amount of 3 billion rupiah (USD 300,000) for the entire land lost.

In Site 2, plasma plantations were started in 1997, while independent growers began planting their plantations in 1999. More than 63 percent of oil palm cultivated by investing households in this area displaced former land uses. The former land uses displaced by oil palm include rubber plantations, pineapple groves, secondary forests, and abandoned land. Higher economic profitability is also the main reason for the shift of livelihood activities to oil palm. The higher income level among investing households shows some benefits for smallholders, with plasma perceived to be more beneficial because most of plantation management work is done by the company. Although monthly income generated from these activities varies, most respondents reported it as satisfactory. Some of them have been able to retain some of their former livelihood activities and therefore are able to obtain additional income.

However, not all investing households have been able to secure immediate returns. For independent growers, the earlier years are most difficult since they have to forgo other livelihood activities to maintain the plantation. Regardless the burden in the early years of oil palm establishment, new families continue to be attracted to invest in oil palm as independent growers.

Investing households in site 2 are better off in comparison to site 1. Prior to oil palm, most of the investing households were cultivating cash crops (e.g. rubber). Some of them were also involved in timber extraction. When forest resources became no longer available due to plantation development, they responded by investing in oil palm plots. These households possessed the capital necessary for up-front investment, enabling them to partner with oil palm companies to meet the company production targets. Respondents also indicated that oil palm plantation has attracted other investors, resulting in increasing land prices. Positive impact was also attributed to road construction that improved access to nearby urban areas to sell agricultural products.

Socio-economic impacts for 'affected neighbors'

Some social and economic effects were observed across all research sites (**Error! Reference source not found.**). A total of 93 respondents interviewed indicated similar effects associated with the oil palm expansion. Flash floods were perceived as an important factor impacting the respondents' social or economic life, as flooding

determined access, or lack thereof, to nearby markets. Water pollution due to extensive use of fertilizers and pesticides on the plantation estate was also perceived as an important factor, primarily in site 2 and site 3. In site 2, respondents reported that their social and economic conditions were negatively affected by the loss of access to customary forest areas due to oil palm expansion. None of the respondents in site 2 were displaced or resettled, while 11 and 3 percent of respondents in site 1 and site 3 respectively, were displaced or resettled due to the oil palm expansion. However, respondents also indicated that employment opportunities in oil palm and road construction have positively affected their socio-economic conditions. The off farm business such as restaurants, repair shops, and transportation are in high demand due to oil palm plantation operations.

Table 10.Perceived social and economic effects associated with the oil palm expansion[44]

	site 1 (n=28)	site 2 (n=30)	site 3 (n=35)	average
Loss of customary access to forest products	14%	77%	29%	40%
Loss of customary access to underutilized land (for cropping	0%	53%	11%	22%
Loss of customary access to water resources	4%	37%	26%	22%
Water pollution	43%	70%	83%	65%
Air pollution	0%	30%	89%	40%
Increased incidence of human or crop pest / disease	18%	30%	69%	39%
Loss of primary crop land	29%	10%	14%	18%
Displacement/resettlement	11%	0%	3%	5%
Flood	64%	87%	54%	68%
Employment opportunities in oil palm plantation	36%	27%	60%	41%
Transportation and access to city	46%	7%	89%	47%

While 51 percent of respondents noted economic losses associated with plantation expansion, only 23 percent indicated there to be any compensation for these losses. When looking into the nature of compensation, we find significant variation across sites. In site 1, none of the families were consulted about the extent of the losses and no compensation was given. In site 2, compensation was provided to affected households in the form of food aid and drainage systems to alleviate flooding, but not cash compensation. Only 17 percent of the respondents stated they were consulted about the level of compensation – stating that only village leaders, plasma holders, and a few village elite were engaged in consultations. In site 3, cash compensation was provided to certain households by the company for the loss of forest products. Consultations

[44] Surveys did not cover the net social and economic effect for this group

were only conducted with village heads. Most families in this site rejected the plantation project from the outset and refused to meet company officials at that time.

Social effects at community level

One of the most important and prevalent social effect observed in all three sites was conflict. Conflict over land and compensation occurred within communities as well as between communities and companies. Conflicts between communities are considered minor, while conflicts between communities and companies are considered as significantly more serious. Another form of conflict observed is conflict between '*ulayat'* owners and non-native communities (migrants). The migrants – either local (from within Papua) or national (from other parts of Indonesia) –are granted 2 hectares of land per household on 'state land'. Prioritizing government control over *'ulayat'* claims, the government routinely allocates the '*ulayat'* land for transmigration and development. This causes conflict that continues long after the transmigration settlements are established. In Lismau Ngu village (Site 1), for example, the land that has been planted with oil palm and incorporated into the plasma program by transmigrants was still claimed by the *'ulayat'* owners after several harvesting periods. As a result, a profit sharing mechanism has been put into place to compensate *'ulayat'* owners.

In site 2, minor conflicts emerged between local communities and migrants. This was mostly attributed to plasma benefit distribution. Respondents stated that plasma' benefits were only enjoyed by the associates and friends of village heads. Conflicts also emerged over profit distributed through KUD. Some plasma growers who received less insisted that it was due to lack of transparency and collusion. Minor conflicts also occurred between local resident and migrant employees over income from the oil palm harvest. Neither of these conflicts escalated, however, due to the effort of community leaders to resolve conflicts through dialogue. One conflict resolution between plantation workers and the company included the reduction of the number of migrant workers and more opportunities for local workers.

In Site 3, interaction between indigenous people and migrants from Java and from elsewhere in Indonesia has reportedly improved the motivation of the local people to educate their children. The increase competition over limited employment has also spurred indigenous residents to be more accepting of existing employment options in oil palm nurseries, weeding, and harvesting. Inspired by the example set by migrant households, they have also started small business enterprises such as kiosks and local transport, e.g. motorcycle, boat rental. However, not all indigenous households are able to effectively capture these opportunities. Those with adequate capital or high positions in traditional communities are more able to benefit from available opportunities. While overall it is the migrants who have gained most from business opportunities associated with the oil palm plantation, this does not appear to have caused much outward animosity towards them.

The limited understanding among investors of traditional land ownership arrangements has led in some cases to misunderstandings about who actually owns the land and who

should receive compensation. Even if the proper land owning parties can be located, compensation payments are often a complicated affair. Sometimes compensation is paid at the beginning of the land transfer, and in other cases it is paid at intervals during the time period of the concession. Other times, payments are made on an ad hoc basis. Form of compensation also varies. In one case, compensation consisted of monthly payments of fresh fruit bunches. Other times, it involves as a lump sum payment immediately after the land transfer. Compensation is often paid to chiefs, who subsequently divide and distribute the money to appropriate clans. The aforementioned payment in fresh fruit bunches, for example, had a value of 25 million rupiah (US$2,500) and was paid to the '*ulayat*' owners. The transfer of these payments does not always go smoothly. In Site 1 and Site 2, indigenous clans that have not received appropriate compensation are demanding the return of the land once the plantation license expires.

In Site 3 one '*ulayat'* owner in POP A received a payment of 1 billion rupiah (US$ 100,000) in 2000, which was distributed among five different clans. Meanwhile, another '*ulayat'* owner in POP B did not get any compensation for land lost to the company. Affected households only received compensation for timber and sago groves cleared by bulldozers. Realizing that compensation was not adequate in comparison to the resources lost, they resolved to press for more. As a result, the company promised to pay more attention to the communities through its community development program. This program included development of public facilities, such as clean water facility, and providing one car for community's religious activities.

Employment guarantees, given to '*ulayat'* owners as a form of compensation for land loss, have also caused misunderstandings and dissatisfaction. With low education levels and lack of experience, local residents generally receive jobs as unskilled workers with low wages. Furthermore, with their existing skill base considered inadequate by managers and contributing to poor performance, most of them are unable to secure or retain plantation jobs. They often revert to former livelihood activities, such as farming, hunting, and gathering, but with limited success due to declining forest areas.

DISCUSSION

Environmental impacts

The three sample sites chosen for analysis display many commonalities with other oil palm estates in Indonesia oriented towards CPO production for food. In all three sites, plantation companies were given concessions covered with primary and secondary forest, leading to subsequent forest conversion. By establishing the causal link between plantation development and changes in forest cover, this study corroborates previous findings indicating a link between oil palm plantation development and deforestation. The study highlights dire consequences of oil palm plantation development, regardless its end use, for remote frontier forests such as those in Papua.

While corporate plans to establish oil palm plantation are often ambitious, often aiming for hundreds of thousands of hectares, actual plantation establishment consistently lags behind these targets. In each site, over 10,000 ha of the concession land has laid idle for several years. This is ironic given the rush by the same and other companies to acquire additional land for plantations. Given the fact that all three companies had parts of their concessions covered with forest, and the same companies or their affiliates first engaged in timber operations before developing oil palm plantations[45], findings confirm the continuation of the established model of plantation development in Indonesia which is preceded by timber extraction (Casson et al 2007; McCarthy and Cramb 2009; Koh and Wilcove 2008). This has been taking place due to the desire by companies to offset plantation investment costs with timber revenues and secure land now for future expansion, or simply because the companies are interested in timber only (Kartodihardjo and Supriono, 2000; Wakker 2005; Reinhardt, et al. 2007; Casson et al 2007; Hunt 2010; Schwarz 2010).

The findings have also exposed contradictions among land allocation regulations for oil palm plantations, and their actual implementation. The Ministry of Forestry and Ministry of Agriculture's decrees[46] clearly indicate that a plantation company may be granted up to 100,000 ha of land outside of Papua and up to 200,000 ha in Papua, although the land should be released gradually in 20,000 -40,000 ha increments. The release of land up to the allowed maximum is contingent upon evaluation and confirmation that the land released earlier had been planted. The proposed plantation concessions under MIFEE program (Merauke Integrated Food and Energy Estate) in Papua, for instance, reflect this step-wise process.[47]

In practice, however, granting large concession areas is fraught with risks. As experiences shows, these areas are unlikely to be fully developed, while restricting customary land uses essential to local livelihoods. As research findings indicate, in site 3 the plantation company took more than 12 years to develop 14,000 ha of plantations and plantation developers in two other sites needed nearly the same period of time. This has been due to financial difficulties, conflicts with local communities, market fluctuations but also poor management Another argument for smaller plantation concessions is that large and remote concession are notoriously difficult to properly monitor and evaluate. Based on the existing evidence, 20,000 ha seem to be the maximum single block area that a company can effectively plant and manage. This is

[45] In Manokwari district, the oil palm plantation is currently managed by PT PN II. This area was formerly under the management of state-owned forestry enterprise, PT. Inhutani. In Boven Digoel, PT TSE which is currently managing oil palm plantation is also a logging company. In Kubu Raya district, PT BPK is linked to a logging company that managed the forest on land currently covered with oil plantations.

[46] The Ministry of Forestry decree's No. P. 33/Menhut-II/2010 regarding the procedures for the release of the conversion forest and The Ministry of Agriculture's decree No. 26/Permentan/OT.140/2/2007 regarding the guidelines for estate crop business licensing.

[47] A number of companies involved in the development of oil palm plantations for MIFEE obtained on average 40,000 ha of land. See: *Warta Ekonomi*, Yr. XXII, 8 -21 March, 2010, page 32.

confirmed by a recent government setting the maximum area for crop estates in Papua at 10,000 ha or 20,000[48].

Depending on the effectiveness of the implementation of the Letter of Intent (LoI) between Indonesia and Norway and other REDD opportunities, the conversion of forests to plantations and other higher value land uses is likely to proceed, particularly in Papua as forest is often perceived by government planners as "idle" land that must be "optimized" for national and local development.[49] The findings of the study question this premise and related changes in land allocation and management practices.

The tendency to clear the forests to make room for plantations is a recurring element in the oil palm plantation sector in Indonesia. The national government has already earmarked 22.8 million ha of convertible production forests to be turned into estate crop plantations and other non-forestry purposes. The conversion of forest to other land uses is legal and the debate may not be whether this can be stopped, but rather about the extent to which the government would be willing to: (a) apply stricter criteria for plantation site applications, (b) revisit concessions already allocated to oil palm in forestland in order to ensure they are optimally used, and (c) promote new plantations on degraded land, offering incentives for companies that do so.

Incentives for growing oil palm on degraded land need to be formulated and promoted in order to steer companies away from established practices of forest conversion towards more sustainable and responsible operations. Unfortunately, a recently issued Government Regulation concerning procedures for changes in forestland functions[50] seems to go against attempts to rationalize the state-owned forestland categories and to make use of degraded land for oil palm plantations. The stipulation in this regulation that the convertible production forests which can be converted to non-forestry purposes may be forested or non-forested areas[51] provides leeway for companies to invest in oil palm plantations in the hopes of profiting from timber (Wakker 2005; Reinhardt, Guido et al. 2007; Casson et al 2007). Once timber is the main target, it also will jeopardize the conservation of forested areas of high biodiversity value.

It is therefore recommended that the granting of forested concession areas for oil palm plantations in Indonesia be evaluated and limited to 20,000 ha per unit area per company. This should also be supplemented by monitoring and evaluation of established estates to verify expansion rates to determine if additional area should be granted or unused concession land returned to customary land users. Based on official statistics from West Kalimantan, for example, it is clear that since the 1980s no single company has been able to develop more than 20,000 ha oil palm plantation on any single block of land (see Dinas Perkebunan Kalbar, 2010). Granting smaller concession

[48] Government Regulation No. 18/2010 regarding estate crop plantation business, which was issued on January 2010 or six month earlier than the issuance of the above mentioned Ministry of Forestry decree's No. P. 33/Menhut-II/2010.
[49] See *Agroindonesia*, 24 March 2010, "Tak Mudah Bangun 'Food Estate" [It is not easy to establish food estates]
[50] Government Regulation No. 10 of 2010 concerning procedure for changes in forestland functions.
[51] Article 19 of Government Regulation No. 10 of 2010.

areas would lead to more optimal use of the land, thereby minimizing negative impacts on forests and customary land uses. This is supported by the analysis by Herman et al. (2009), who determine 6000 ha of oil palm plantation to be a preferred concession size for economic feasibility. Further analysis of the track record of companies with larger land banks should be undertaken to form a more rational basis for policy decisions on the size of plantation concessions.

This study suggests that the clearance of forests causes not only loss of forest cover, but also leads to a range of direct and indirect environmental impacts. While some of these occur naturally, with or without the presence of plantations, some adverse impacts are clearly due to poor oil palm plantation practices. Findings from the three sites indicate significant environmental impacts such as soil erosion, flooding, biodiversity loss and air pollution ensue as a result of these practices. This raises the question of whether the concerned companies have implemented EIA guidelines effectively. An official at the Papua Provincial Agency for Environmental Management acknowledged that recent improvements in environmental regulations do not apply to those companies whose permits were issued during the 1990s. These companies have essentially been operating without EIA documents or guidelines.

Although some plantation companies have approved plans to manage and monitor environmental impacts on their plantation estates, the extent to which they actually do so is uncertain. While environmental management plans are in place, the problems associated with environmental impacts continue. It is clear that more consistent application of the management and monitoring measures prescribed under the environmental management and monitoring guidelines and associated EIA documents would mitigate some of the observed negative environmental impacts. It is also important that the plans are duly examined before approval to ensure they are not unreasonably optimistic or ineffectively implemented.[52] More stringent sanctions should be applied to the companies failing to mitigate adverse environmental impacts, and to the government institutions failing to take necessary actions for monitoring and supervision.[53] Act No. 32 of 2009 on Environmental Protection and Management requires companies to conduct an environmental audit either directly or through an independent taskforce. It remains to be seen whether this new instrument will be effectively implemented.

Socio-economic impacts

Findings suggest that socio-economic impacts are more positive than environmental impacts, although differentiated outcomes were observed for stakeholders affected differently by plantation expansion. Positive impacts were observed in terms of employment, with oil palm plantations absorbing up to half million of small holder families, thus contributing significantly to government efforts to reduce unemployment (Hunt 2010; Schwarz 2010). In West Papua, agriculture is the most important sector in

[52] In site 2, the company allocates only Rp 10 million to manage social conflict in and around the concession during the entire period of operation..

[53] The EIA document contains a statement that the oil palm company should cease operations once it is found that it failed to follow appropriate EIA guidelines.

terms of job creation, accounting for 57% of total formal employment in the province – a figure that is on the rise.[54] However, some important labor issues need to be addressed. Despite government regulations on minimum wages (UMR)[55], unskilled plantation workers are usually paid wages lower than the prescribed minimum. The company has its own calculation of how wages are determined for each type of work, based on output. This has meant that in order to reach the government minimum wage, unskilled workers have to work much longer hours than the standard 40-hour work week.

Some workers with more than five years' working experience feel that their livelihood has improved, others are disappointed with low salaries and limited benefits. Most plantations workers with 25 years of work experience have also decided to leave, as they are no longer physically able to do the job. Those workers generally report positive impacts from oil palm plantation and attest that working in plantations can provide them with adequate income. They have relatively good positions in the company, though this is enjoyed only by a small number of people.

Clearly, many outgrowers have experienced positive socio-economic impacts from oil palm. Most of them have benefited from higher returns and incomes compared to previous livelihood activities. This corroborates research findings in Sumatra and Kalimantan (Rist, et al, 2010). The relatively high profitability of oil palm in comparison to other crops has drawn many people to invest in oil palm. Despite some positive impacts, there is a question of how fairly have benefits been distributed among the actors involved, given that outgrower plantations are managed collectively through cooperatives. Individual growers often do not even know the precise location of their plantation plots allocated by the company, thereby impairing their contribution in terms of management and harvest. They end up working at impromptu selected sites. However their income would have been higher if plantation companies were more serious and transparent in allocating the plantation land for outgrowers.

One of the challenges facing the achievement of sustainable and responsible investments is how the land is transferred from customary land owners to companies. The root of the problem seems to lie in the process of allocating plantation permits to investors. When district agencies allocate permits and companies initiate negotiations with local communities, consultation with affected households is often fraught with difficulties. Companies often persuade land owners and customary land users to release the land using misleading information about potential benefits of plantation development, undermining the spirit of free, prior and informed consent. Investors and local government institutions also tend to approach village heads to negotiate agreements and compensation. However, most land, particularly in sites 1 and 3, is under collective ownership by various clans. Acknowledging customary land rights

[54] The August 2009 record has shown decreased employment in many sectors, but increased number of employees in agriculture, electricity and mining (*Berita Resmi Statistik* No.48/12/91/Th. III, 1 Desember 2009, Central Bureau of Statistics of West Papua Province, 2009).

[55] In late 2009, the Governor of West Kalimantan se the minimum wage levels for workers working in oil palm (Rp 779,000 equal to USD86) and forestry, logging, sawnwood and plywood industries (Rp 778,100). This is based on an assumption of 7 working hours per day and 40 hours per week.

requires that investors identify the rightful customary land owners. Governments should be aware of these complexities and assist the investors accordingly.

The negative image of oil palm plantations among customary land owners and users is also often related to their failure to fulfill their promises. Frequently, companies promise high levels of compensation, investment in public facilities and services, and other benefits. Yet in reality, these benefits turn out to be considerably restricted in scale or in their reach – and often restricted to employees and groups other than those suffering the most significant economic losses. Land owners often come to realize years after land transfer that the compensation they had received is inadequate to compensate for their losses, and seek to reopen negotiations. While several existing government regulations provide guidelines for fair agreements to be achieved at the outset, these guidelines are for the most part ignored.[56] The negotiation and compensation arrangements tend to be one-sided, dominated by the interests of investors.

Government policies to require oil palm plantations companies to adopt Nucleus Estate and Smallholder (NES) schemes and integrated NES and transmigration schemes (KKPA) have been successful. These schemes have provided an opportunity for smallholders to obtain work while securing access to land. As shown by this study, investing households in all sites recognized that the partnership model has been instrumental in improving their standard of living.

The affected neighbors indicate that they have also experienced positive impacts from the presence of plantations; however, upon closer examination we found that only a small number of people have actually derived benefits. The main concerns of this group relate to company expansion plans, which are likely to negatively impact their land and customary livelihood activities. However, this also presents an opportunity to improve land transfer practices during subsequent phases of expansion.

In order to improve plantation management practices among oil palm growers, a broader adherence and implementation of relevant codes of conduct or industry standards should be pursued by the oil palm sector supervisory organizations such as GAPKI (Indonesian Association of Oil Palm Companies) [57]. The most readily available mechanism, Roundtable on Sustainable Palm Oil (RSPO) with its 8 principles and 39 criteria, should help plantation companies to make significant progress towards sustainable plantation practices. The companies in site 1 and 3 are members of GAPKI. However, GAPKI is mostly business oriented and it does not have a system in place to require standard-specific plantation management practices and minimization of adverse

[56] The decree of the Head of National Land Agency No 21/1994 concerning procedure for land acquisition for investment and corporation, for instance, stipulates that transfer of land agreements shall be made into a written document. The available forms indicate that landowners shall express their willingness to transfer the land and accept to receive appropriate compensation. Interestingly, no space is provided to allow for their unwillingness to transfer the land.

[57] When it was established in 1981, there were only 23 oil palm companies, The membership number has now grown to 382, mostly companies operating in Sumatra and Kalimantan. GAPKI is the Indonesian Association of Oil Palm Companies aiming to advance the development of oil palm and provide input for policy making. GAPKI also coordinates CPO production targets and distribution for domestic needs and export.

impacts. GAPKI officials acknowledge they do not require its members to apply RSPO principles and criteria.[58]

None of the three plantation sites examined are member of RSPO, although the company in site 2 is affiliated with a large international group (Wilmar) which has been part of RSPO since 2006 [59]. The plantation company in site 3 is a subsidiary of the Korindo group until recently mostly concerned with logging operations and other forestry activities.[60] Considering the large plantation areas these companies manage and further planned development, it is important to find ways to affect their greater adoption of sustainability principles and better management practices.

One possible strategy that government decision-making should consider is to require all oil palm plantation companies to become the members of RSPO and implement appropriate principles and criteria.

CONCLUSIONS

The objective of this study was to shed light on the social and environmental impacts of oil palm plantations associated with bioenergy production. Most environmental impacts, especially deforestation, are allowed to occur due to the official perceptions of forest land in Indonesia as "idle" and official policies on forest conversion. From this perspective, the transformation of forest cover to more economically productive land uses is desirable. In practice, this means that plantation companies operating in Indonesia are frequently allowed to clear forest in order to establish plantations. This perspective is reflected in oil palm expansion plans and the classification of forest areas into different use zones.

Another important driver behind the expansion of plantations is the investment and development objectives of government institutions in Indonesia's provinces and districts. Since decentralization and regional autonomy was introduced in 1999, local policy-makers in Indonesia have taken steps to encourage plantation investment in their respective areas as a means to speed up infrastructure development and increase local tax revenues – with central government funding considered slow and inadequate. While the ultimate decision making power over plantation permits rests with Jakarta, districts and provinces play an important role in providing technical and political recommendations necessary to acquire plantation permits.

In many cases, the lack of legal recognition of customary land tenure in Indonesia has also contributed to accelerated plantation investment and pressure on forests. Even though companies are legally required to address traditional land claims and provide

[58] Based on a discussion organized by RSPO Secretariat. See: http://www.rspo.org/files/resource_centre/Laporan%20Komunikasi%20RSPO%20Liaison%20Office%20C-05.pdf

[59] Wilmar International Ltd., PT. Perkebunan Nusantara III, IV and V, for instance, have become the members of RSPO. See: http://www.rspo.org/.

[60] http://www.korindo.co.id/

compensation, the lack of legal backing for community claims, negotiation and compensation tends to be one-sided, dominated by the interests of corporations. On the other hand, lack of legal certainty has acted as a road block for oil palm investors. In this context, the legal uncertainty has to do with confusion and lack of synergy among government agencies responsible for various aspects of land allocation and concession permit issuance.

The failure of companies to effectively implement plans for environmental monitoring and management attribute to adverse impacts such as soil erosion, flooding, biodiversity loss, and increased haze, among others. Inconsistent application of the management measures prescribed under EIA procedures is unlikely to mitigate some of the observed negative environmental impacts. While approved EIA documents and policy instruments for protecting the environment are in place, government institutions should have a stronger role in minimizing adverse effects through regular monitoring and supervision and enforcing relevant regulations.

There is no doubt that oil palm plantations result in improved income among certain groups of stakeholders. The plantations also generate opportunities for employment and result in some improvement of public infrastructure in rural areas. However, findings indicate that in many cases oil palm plantations fail to deliver these benefits to a sufficiently large spectrum of actors. Those benefitting most are individuals with some prior experience, knowledge, or skills associated with oil palm, cash crops, or other plantations estates. Those who should benefit most (e.g. unskilled workers, local land owners, remote indigenous communities) are unable to reap significant benefits. Unskilled workers receive minimal compensation and must seek complimentary income generating activities on their own. Local landowners end up with shrinking communal land base, limited compensation for the land released for plantations, increasing time/labor investment needed for the collection of forest resources, and very few plantations jobs.

Among key unresolved issues in Indonesia's oil palm sector is the lack of legal recognition of customary land rights. The failure to recognize the traditional land use/ownerships system that have been in effect since time immemorial results in overt and latent conflicts among stakeholders involved in and affected by oil palm plantations. The customary land owners in all research sites are mostly native communities dependent on forests and other natural resources for their livelihoods, and therefore unaccustomed to intensive farming practices. Inability to adapt to the changing legal and economic environment renders these groups susceptible to negative impacts of oil palm development through their economic marginalization and damage to resources upon which their livelihoods depend.

In summary, there are several important processes that must take place in Indonesia in order to address the above negative impacts and find a way towards better outcomes from bioenergy development. Among the key steps needed is the synchronization of land use planning and license allocation procedures for plantations. All too often, and contrary to emerging environmental norms for biofuels, plantation permits are given for forested land. Uncoordinated permit issuance also leads to overlapping land claims by

concession holders. This requires closer coordination between relevant forestry, plantation and land-use planning agencies at multiple levels. The cross-sectoral turf war and mistrust has so far prevented this from happening (Patlis, 2005). Equally important is the legal recognition of customary land rights in Indonesia and their codification. Unless this is effectively accomplished, there is little hope for improving the livelihoods of customary land users in Indonesia through oil palm development. Benefits will instead continue to flow to non-native groups such as migrant laborers and transmigrants. In terms of plantation operations, it is important that closer attention be paid to ensure the adherence of plantation companies to best practice guidelines. This involves compliance to Environmental Impact Assessment (AMDAL) guidelines at the very least. More broadly, however, oil palm companies should be encouraged, and eventually perhaps required, to apply some of the most relevant RSPO criteria such as the protection of high conservation value forests and the use of FPIC practices in their estate operations.

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