Global Assessment of Biomass and Bioproduct Impacts on Socio-economics and Sustainability

Project No: FP7-245085

Global-Bio-Pact Case Study Socio-Economic Impacts of the Palm oil chain in Indonesia

WP 2,3,5,6 – D2.4

August 2011

PT. GREENLIGHT BIOFUELS INDONESIA

Author: Alison Wright - Greenlight Biofuels Indonesia

Editors: Agnes Safford – Greenlight Biofuels Indonesia
John Huffman

Contact: Alison Wright
Greenlight Biofuels Indonesia
alison@glbiofuels-sea.com

The Global-Bio-Pact project (Global Assessment of Biomass and Bioproduct Impacts on Socio-economics and Sustainability) is supported by the European Commission in the 7th Framework Programme for Research and Technological Development (2007-2013). The sole responsibility for the content of this report lies with the authors. It does not represent the opinion of the Community. The European Commission is not responsible for any use that may be made of the information contained therein. The Global-Bio-Pact project duration is February 2010 to January 2013 (Contract Number: 245085).

Global-Bio-Pact website: www.globalbiopact.eu

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Acknowledgements

The author would like to thank the European Commission for supporting the Global-Bio-Pact project, as well as Dr Diana Chalil and students at the University of North Sumatra for their support with data collection in North Sumatra and Yayasan Setera Jambi and Mahdayeni Je de Angel from Walhi Jambi for assisting with the data collection in Jambi. Maps and graphics were done by John Huffman, and support with desk based research was also provided by Primanitya Swastyastu from Greenworks Asia.

Abbreviations

AMDAL	*Analisis Mengenai Dampak Lingkungan* (Environmental Impact Assessment)
APKASINDO	*Asosiasi Petani Kelapa Sawit Indonesia* (Indonesian Palm Oil Growers Association)
APROBI	*Asosiasi Produsen Biofuel Indonesia* (Indonesian Biofuel Producers Association)
BAPPENAS	*Badan Perencanaan Pembangunan Nasional* (National Development Planning Agency)
BPS	*Badan Pusat Statistik* (Central Statistics Agency)
CPO	Crude Palm Oil
EU RED	European Union Renewable Energy Directive
FFB	Fresh Fruit Bunches
FPIC	Free Prior and Informed Consent
GAPKI	Gabungan Pengusaha Kelapa Sawit Indonesia (Indonesian Palm Oil Association)
GDI	Gender Development Index
GDP	Gross Domestic Product
GEM	Gender Empowerment Measure
GNI	Gross National Income
GRDP	Gross Regional Domestic Product
HDI	Human Development Index
ILO	International Labour Organisation
IOPRI	Indonesian Oil Palm Research Institute
IRR	Internal Rate of Return
ISPO	Indonesia Sustainable Palm Oil
KKPA	*Koperasi Kredit Primer Anggota*
MoF	Ministry of Forestry
NES	Nucleus Estate and Smallholder
NGO	Non Governmental Organisation
OSH	Occupational Safety and Health
PIR	*Perkebunan Inti Rakyat* (same as NES)
PKO	Palm Kernel Oil
POME	Palm Oil Mill Effluent
PPE	Personal Protective Equipment
PT	*Perseroan Terbatas* (Privately Limited Company)
PTPN	*PT Perkebunan Nusantara* (state owned plantation companies)
RBDPO	Refined Bleached and Deodorised Palm Oil
RBS	Roundtable on Sustainable Biofuels
REDD+	Reducing Emissions from Deforestation and forest Degredation
RSPO	Roundtable on Sustainable Palm Oil
SAKERNAS	*Survey Angkatan Kerja Nasional* (National Labour Force Survey)

SAN	Sustainable Agriculture Network
SEIA	Socio-Economic Impact Assessment
SUMUT	*Sumatera Utara* (North Sumatra)
SUSENAS	Survei Sosial Ekonomi Nasional (National Socio Economic Survey)
TINMAS BBN	Tim Nasional Pengembangan Bahan Bakar Nabati (National Biofuels Team)
WFP	World Food Programme

Preface

This report was elaborated in the framework of the Global-Bio-Pact project (Global Assessment of Biomass and Bioproduct Impacts on Socio-economics and Sustainability) which is supported by the European Commission in the Seventh Framework Programme for Research (FP7). Global-Bio-Pact is coordinated by WIP Renewable Energies and runs from February 2010 to January 2013.

The main aim of Global-Bio-Pact is the improvement and harmonisation of global sustainability certification systems for biomass production, conversion systems and trade in order to prevent negative socio-economic impacts. Thereby, emphasis is placed on a detailed assessment of the socio-economic impacts of raw material production and a variety of biomass conversion chains. The impact of biomass production on global and local food security and the links between environmental and socio-economic impacts are analysed. Furthermore, the Global-Bio-Pact project investigates the impact of biomass production on food security and the interrelationship of global sustainability certification systems with international trade of biomass and bioproducts as well as with public perception of biomass production for industrial uses. Finally, Global-Bio-Pact focuses on socio-economic sustainability criteria and indicators for inclusion into certification schemes, and the project elaborates recommendations on how to best integrate socio-economic sustainability criteria in European legislation and policies on biomass and bioproducts.

A core activity of Global-Bio-Pact is the description of socio-economic impacts in different countries and continents in order to collect practical experience about socio-economic impacts of bioproducts and biofuels under different environmental, legal, social, and economical framework conditions. The results of these surveys are described in different case studies.

The present report presents the Global-Bio-Pact Case Study for the palm oil chain in Indonesia. This Case Study was elaborated by Greenlight Biofuels, Indonesia.

1. Introduction

A strong public debate on sustainability aspects for biomass use for energy and products emerged in the last few years. This debate focused mainly on negative social and environmental impacts. In consequence, several initiatives were set-up, which are engaged in developing tools to ensure sustainability of biofuels. One option to ensure the sustainability of biofuels is the application of certification systems.

The main aim of the Global-Bio-Pact project is the improvement of global sustainability certification systems for biomass production, conversion systems and trade in order to prevent negative and to promote positive socio-economic impacts. Thereby, emphasis is placed on a detailed assessment of the socio-economic impacts of feedstock production and a variety of biomass conversion chains.

In order to generate data on the ground, five in-depth case studies for socio-economic impacts were investigated in the framework of Global-Bio-Pact:

- Biodiesel from soy in Argentina
- Palm oil and biodiesel in Indonesia
- Bioethanol from sugarcane in Brazil
- Bioethanol from sugarcane in Costa Rica
- Jatropha oil and biodiesel in Tanzania
- Jatropha oil and biodiesel in Mali
- 2nd generation biofuels and products from lignocellulosic material in Europe and North-America

The present report presents the Global-Bio-Pact Case Study for the palm oil chain in Indonesia. This Case Study was elaborated by Greenlight Biofuels Indonesia.

2. Case Study selection

Since the impacts of the production of biofuels and bioproducts depends on the investigated scale, different levels were investigated in all Global-Bio-Pact Case Studies, including the national, regional, and local/company/project level (Figure 1). In each Case Study country of the Global-Bio-Pact project the following assessments were made:

- One study at national level
- One study at regional level
- Two studies at local, company or project level

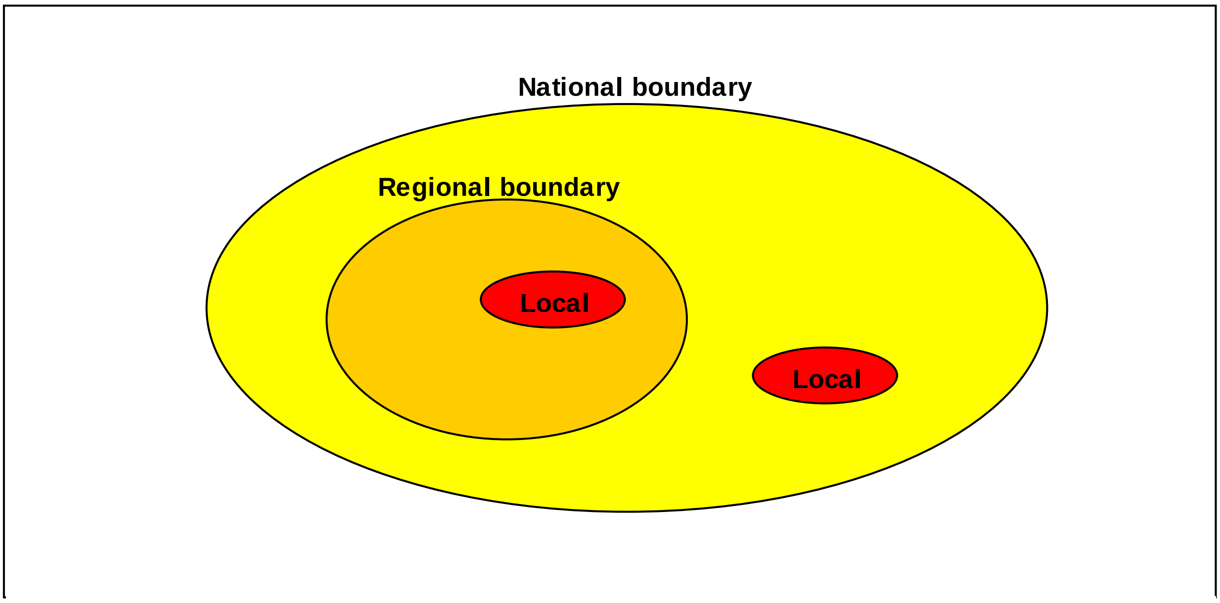


Figure 1: System boundaries of the Global-Bio-Pact project

2.1 Case Studies at national level

The Case Studies at the national level were selected in order to balance the geographical distribution (Africa, Latin America, Asia, Europe, N-America), feedstock sources (soy, palm oil, jatropha, sugarcane, lignocellulosic feedstock), conversion technologies (e.g. fermentation, pressing, transesterification, hydrolysis, gasification) and products (biodiesel, pure plant oil, ethanol, bioproducts, 2nd generation technologies). Thereby, the assessment focuses on existing conversion technologies since these are the current hotspots of socio-economic concern, but also include impacts of future technologies which are not yet commercially available.

The present report presents the Global-Bio-Pact Case Study for the Palm Oil Chain in Indonesia

2.2 Case Studies at regional level

In this project, the regional level was defined as a homogenous region in climate, soil, and socio-economic parameters. The size of the region depends on the country and can be a province or district.

In the present report, North Sumatra was selected as Case Study region as it one of the centres of the palm oil industry. Palm oil production in Indonesia began in the province and as such, a wide variety of plantations can be found in the region. Moreover, the full extent of the palm oil conversion chain is represented in North Sumatra.

2.3 Case Studies at local level

At the local level the system boundary is a local area from an e.g. farmer, company, association or project level. The local area refers to the area where the biomass feedstock (including by-products) is produced and converted into the final or intermediate product. In each Global-Bio-Pact Case Study country different local Case Studies (projects, companies) were selected and investigated. These local Case Studies can be within or outside the regional boundary. In the present report, three case studies were selected to represent palm oil production, as most socio-economic indicators identified are concentrated at the production stage. These include one palm oil plantation and two contrasting examples of independent smallholders. At the conversion stage, the palm oil mill associated with the plantation was studied. Due to the limited scale of biodiesel production in Indonesia it was not possible to study a specific biodiesel refinery. This issue has been partially addressed through a desktop study. The specific case studies chosen are:

1. Aek Raso Plantation in Labuhan Batu District of North Sumatra. This is an established state-owned plantation with an associated plasma smallholder scheme. This case study was selected as a typical example of plantations in the region, and also allowed for the study of outgrowers.
2. Independent smallholders in Desa Asam Jawa, also in Labuhan Batu District. This represents an example of established smallholders, in a reasonably well situated location.
3. Independent smallholders in Harapan Makmur, Tanjung Jabung Timor District of Jambi province. These were selected to represent a contract to Asam Jawa, being recently established, and in a more isolated location.
4. Aek Raso mill, located on Aek Raso Plantation. This was selected as a typical example of an Indonesian palm oil mill.

3. General description of the Case Study

3.1 Case Study at the national level: The Indonesian context

3.1.1 Land use

Indonesia's 189 million ha land area extends over an archipelago of over 17,000 islands, of which around 6,000 are inhabited (Figure 2). Two thirds of Indonesia's land area (127 million ha) is designated as 'forest zone'[1], although it is estimated that up to 30% of this land has no forest cover[2]. Most land in this zone lies on Indonesia's outer islands. The government categorises forest zone land, allocating various functions to different areas[3]. 55 million ha is designated as protection and conservation forest, which is afforded varying degrees of protection, while production and conversion forest, allocated to economic activity, account for 70 million ha (Ministry of Forestry 2006)[4]. Indonesia is experiencing a net loss of forest cover, and degradation of its remaining forests, although precise and up to date data is unavailable[5].

[1] Land designated as belonging to or being under the control of the Ministry of Forestry.
[2] This is due to the fact the land classification is administratively defined and does not always correlate with land cover or land use
[3] Functions stated in Article 6 of 1999 Forestry Law.
[4] See World Bank (2006_2: 20) for a full discussion of State Forest Land classifications.
[5] See World Bank (2006_2: 26) for an analysis of available data.

Agricultural land accounts for around 27% (172 million ha) of Indonesia's land area (FAO Resourcestat). Of this, estate crops account for the largest proportion of land (18.5 million ha) with palm oil plantations as the biggest and fastest expanding land user (see section 3.2.4). Other significant agricultural land uses include lowland rice, occupying 7.9 million ha and dryland crops and horticulture covering 10.8 million ha. (IFAD, 2008).

Figure 2: Map of Indonesia

Source: Nations Online

3.1.2 Economy and poverty

Indonesia is a lower middle income country with a Gross National Income (GNI) per capita of €2853) in 2009. GDP in 2008 was €370,699 million), with growth rates between 2004 and 2008 averaging 5.7% (5.03% - 6.28%) (World Databank). The Indonesian economy proved relatively resilient during the recent global financial crisis; although exports declined, overall economic growth was sustained (Basri et al, 2010). In 2009, the manufacturing sector accounted for the largest share of GDP (26%); agriculture (outlined in section 3.1.4) contributed 16%; mining and quarrying 11% and construction 10%. The remaining service sectors together accounted for 47% of GDP (BPS).

Indonesia has faced challenges over recent years in converting economic growth into job creation. The current labour force (2010) is 116.5 million, with a labour force participation rate of 67.7%. The latest unemployment figures (August 2010) indicate that 8.3 million people are unemployed, with open unemployment rate of 7.14%, which is a slight decline from previous years (in 2008 the rate was 8.46%) (BPS). The Indonesian economy is characterised by a large informal economy, and underemployment is a concern, estimated in 2006 at 30% of the workforce (ILO, 2007). As with many economic and social variables in Indonesia, entrenched regional disparities exist in unemployment rates.

In 2009, 32.5 million Indonesians lived below the national poverty lines[6] (14.5% of the population), with poverty rates being higher in rural areas (17.35% of the rural population live below the rural poverty line) and amongst agricultural households (BPS; IFAD, 2008). Indonesia has made considerable progress in reducing its income poverty rate in recent years, although poverty figures disguise a large number of 'near poor' people who live just above the poverty line and who are vulnerable to poverty. In 2006 around 32% of the population lived above the national poverty line but under US$2 per day (World Bank 2006_1). Again, wide regional disparities are a feature of poverty in Indonesia. Income inequality is moderate, with a Gini coefficient of 38 in 2007 (World Databank), although this has steadily increased over the last decade, indicating increasing inequality (Winoto, 2010).

3.1.3 Population

According to Indonesia's 2010 census, the country's total population is 237,641,326, with a growth rate of 1.18% (BPS). Population distribution in Indonesia is characterised by marked differences in population density between regions (Figure 3). The island of Java, on which the capital Jakarta is situated, is the most densely populated region, with an average density of 2070 people per sq. km, and home to 60% of Indonesia's population. In stark contrast, regions in Indonesia's outer islands are very sparsely populated. The provinces in Kalimantan on the island of Borneo, have an average population density of 44 people per sq. km, while Papua has only 10 people per sq. km. Sumatra, despite rapid urban development in recent years, still only has an average density of 199 people per sq. km (Indonesia Embassy, 2010).

Figure 3: Population distribution in Indonesia

Indonesia is home to a diversity of regionally concentrated ethnic groups. While the national language is Bahasa Indonesia, most ethnic groups retain their own languages alongside the national tongue. The largest group is the Javanese, accounting for 45% of the population, followed by the Sundanese (14%), Madurese (7.5%) and ethnic Malay (7.5%). The remaining

[6] Aggregation of rural poor and urban poor – different poverty thresholds apply to rural/urban areas.

26% of the population is composed of a range of minority groups including the Balinese, Achenese, Batak, Minangkabau and Chinese.

3.1.4 Agricultural sector

The agricultural sector continues to make a significant contribution to Indonesia's GDP, comprising 14.5% of GDP in 2008. The sector continues to grow; the provisional growth rate in 2008 was 4.77%, an increase on recent years (average growth rate between 2004 and 2007 was 3.08% per year) (BPS). Nevertheless, the long term trend is a reduction in the contribution made by the sector to Indonesia's GDP (IFAD, 2008), a trend attributed to the significant slowing of productivity gains since the mid-1990s (World Bank, undated). Agriculture remains the largest sector of the economy in terms of employment, accounting for 41% in 2009, although wages are low; the average daily wage for a farm labourer is around €2.11 (BPS).

Food crops still make the most significant contribution to GDP within the agricultural sector (49% in 2008; 7.5% share of overall GDP) and staple crops, particularly rice, remain a strategic policy priority for the Indonesian government. The long term trend, however, is a reduction in the relative importance of food crops within the sector (IFAD, 2008).

Estate crops, including oil palm, cocoa and rubber, constituted 14% of the agricultural sector in 2008 (2.1% share of overall GDP). This subsector is the most important contributor to Indonesia's export earnings; palm oil and derived products contributed 6% of export earnings in the period 2003 to 2007 (World Bank 2010), with crude palm oil as the leading commodity export, worth around €5150 million in 2007[7] (FAO Tradestat). Other agricultural products contributed 4% over the same period (World Bank 2010).

3.1.5 Forestry sector

Forestry contributes directly to Indonesia's GDP through the production of tropical hardwood logs. It also contributes indirectly, through processed forest products: sawnwood, plywood and other boards, and pulp for paper making. Forest harvesting only constitutes a 5.5% share of the agricultural sector (0.8% share of overall GDP), while forest products[8] contribute an 11% share of the non oil and gas manufacturing sector (2.5% share of overall GDP)[9] (BPS). The forestry sector and most sub-sectors have shown negative growth rates in recent years, a trend attributed to forest fires, income losses from illegal logging and a slowdown in the rate of production of wood products (BAPPENAS, 2007)[10].

The majority of Indonesia's wood production is used by the domestic wood processing industries. While significant proportions of the output from these industries are exported (World Bank, 2006_2) domestic consumption of processed products, in particular paper, is growing (Indonesian Commercial Newsletter, 2006). The destinations of processed wood exports vary

[7] US$ million 6868.
[8] Combined % for 'Wood and other products industries' and 'Paper and printing'.
[9] Provisional figures given at current market prices.
[10] Growth rates of GDP by Industrial Origin: http://dds.bps.go.id/eng/tab_sub/view.php?tabel=1&daftar=1&id_subyek=11&notab=9. Negative growth rates for all forestry sub-sectors in period 2004 – 2009 except 'Paper and printing'.

by product type, although China, Japan and the Republic of Korea consume over half of Indonesia's plywood, pulp and sawnwood exports. The largest market for secondary processed wood products, in particular furniture, is Western Europe (World Bank, 2006_2)**.**

The forestry sector has seen important structural changes in recent decades, largely as a result of government policies. Most significantly, the pulp sub-sector has grown very rapidly since the mid-90s, now accounting for half of Indonesia's log consumption (World Bank, 2006_2). The increase in demand from the pulp sub-sector has far outstripped the development of pulp plantations and sustainable, legal harvesting. This shortfall has created powerful incentives for overharvesting and illegal logging and trade. Estimates suggest that up to 2/3 of Indonesia's forest sector production is based on non-legal sources (ibid).

Developments and tensions in the forestry sector have important implications for understanding palm oil development. Firstly, the granting of palm oil concessions permits the concessionaire to clear fell areas of conversion forest. Harvesting and selling this timber, even on degraded land, provides an economic boon to rights holders and means that plantation development is sometimes not followed through (World Bank, 2006_2; van Gelder, 2004). Secondly, there is a tension between policies designed to increase the sustainability of the pulp sector by encouraging pulp plantations and the development of oil palm plantations as the two are in many cases in competition for suitable sites (World Bank, 2006_2).

3.1.6 Land ownership and concentration

Indonesia faces a number of issues related to land ownership, many of which are important in the context of oil palm plantation development. Firstly, there are a large number of people in rural areas of Indonesia who have little or no land; the 2003 agricultural census indicated that almost half of agricultural households cultivate less than 0.5 ha of land (Winoto, 2010). Furthermore, there are high levels of inequality in the distribution of agricultural land ownership, with a Gini coefficient of around 0.6 (ibid). An increasing number of conflicts over land have been witnessed in recent years; in 2007, there were 7491 significant land disputes and conflicts recorded, covering almost 608,000 ha of land (ibid). Many such conflicts have resulted from the allocation of land for plantation estate development (Wakker, 2005).

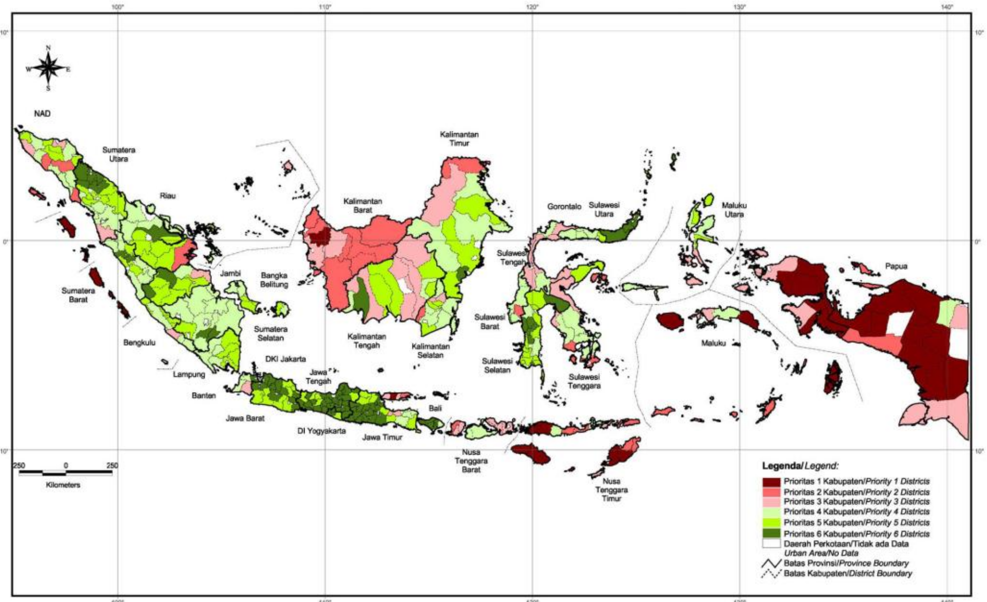
These issues are attributed to a number of problems and weaknesses in Indonesia's system of land governance. Firstly, the land ownership structure, largely a legacy of the Dutch colonial system along with later allocation processes, has proved inflexible in responding to social changes (Winoto, 2010; Marti, 2008). A second set of issues concerns the lack of transparency, complexity and confusion surrounding the legal framework governing land rights. Furthermore, and crucial to explaining land conflicts surrounding palm oil concessions, there is a lack of adequate legal recognition of customary rights to land.

Access to much of the land supporting the livelihoods of rural households, particularly forest dwellers, is regulated by customary law (Wakker, 2005) and few local farmers have titles to land (World Bank, 2010). These rights are partially recognised by the Indonesian constitution, but are legally subordinated to the needs of national development and government agencies have discretionary power in deciding whether to respect them (Colchester et al, 2006). Although in theory recognition of indigenous rights has improved since the end of the Suharto era in 1998, even recent legislation gives businesses the right to take over land if plans are in accordance with state development plans (Marti, 2008). There also appears to be considerable variation between provinces in the degree to which local governments recognise local communities' land right, despite operating within the same legal framework (Colchester et al, 2006). There do, however, appear to be early signs of move towards strengthening community and traditional rights and implementing supporting regulation (AIPP, 2011).

3.1.7 Food security

A long term trend since the 1970s has been a decline in food insecurity in Indonesia. The country reduced its Global Hunger Index score by almost 50% between 1981 and 2009 from 28.17 to 14.8[11] (IFPRI, 2009). Despite this trend, problems of food insecurity persist. Data on nutritional status indicate that 28% of children under five are underweight, and 44% are stunted due to nutritional deficiencies (WFP, 2007). These problems are more evident in some parts of the country than others, and tend to be worse in Eastern Indonesia (Figure 4). Other provinces categorised by the World Food Programme as chronically food insecure include South Sumatra, East Java, West, East and part of Central Kalimantan (ibid). The principal issue for food insecure groups in recent years has been a lack of access to food, primarily due to high food prices. High food prices, in turn, have resulted from a combination of domestic policy and spikes in international prices. Self sufficiency in food has long been held as a key policy goal in Indonesia. This has been most evident in the national rice policy, described in section 3.1.9.

Figure 4: Vulnerability to food insecurity in Indonesia



Source: WFP (2007)

[11] The International Food Policy Research Institute's Global Hunger Index constitutes a measure of food security by equally weighting the proportion of undernourished as a percentage of the population, the prevalence of underweight children under the age of 5, and the under-five mortality rate.

3.1.8 Energy sector

Indonesia's primary energy consumption is dominated by fossil fuels. In 2008, oil, which has historically been subsidised, accounted for 45% of energy consumption, coal for 32% and gas for 19%. Of the remaining share of the energy mix, hydro power accounted for 3% and geothermal for 1.3%[12] (MEMR, 2009).

Indonesia is a producer of oil, coal and natural gas, but also has considerable potential as a producer of renewable energy, particularly geothermal power. Oil production has been steadily declining during the last decade, a trend that, combined with rising consumption, meant that Indonesia became a net importer of oil in 2004. The country is a net exporter of coal and natural gas (USEIA, 2010). As a tectonically active nation, Indonesia has approximately 40% of the world potential geothermal energy reserves, of which only a fraction is currently being exploited (Holm et al, 2010)[13]. There is also considerable potential for Indonesia to develop hydro electric power. Biofuel production began on an industrial scale in 2005, but this subsector has been faced with a number of issues, described in section 4.2.1. While the government has set ambitious targets for biofuel production, primarily biodiesel from palm oil, actual production has fallen far short of expectations, with approximately 400 million litres being produced in 2010 (USDA - FAS, 2010) (see section 3.2.5).

3.1.9 Policy framework

Indonesia's political landscape has undergone tremendous changes over the last decade. Foremost amongst them has been the transition from autocratic rule, which ended in 1998, to a multiparty democracy. This was followed by a process of decentralisation, which has given the country's regions considerably more autonomy over their development. A number of persistent challenges remain with regard to Indonesia's policy making and implementation. A key issue is poor coordination and disharmony between the various ministries of governments and between the various laws and regulations. This is a particular concern for sectors which cut across the mandates of several ministries, including the palm oil industry (see section 3.3.8).

A second issue concerns the tension between regional and national tiers of government. Again, this is a pertinent issue for the palm oil sector. The decentralisation laws passed between 1998 and 2002 gave regional governments significant control over land allocation, an important factor in the expansion of the sector, but this has been poorly coordinated. A range of financial incentives encourage local government to expand oil palm areas (Rist et al, 2010) and examples have been seen of regional government releasing land in ways which contravene national regulations (FOE, 2009, cited in World Bank, 2010).

A final and well recognised issue is corruption and lack of transparency, which is pervasive and cuts across many areas and levels of government; this is a contributory factor to poor law enforcement. Indonesia ranked 110/178 countries in Transparency International's perceptions of corruption Index 2010 (TI, 2010)

[12] Figures exclude 'biomass', which is predominantly firewood.
[13] 1,197 MW of an estimated 28,100 MW potential is currently being exploited (Rugerro, 2010)

Rather than attempting an overall policy review, the following highlights some of the key policies which are relevant for the development of the palm oil and biofuels sector.

Energy policies

Since 2006, Indonesia's energy policy has been attempting to shift the composition of the nation's energy mix, with important implications for biofuels. High oil prices in 2005 prompted the development of a strategic plan for energy security[14]. Alongside a move away from oil towards coal and natural gas, the national strategy includes a commitment to increase the contribution of renewable energy sources, including biofuels[15]. The target for 2025 is for 17% of energy to come from new and renewable sources, including 5% from biofuels (10% of energy use in transportation)[16]. Specific initiatives designed to promote biofuel development included the introduction of blending targets for state owned oil and gas company PT Pertamina, and the formation of the National Biofuels Development Team (TINMAS). Biofuels were seen as a particularly attractive option not only because of Indonesia's abundant source of feedstock, but also because they held the potential to reduce the expenditure burden of fuel subsidies while slowing energy sector carbon emissions and creating jobs (Butler, 2008).

Despite these ambitious targets, progress on energy diversification has been limited. Entrenched interests and the high levels of required investment, along with a range of issues retarding the development of biofuels (see section 4.2.1) have meant that targets are being missed (Simbolon, 2009).

Agricultural policies

Indonesia's key policy on food security is the National Rice Policy, intended to ensure self sufficiency in rice production. This takes the form of protecting domestic rice production through import restrictions and maintaining high domestic prices (Barichello and Patunru, 2009). While the potential for this policy to increase domestic rice production is debated, evidence suggests that it disproportionately affects incomes and hence food security amongst the poorest, who are net rice consumers (Timmer, 2004). It is also argued that this approach has led to an over dependence of the Indonesian food system on rice and has reduced the development of local food resources (Winrock, 2009). While this policy largely shields the domestic rice market from global fluctuations in prices, high prices of other staple food commodities such as maize and soybeans have affected domestic consumers, again disproportionately affecting the poor (Warr and Yusuf, 2010).

Forestry policies

Overall management of Indonesia's forest resources is the responsibility of the Ministry of Forestry (MoF) and the legal basis for the country's forestry policies is the 1999 Forestry Law. This law includes principles of good governance, and promotes both social and environmental objectives. While there is evidence that MoF programmes have been directed towards meeting these objectives, especially since 2004 (Yasmi et al, 2010), in reality Indonesia's forest policies

[14] National Energy Policy (Presidential Regulation No. 5/2006)
[15] Law no. 30/2007 on Energy
[16] Presidential Regulation No. 5/2006

often favour large scale resource extraction (FWI, 2009) and there remain considerable challenges and issues in the governance of the nation's forests.

Key issues concern both the design and implementation of forestry law and policy and include: forest assignment with little reference to conditions on the ground, meaning that less that 10% of forests are gazetted; inconsistent and overlapping policies; conflicting land use allocations between different levels of administration; weak state capacity for forest management and poor enforcement of forest laws (FWI, 2009). These issues are compounded by macroeconomic policies which reward district governments for resource extraction and hence incentivise resource depletion rather than stewardship (World Bank, 2011_1). There is also a lack of forest data in Indonesia, including information about forest boundaries and rights (FWI, 2009)

A recent development in the policy context of Indonesia's forestry sector is the signing of a presidential instruction implementing a two-year moratorium on issuing new forest permits. The moratorium is part of a $US 1billion REDD+ partnership between Indonesia and Norway and applies to between 64 and 72 million hectares of primary forest and peatland. The terms of the decree have, however, been met by widespread criticism. Crucially, areas of secondary forest are not covered. In addition, key Ministries overseeing forest exploitation activities such as the Ministry of Mines and Energy and Ministry of Agriculture are not mentioned. The decree also exempts existing permits; the extent and location of these is not clear (Gingold and Stolle, 2011). These issues mean that it is difficult to judge the extent to which the moratorium will help to reduce Indonesia's carbon emissions, but also the impact it will have on the palm oil sector.

Labour policies

Indonesia has ratified all ILO conventions related to core labour rights underpinning the Declaration on the Fundamental Principles and Rights at Work (Table 1).

Table 1: ILO conventions on core labour rights ratified by Indonesia

Area of labour rights	ILO conventions ratified by Indonesia	Date of ratification
Freedom of association and collective bargaining	No. 87: Freedom of Association and Protection of the Right to Organise Convention, 1948.	9.06.1998
	No. 98: Right to Organise and Collective Bargaining Convention, 1949	15.07.1957
Equality of opportunity and treatment	No. 100: Equal Remuneration Convention, 1951	11.08.1958
	No. 111: Discrimination (Employment and Occupation) Convention, 1958	7.06.1999
Child labour	No. 138: Minimum Age Convention, 1973	7.06.1999
	No. 182: Worst Forms of Child Labour Convention, 1999	28.03.2000
Forced labour	No. 29: Forced Labour Convention, 1930	12.06.1950
	No. 105: Abolition of Forced Labour Convention, 1957	7.06.1999

Source: APPLIS database

At the national level, the key labour laws are the 2000 Trade Union Act and 2003 Manpower Act. These Acts, in combination with additional and supporting legislation make broad provisions for labour rights and protections and meet most fundamental ILO standards[17]. These include the right to organise (for private sector workers) and protection for trade union members, provisions for prohibiting discrimination and restrictions on child labour. Indonesia has not ratified any of the ILO conventions on occupational safety and health (OSH), although there is legislation at the national level on OSH, primarily the 1970 Occupational Safety Act, and additional provision in the 2003 Manpower Act.

Labour legislation and enforcement falls under the mandate of the Ministry of Manpower. In addition, there is a separate ministry for women's empowerment, which coordinates children protection policies, although this does not have enforcement powers (Winrock, 2009)

Despite these legal provisions and protections, weaknesses exist in both the labour laws themselves and in the manner in which they are implemented. The ITUC (2007) highlights a number of discrepancies between Indonesian national legislation and ILO conventions, in particular relating restrictions on trade union rights and anti-discrimination legislation. Moreover, the reality of many aspects of labour rights in Indonesia gives cause for concern, including widespread discrimination on the grounds of gender and trade union membership and restrictions on the right to strike (ITUC, 2007). Issues relating to child labour are also persistent, and no child labour case has formally been acted on (Winrock, 2009). These issues are discussed further in section 4.4.

Other legislation relevant to employment provisions in Indonesia includes that pertaining to the minimum wage[18] and social security[19]. Minimum wage setting in Indonesia is de-centralized. The Governor of each province sets minimum wage rates for their respective province or regency in line with the basic cost of living. According to social security legislation, it is mandatory for companies above a certain size to pay contributions to JAMSOSTEK (national social insurance scheme), which covers employee benefits related to accidents, old age, death and health care.

3.2 The palm oil supply chain in Indonesia

3.2.1 Overview of the palm oil supply chain

The palm oil supply chain is comprised of three main stages: production of fresh fruit bunches (FFBs) in palm oil plantations; initial processing of FFBs into crude palm oil (CPO) in palm oil mills; and secondary refining and processing of CPO into a range of food and non-food products (Figure 6). The principal end use of CPO is in the production of cooking oil, with significant quantities also used in the production of margarine and shortening and oleochemicals. The use of CPO for the production of biodiesel is a relatively new development in Indonesia.

[1717] An exception is compliance with child labour conventions

[18] Regulation of the Minister of Manpower No.PER-01/MEN/1999 on Minimum Wages

[19] Employees' Social Security Act in 1992

Figure 5: Fresh Fruit Bunches (FFBs)
(USDA – FAS, 2007)

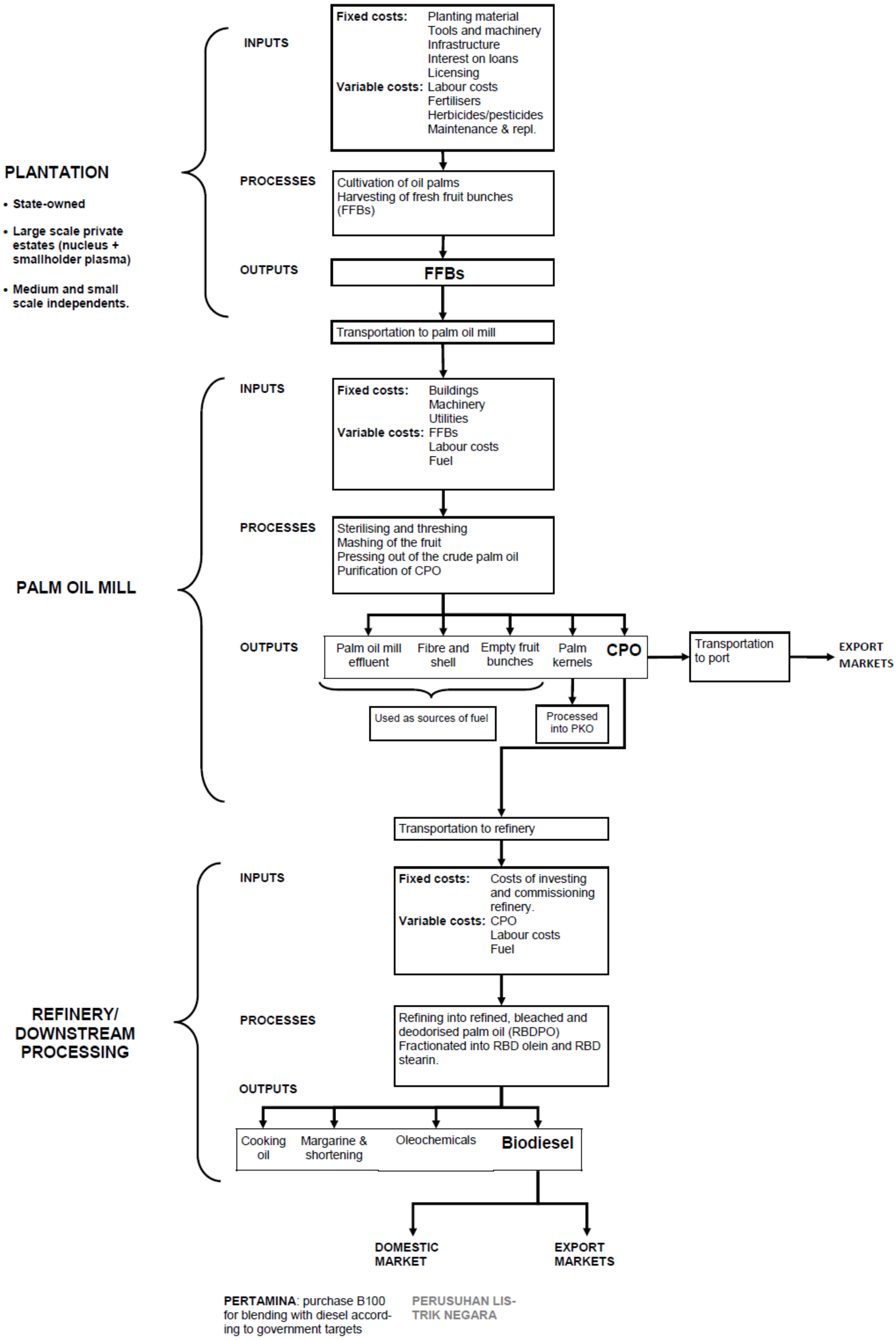
Palm oil is produced from the oil palm tree *Elaeis guineensis*, the products of which are fresh fruit bunches (FFBs) (Figure 5). Commercial oil palms used in Indonesia are almost exclusively DxP or Tenera hybrid, bred for their higher yields (USDA – FAS, 2007). After planting, the young palms take 30-36 months to produce their first harvestable FFBs, and yield their peak harvest from years 8-15. The oil palm's economically viable life span is typically 22-25 years, although can be extended for as long as 30 years, after which the old stand requires replanting (ibid).

Harvesting of FFBs in Indonesia is done manually. From the field, FFBs are transported to the palm oil mill for processing. Around 24 hours after harvesting the FFBs begin to degrade in quality, so palm oil mills are situated on or in the vicinity of the plantations. In the palm oil mill, bunches undergo sterilizing and threshing to free the palm fruit, mashing of the fruit and pressing out of the crude palm oil. The crude oil is further treated to purify it for storage and export. The primary output of this initial processing is therefore CPO, derived from the fleshy part of the oil palm fruit (mesocarp). The fruit kernels are also separately processed into palm kernel oil (PKO); a process that may take place in the same mills or elsewhere. One tonne of FFB yields approximately 0.21 tonnes of CPO and 0.05 tonnes of PKO (DG Estate Crops 2007, cited in World Bank, 2010).

Further refining of CPO takes place in a palm oil refinery. CPO is first refined into refined, bleached and deodorised palm oil (RBDPO), and then fractionated into RBD olein and RBD stearin. These components are then used to produce a variety of food and non food products. The liquid fraction (olein) is used extensively as a cooking oil, while the solid fraction (stearin) is used to produce margarine and shortening. Indonesia also has refineries producing oleochemicals (including fatty acids, fatty alcohol, methyl ester and glycerine) and biodiesel from CPO[20].

[20] More research is needed to determine the ownership and production levels of Indonesia's palm oil refineries.

Figure 6: Overview of the palm oil chain in Indonesia



3.2.2 Description of the production system

A number of phases can be identified in the production of palm oil, described in this section. It should be noted, however that as oil palm is cultivated by a range of actors, inevitably the technical knowledge and capacity and financial situation of the various producers differs. Moreover, interest in improving practices and willingness to follow standards even by the large scale growers also varies widely. The following is an attempt to describe typical practices, while highlighting some of this diversity.

The first stage of plantation development is land clearance. Oil palm plantations in Indonesia have typically replaced forests, and their expansion is a significant factor in lowland tropical deforestation. Most oil palm development has taken place on forest land designated as production or conversion forest (World Bank, 2006_2). Although there is increasing pressure to use 'degraded land' for new oil palm development[21] a commonly accepted definition for such areas has yet to be established (Gingold, 2010) and Indonesia's land classification system associated governance issues represent significant challenges (Winrock 2009). A significant amount of recent oil palm development has also occurred on peatland.

Land clearance therefore typically begins with logging of timber within the concession area. Although the practice is illegal, and more reputable companies have adopted zero-burning techniques to clear remaining vegetation, fire is still used for land clearance in Indonesia (Wong-Anan, 2010). This is in spite of international concerns, and the implementation of an ASEAN Agreement on Transboundary Haze Pollution[22].

After land clearance, further field preparation is required, including the establishment of a field drainage system and the development of roads by estates. Soil conservation measures such as terracing, conservation bunds and silt pits and sowing of leguminous cover crops may also be employed at this stage, when the risk of soil erosion is highest (Teoh, 2002). After field preparation the seedlings will be planted. The establishment phase (prior to production of the first harvestable FFBs) is typically between 3 and 4 years.

Field Maintenance includes water and soil management, pruning, weeding, pest and disease management and fertiliser application. Soil and water management practices vary; larger estates commonly employ independent consultants and follow recommendations, whereas most smallholders do not use such practices. Poor water management leads to concerns about drainage (especially on peat) and unsustainable irrigation (Proforest et al, 2004). Integrated pest management has been adopted by some estates. In all but a few best practice examples, nitrogen-based chemical fertilisers are used in large quantities on Indonesian plantations; there is very limited use of organic fertilisers. Chemical herbicides are also used in significant quantities and there is widespread use of paraquat, which has been the focus of campaigns on healthy grounds (e.g. Berne Declaration, 2011).

After planting, the young palms take 30-36 months to produce their first harvestable FFBs, and

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[21] One initiative promoting this approach currently under development in Indonesia is the World Resources' Institute's project POTICO: http://www.projectpotico.org/

[22] See http://haze.asean.org/info/history-response for more details.

yield their peak harvest from years 8-15. Harvesting of FFBs in Indonesia is done manually, and is relatively labour intensive, with an average of one worker per 3 ha. (Barlow et al, 2003). The oil palm's economically viable life span is typically 22-25 years, although can be extended for as long as 30 years, after which the old stand requires replanting (USDA – FAS, 2007).

3.2.3 Description of the conversion processes

Palm oil processing involves two main stages: primary processing in a palm oil mill and secondary processing in a refinery. The purpose of this initial processing is to physically extract the CPO (and palm kernel oil) from the FFBs, while in the second stage CPO is further refined before being used in a range of food and non food products.

The first process at the mill is the sterilising of FFBs, which takes place in pressurised vessels using steam at high temperatures. This process both arrests the formation of free fatty acids (FFAs) and softens the bunches in preparation for subsequent sub-processes. After sterilising, the bunches are stripped of their fruitlets in a thresher, leaving empty fruit bunches (EFB) as a waste product. The fruitlets are then transferred to a press digester where they are heated using steam, while being stirred; this loosens the oil bearing mesocarp from the nuts while breaking open the oil cells. The digested mash is then pressed to extract the oil. The press cake is sent to the kernel plant so that the kernels can be recovered, while the oil is diluted and clarified in vertical clarifier tanks. Clarified oil is subsequently transferred to purifiers, which remove dirt, moisture and other impurities and finally dried in a vacuum drier to prepare it for storage and dispatch. Meanwhile sludge from the clarifier is fed into a centrifuge to extract remaining oil. The waste product from this process is palm oil mill effluent (POME). The press cake is subsequently processed using depericarper, which separates the nuts from the fibre. The nuts are then cracked using a winnower and hydro-cyclone; the kernels are extracted and can then be further processed to extract palm kernel oil, leaving the shells behind (Teoh, 2002).

The side products from the milling processes are utilised to varying extents on Indonesian plantations. Shells and fibre are in demand as a fuel source, and are sold or used by the mills themselves. Empty fruit bunches are also burnt, both to avoid their accumulation, which is considered a fire hazard, and to produce ash for use on the plantation. Burning of EFBs, however, is often a source of air pollution due to the mills' inappropriate boiler capacity. Despite the potential for EFBs to be recycled as organic fertiliser, as noted above, this practice has seen very limited adoption in Indonesia. POME was, in the past, returned directly to water courses, affecting both aquatic ecosystems and local communities. Although problems persist, observations suggest that POME management is improving in Indonesian palm oil mills, and that regulations are being more strictly enforced. Indonesia does, however, still lag behind Malaysia in POME management (Sheil et al, 2009).

A few large palm oil mills in Indonesia have integrated refining capacity, but the majority of refining takes place elsewhere, either in Indonesia or in the destination country after export. The refining of CPO removes free fatty acids, phosphatides, odouriferous matter, water, and other impurities. This is necessary for CPO to be used in food products, and the objective is to produce an edible oil of consistent quality that meets industry standards.

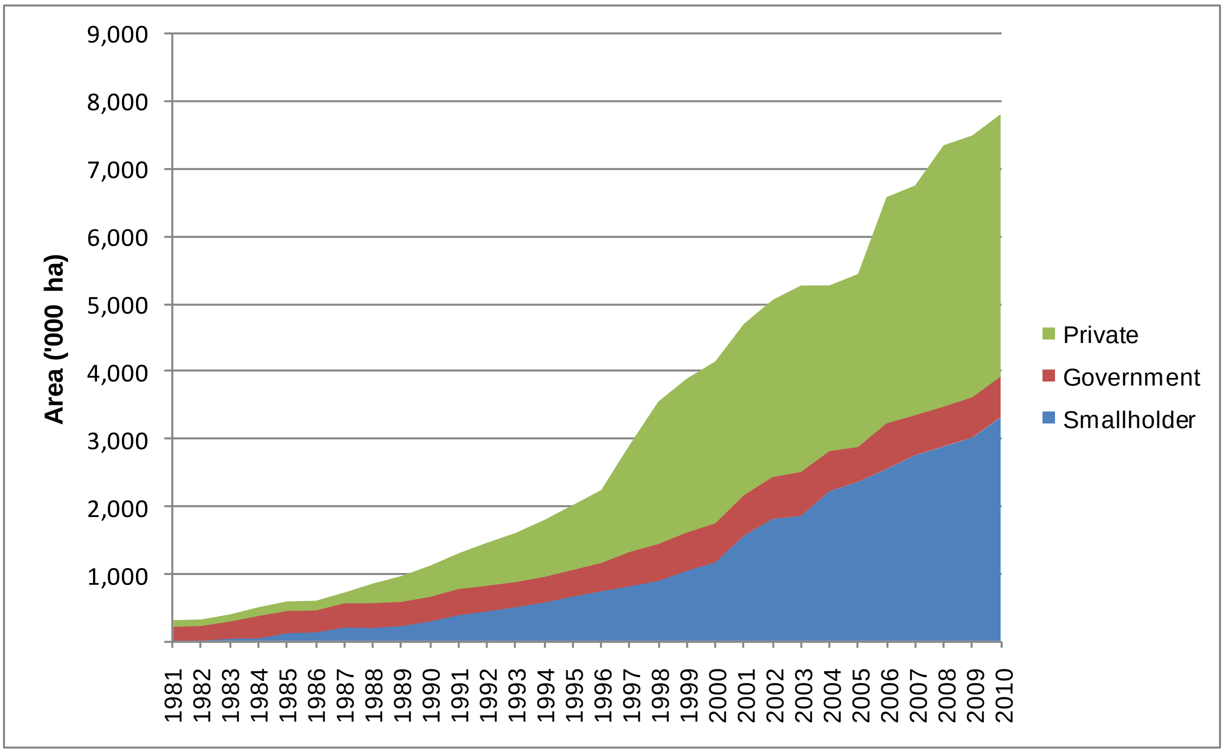
The first stage of the refining process produces refined, bleached and deodorised palm oil (RBDPO), most commonly by physical refining. CPO is firstly degummed; it is treated with phosphoric or citric acid to remove natural gums. It is then bleached, which removes coloured matter and any metal ions in the oil, then subsequently heated for simultaneous deacidification and deodorisation. The treated oil is then subjected to steam distillation, which strips free fatty acids while removing odours. The oil is then cooled to 55°C before polishing. The second refining stage is fractionation. The main fractions from the refined oil are (RBD) olein (liquid fraction) and (RBD) stearin (solid fraction). These fractions can be separated by dry fractionation, detergent fractionation and solvent fractionation. RBDPO and its fractions are used for different purposes. Most refined oil is used for food purposes; (RBD) olein is mainly used as cooking oil, while (RBD) stearin is used in the production of margarines and shortenings. RBDPO (unfractionated) is also used to produce margarine and shortening along with frying fats and ice cream (Teoh, 2002).

CPO and RBDPO (and palm kernel oil) are also used to produce a wide range of non food products. These may result from direct processing of CPO/RBDPO (such as biodiesel, drilling mud soaps, and epoxidised palm oil products (EPOPs)), or through the oleochemical route. Biodiesel is produced in reactors by the process of transesterification; RBDPO is mixed with an alcohol (usually methanol) in the presence of a catalyst. This process produces methyl esters (biodiesel) and glycerol, which may either be allowed to separate by gravity, or the methyl ester is separated from the glycerol and washed with water and acetic acid until the washing water is neutral. The methyl ester is then dried by heating. The co-product from the production of biodiesel is therefore glycerol, which may be used to produce soap or other products. Wastewater is also produced, which should be treated before being disposed of or released into the environment (Teoh, 2002).

3.2.4 Trends in production and supply

Palm oil production in Indonesia has expanded rapidly in recent years, stimulated by increases in demand. Indonesia's total CPO production was 19.4 million tonnes in 2009 (DG estate crops). The government target for CPO output by 2020 is 40 million tonnes (Jakarta Post, 2009_2). Production increases have come primarily from expansion of plantation area, but also from increases in yield.

Figure 7: Expansion of oil palm area by ownership category



Source: DG Estate Crops data.

The total area planted with oil palm has increased dramatically in recent years: between 1997 and 2010 oil palm area increased from 2.9 million ha. to 7.8 million ha (Figure 7). This translates into average growth rates of 8% per year over this period. Although private estates still occupy the largest share of planted area (50%), the fastest growth over this period came from smallholder areas, which grew at an average of 12% per year and now occupy around 42% of oil palm areas. The remaining 8% is controlled by state owned plantations (DG estate crops). This area is expected to continue to grow at an estimated annual expansion rate of 400,000 - 500,000 ha from 2006 to 2020 (Bisinfocus, 2006). Most of this expansion, particularly by private plantation companies is expected to take place in Kalimantan and Papua, as suitable land in Sumatra is increasingly scarce.

Indonesia's biofuels targets also include plans for palm oil area expansion. Between 2010 and 2015, the government plans to develop 1.5 million ha of new oil palm plantations in order to reach 6 million tonnes of biodiesel annually, and between 2016 and 2025, the plantation area for biodiesel is to increase by an additional 4 million ha[23] (Andriani et al, 2010). As noted elsewhere, targets related to biofuel expansion should be treated with caution.

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

Palm oil yields per hectare are also increasing, further accelerating growth in production. Between 1997 and 2007, average yields increased from 1.9 to 2.7 tonnes of CPO per ha[24], with most of the yield gains in recent years attributed to improved planting material (Sheil et al 2009). Average yields in smallholder areas, however, are falling behind those of private estates[25] (World Bank, 2010).

Data on palm oil conversion facilities is updated less frequently than production. In 2006, there were 477 palm oil mills in Indonesia (Table 2). The majority of these were in Sumatra, and were concentrated in North Sumatra and Riau. Most mills are associated with plantation areas owned by the same company, although Ministry of Agriculture statistics indicate that there were also 57 independent mills, again concentrated in Sumatra (cited in World Bank, 2010).

Table 2: Distribution of palm oil mills

Location	Oil palm area (ha)	Mills (no. of units)	Intake capacity (t FFB/hr)	CPO output capacity (t/yr)[26]
Sumatra	4,203,196	402	17,233	16,285,185
Kalimantan	1,485,141	57	2,770	2,617,650
Java	21,184	6	215	203,175
Sulawesi	239,814	8	270	255,150
Papua	125,591	4	170	160,650
Total	**6,074,929**	**477**	**20,658**	**19,521,810**

Source: DG Estate Crops, 2007 and IPOB, 2008, cited in World Bank 2010

3.2.5 Trends in national level demand

As an export oriented commodity, the palm oil sub-sector is principally affected by demand conditions in international markets. Nevertheless, domestic demand for CPO has continued to grow. While biofuel production represents a potentially significant dynamic in domestic demand, it should be stressed that the majority of domestic downstream processing of CPO still produces other food and non-food products. The largest share of processed CPO is used to make cooking oil; in 2005, 6 million tonnes of CPO were used to produce 5.3 million tonnes of cooking oil, of which around 40% was used domestically. Other major uses of CPO in Indonesia are in the production of margarine and shortening (570,000 million tonnes in 2005) and oleochemicals (also 570,000 tonnes in 2005) (World Bank, 2010).

The use of CPO to produce biodiesel is a recent development in Indonesia; biodiesel production only began on an industrial scale in 2005. As noted in section 3.1.9, Indonesia's energy policy anticipates that biodiesel producers will consume increasing amounts of CPO: it was initially anticipated that biodiesel production would reach 4 billion litres by 2017 (FAO, 2008; USDA -

[24] Yields are very dependent on the age of the plantation. Cited figures are not adjusted for plantation age and therefore comparisons across age and ownership classes should be considered rough estimates only. Year on year variations also affected by weather conditions, notably the impacts of El Nino. Yields in literature commonly refer to CPO yield per ha. As the case study level, FFB production per ha. is used, as mill yields of CPO from FFBs can vary.
[25] Average annual yield in 2006 for smallholder plantations was 2.2 tonnes of CPO per ha. compared to 2.8 tonnes per ha. for private estates and 3.4 tonnes per ha. for state owned plantations. (World Bank, 2010)
[26] Production capacity uses assumptions of 21% CPO yield and 4500 operating hours per year (Ministry of Agriculture, 2007)

FAS, 2009_2). Actual production, however, is falling far short of targets. Although accurate and up to date production data is difficult to come by, what is known is that despite initial interest and private sector investment, in 2007-8 production levels fell by an estimated 60% (Sugiyono 2008), leaving the majority of biodiesel capacity unutilised. It was reported in 2010 that there were 20 plants producing biodiesel, with a total installed capacity was of 4,300 million litres, but that only 9.3% of this capacity was being used, resulting in total production in 2010 of approximately 400 million litres (USDA – FAS, 2010) Levels of production have been influenced by both supply and demand factors, and by the policy context; these factors are discussed further in section 4.2.1. The future of Indonesia's biodiesel industry and by extension the implications for domestic demand for palm oil by the sector are uncertain, but will hinge on both the economic and political context of production.

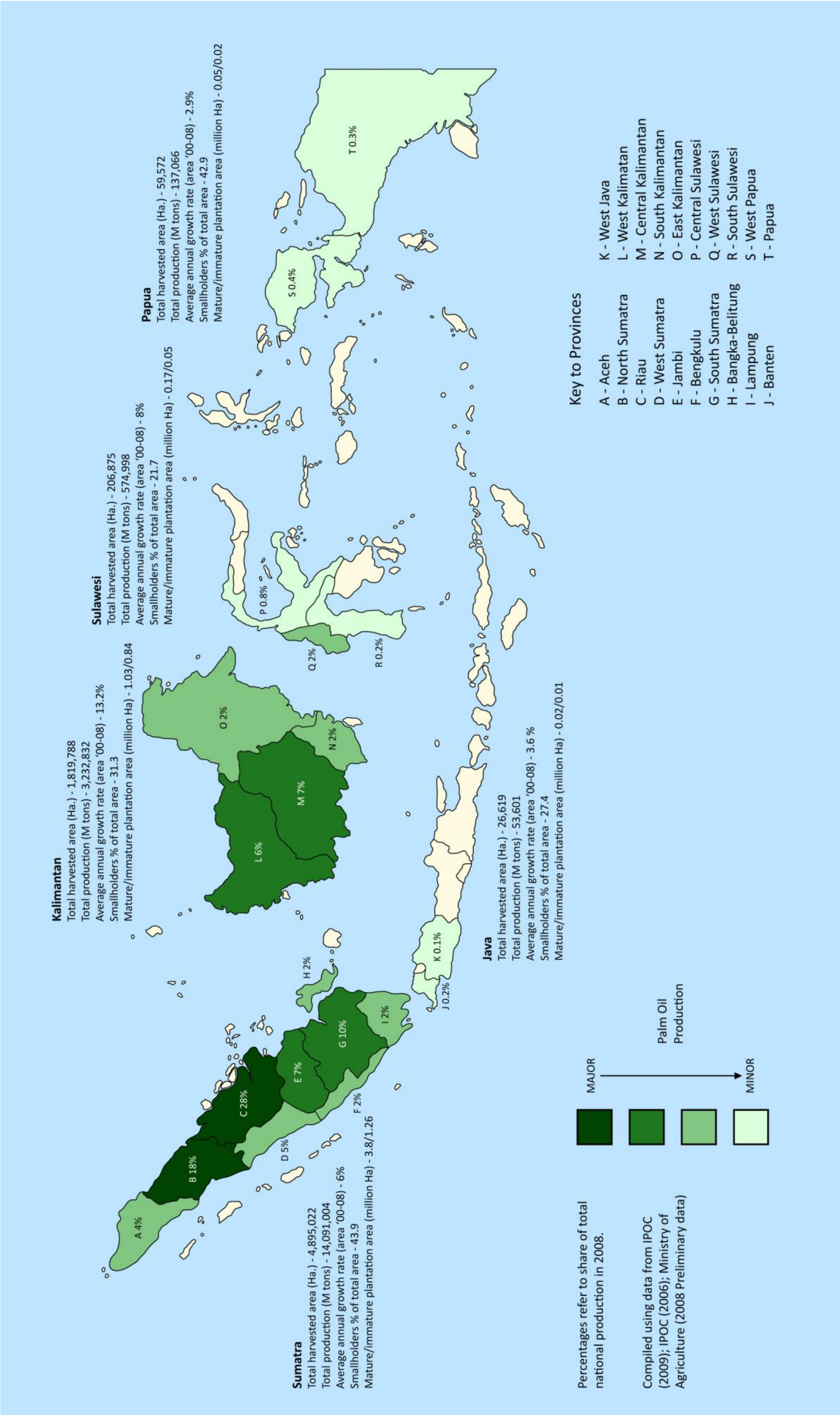
3.2.6 Regional patterns of palm oil production and conversion

The vast majority of Indonesia's oil palm plantation area is located in Sumatra and Kalimantan (Figure 8). Indonesia's first plantations were developed in Sumatra, and today the region is home to 75% of the county's mature palm area and accounts for 80% of palm oil production (USDA – FAS, 2009_1). Within Sumatra, the provinces of North Sumatra and Riau have the largest planted areas and contribute the largest shares of both Sumatra's and Indonesia's palm oil production. Palm oil production in Sumatra continues to be more profitable than in more remote regions due to more favourable climate and soils and more established infrastructure. IFCA (2008) estimates that Net Present Value of palm oil production in Sumatra and West Kalimantan to be €2,381 per ha over a 25 year period, as opposed to €1,862 in more remote regions[27]. Expansion of plantation area is still occurring in Sumatra, with an additional 600,000 ha planted between 2000 and 2009, although rates of area growth are slower here than in other regions (USDA – FAS, 2009_1).

Expansion of oil palm plantations into regions outside Sumatra accelerated from the late 1980s, with much of the growth occurring in the region of Kalimantan on the island of Borneo. Kalimantan now accounts for 17% of national palm oil production, with the provinces of Central and West Kalimantan home to the largest oil palm areas and accounting for the largest shares of palm oil production. Area expansion has been rapid in areas of Central and East Kalimantan in particular, with an average growth rate of 13% over the last decade (USDA – FAS, 2009_1). Even more recently, expansion of oil palm plantation area has been taking place in provinces on the islands of Sulawesi and Papua. Production in these regions, however, is much lower than in Sumatra and Kalimantan, and makes a much smaller contribution to Gross Regional Domestic Product (GRDP).

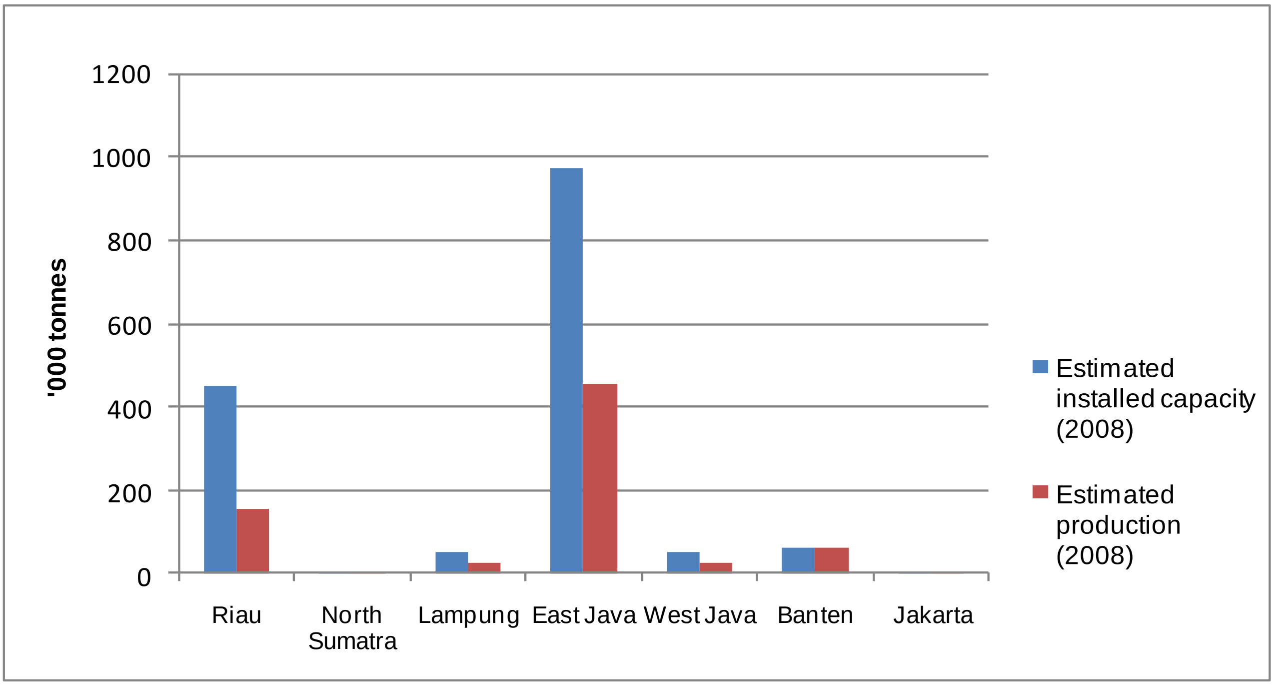
[27] IFCA's Net Present Value estimates of oil palm considered a range of costs associated with oil palm establishment, including land clearing, building roads and drainage, land preparation and planting. It also considered the average yield of Fresh Fruit Bunches (FFB) over a 25 year period (20t/ha/yr) and the price of FFB in 2006 (€58 / Rp.706,638 per kg).

Figure 8: Regional distribution of palm oil production in Indonesia



The composition of palm oil producers is another key difference between producing regions. While large, private plantations are found in all producing areas, there is a more significant smallholder presence in Sumatra, (occupying 43.9% of the total planted area) than in Kalimantan (31.3%) (IPOC, 2006, cited in Sheil et al, 2009). Although official statistics do not distinguish between different groups of smallholders, evidence suggests that independent smallholders are also far more prevalent in Sumatra (see section 3.2.7) (World Bank, 2010). State owned plantation companies are also more significant to production in Sumatra; in North Sumatra, the Government of Indonesia controls nearly 70% of the larger plantations, either directly or through joint enterprises (BPS SUMUT, cited in US Embassy, undated).

Figure 9: Distribution of biodiesel capacity



Source: Based on data from Dillon et al, 2008, updated from current company data

The extent of the palm oil conversion chain also differs between regions. While all provinces with oil palm plantations also have palm oil mills for initial processing, 83% of Indonesia's mills are located in Sumatra (USDA – FAS, 2009_1). In addition, not all regions have refineries or downstream processing facilities; the most developed areas are Riau and North Sumatra, both of which are developing industrial clusters to encourage the development of downstream palm oil processing industries (Jakarta Post. 2009_2). While data on both capacity and production of biodiesel in Indonesia should be treated with caution, Figure 9 represents an estimation of the regional distribution of facilities in 2008. With the exception of Riau, the location of biodiesel refineries does not correlate with the main palm oil production areas. The ports on the northern coast of East Java are, however, accessible by boat from Kalimantan, and the area is an industrial hub. In most of the islands outside Sumatra both oil palm processing and transportation infrastructure is extremely limited (USDA – FAS, 2009_1).

3.2.7 Plantation ownership models

There are three main ownership models operating in Indonesian oil palm plantations: privately owned estates, independent smallholder plots, and government owned plantations. Many privately owned and government estates have been developed using some form of Nucleus Estate Smallholder (NES) or *Perkebunan Inti Rakyat (PIR*) scheme. In this model, smallholder plots (known as 'plasma') are developed in conjunction with the main estate (the nucleus or *'inti'*). There are notable differences between the productions systems used in each model, which in turn affects yields. Reported yields are highest in state-owned plantations, which in 2006 produced average annual yields of 3.4 tonnes of CPO per ha, followed by private estates with 2.8 tonnes per ha (although there are considerable variations in yields between private plantations). Average smallholder yields were the lowest, at only 2.2 tonnes per ha[28] (World Bank, 2010). It should be noted that national data on smallholders[29] does not distinguish between different categories of producers, and includes both independent growers and smallholders involved in NES schemes. Differences in growth rates and yields between different types of smallholders are therefore difficult to establish.

Nucleus Estate Smallholder (NES) and KKPA schemes.

Estates operating the NES model of production are divided into two areas: a core plantation area ('nucleus') run by the plantation company, which also owns the associated palm oil mill, and a surrounding plantation area ('plasma') owned by smallholder producers. The company clears the plantation area at the outset, and provides agricultural inputs and management services in the early stages of plantation development. When the oil palms reach maturity, the company turns the plasma area over to smallholders or to a smallholder cooperative, with a typical land allocation of 2 ha per family[30]. Smallholders continue to operate in a formal relationship with the company, providing FFBs to the palm oil mill from which the repayments for the start-up costs are deducted (World Bank, 2010). Data on the prior economic status of the smallholders involved is limited, although the allocation of land is small, and it seems that many were part of transmigration programs, which suggests that they started off poor (ibid).

Inputs into the production systems in both nucleus and plasma areas are broadly similar; plantation companies have access to improved planting materials, which are used throughout the estate. Furthermore, NES smallholders benefit from the superior expertise and inputs of the plantation company.

In theory, yields should therefore show little variation within NES schemes, although in practice this does not seem to be the case. Smallholder plasma areas have been shown to produce lower yields than nucleus areas (World Bank, 2010). It is suggested that this is a function of the management practices used in smallholder areas. In particular, smallholders often find it

[28] This data should be treated with considerable caution: yields show variations over time, are heavily affected by the age of plantations, and data seems to be imprecise.
[29] The term 'smallholder' in national statistics is also fairly broad, appearing to refer to all oil palm cultivation not carried out by plantation companies (World Bank, 2010). The RSPO definition is: "family based enterprises producing palm oil from less than 50 ha. of land" (Vermeulin and Goad, 2006, cited in World Bank, 2010)
[30] Smallholders turn over to the company considerably more land than they receive as their allocation. Although models vary, this can mean communities hand over 10 ha. of land for every 1 ha. they are allocated (Marti, 2008).

difficult to maintain fertiliser application, an important factor determining yields (Zen et al, 2005). In addition, there is some evidence to suggest that within an NES scheme, plasma areas are more likely to be found on poorer soil, further disadvantaging smallholder producers (World Bank, 2010), and may not be developed to the same standard as the nucleus (Marti, 2008)[31].

The initial development of the NES model of production was heavily influenced by government policy; the system was initiated in the 1970s as a way of providing income generating opportunities in rural communities and was part of the government's resettlement (*transmigrasi*) program. When the system was first established, companies were required to develop plasma areas in order to access land and subsidized capital. Government regulations have reduced over time and government support officially ended in 2001, but the NES system continues to play a central role in the Indonesian oil palm sector. For companies establishing plantations today, implementing some form of NES model can help them to access land while demonstrating corporate social responsibility. With the reduction in government requirements, however, the trend has been a decline in the proportion of estates' land allocated as plasma areas.

This in turn has reduced the bargaining power of smallholders over the sale of FFBs, as mills can meet most of their requirements from the nucleus areas (World Bank, 2010). The livelihood benefits for smallholders involved in NES schemes also vary between plantations. Both the content and process of contract negotiations between companies and smallholders have been seen to cause problems and limit benefits for smallholders (Rist et al, 2010).

In addition to the NES style schemes, the KKPA (*Koperasi Kredit Primer Anggota: Members* Primary Credit Co-operative) scheme was developed by the government to integrate local landowners into new plantation developments. Land owners provided approximately one-third of their land to the plantation company's nucleus estate while the remaining two-thirds was developed by the company and returned to them in the form of an oil palm smallholding. These smallholders are contractually obliged to sell FFBs to the company (Winrock, 2009). The scheme also allowed formalized local cooperatives to borrow up to a maximum of IDR50 million €4117, at a partially subsidized repayment rate of 16% for small business development (Vermeulen & Goad, 2006).

Independent smallholders

It is believed that much of the recent growth in smallholder production, particularly in Sumatra, has come from the increasing number of independent smallholders, and that this trend is likely to continue. These producers establish themselves independently of mills, but generally sell their FFBs to nearby plantation companies. Despite the increasing significance of this group, little is known about their landholdings. Data about the economic status of independent smallholders is also limited, although the fact that they have access to land and sufficient resources to grow oil palm suggests that they do not belong to the poorest group (World Bank, 2010). Anecdotal evidence suggests that many independent smallholders actually operate in

[31] Marti (2008) cites an example from Riau, where the smallholding area was planted with 78 palms per ha as opposed to the 130 palms per ha. promised.

conjunction with absent landlords known as *petani berdasi* (lit. ‘white collar farmers’), who pay farmers a small wage for running palm oil plots.

Independent smallholders have the lowest average yields, and hence the lowest financial returns of any group of producers. Similar to NES smallholders, this is likely to be partly a function of suboptimal management practices, which in turn results in part from higher unit costs of inputs. In addition, independent smallholders often lack access to improved planting material along with other inputs and expertise, from which NES smallholders benefit. In situations where smallholders are paid by absent landlords, there is also likely to be a lack of incentives for them to increase yields.

The initial expansion of independent smallholder production has been attributed to the growth of palm oil processing capacity from the late 1980s, particularly in North Sumatra. As this growth outpaced the development of plantations, an opportunity was created for independent producers (Papenfus, 2000). More recently, a lack of large areas of contiguous land in Sumatra have limited the expansion of large estates. Smallholders, however, are able to develop smaller areas of land (World Bank, 2010).

The increasing numbers of smallholders entering the palm oil sector is also a result of the competitive financial returns offered by palm oil cultivation. The average cash income from oil palm cultivation is significantly higher than that from subsistence farming (Hardter et al 1997 cited in Sheil et al, 2009) or from competing cash crops, making it an attractive option for subsistence farmers wanting to enter the cash economy (Rist el al, 2010). The longer term net results for farmers of moving from subsistence agriculture to palm oil cultivation, however, may be more complex[32].

Despite the factors encouraging the entry of independent smallholders into the sector, these producers face a number of issues. Firstly, independent growers are often forced to rely on a single buyer for their produce due to capital and distance constraints. Dependency on a single buyer is risky for independent producers, especially as palm oil prices fluctuate; in times of low CPO prices, independent smallholders can face economic hardship (World Bank, 2010). Marketing options for this group are further constrained by the lack of independent mills, and by government regulations which restrict their construction[33]. Access to credit is another issue for independent producers. Although the government introduced a subsidised credit programme for plantation smallholders in 2006, this programme has faced a number of problems, and disbursement of funds has been slow (ibid).

[32] Accounting for factors such as rising prices, loss of subsistence food and forest services. This is an area which requires further research.
[33] Decree of the Ministry of Agriculture No. 26/2007 on Plantation Business Licences, Par. 10 and 16, forbids the construction of new palm oil mills that cannot demonstrate a secure source of FFBs.

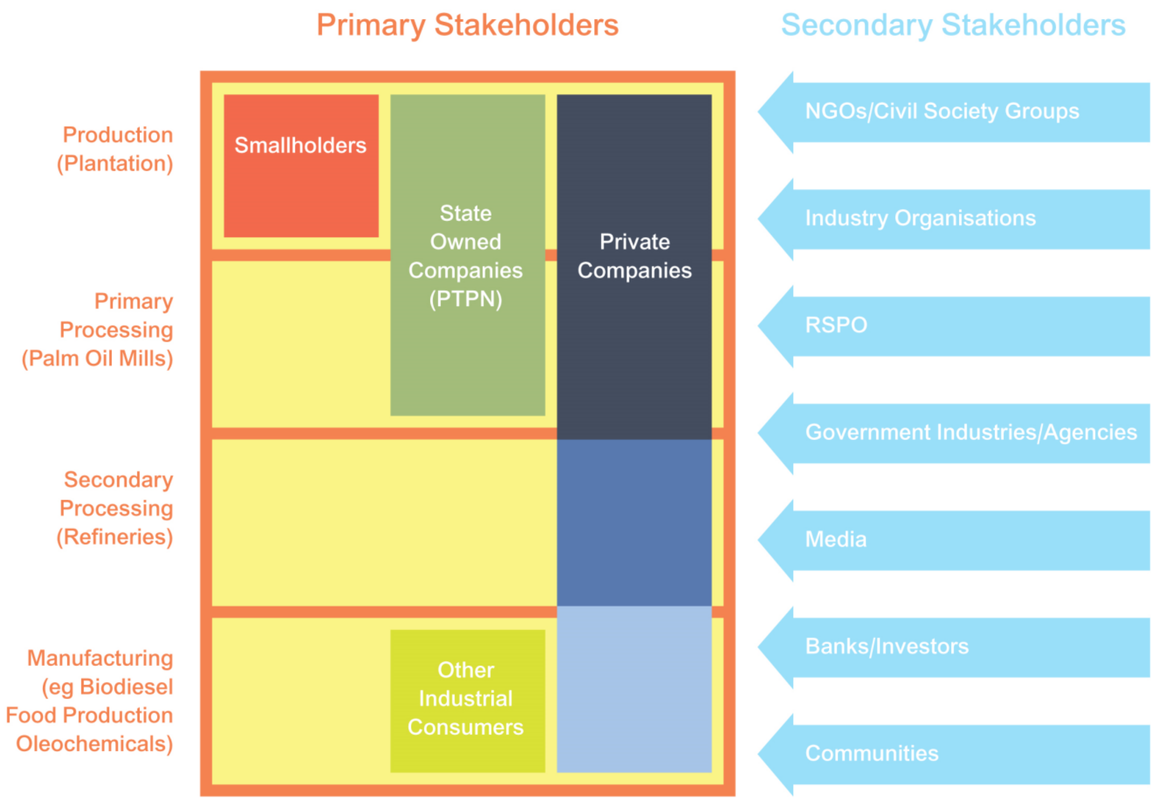
Government plantations

Government owned plantations *Perusahaan Terbatas Perkebunan Nasional* (PTPN), had an important role in the early development of the palm oil sector in Indonesia[34]. PTPN used to control the majority of oil palm plantation land, although it has now been overtaken in both area and production by the private sector and smallholders. PTPN plantations now occupy 11% of planted hectares and account for 14% of production: evidence of the higher than average yields of PTPN plantations. A key factor in the high yields is that state owned plantations tend to occupy the best land, in Sumatra in particular, a legacy of their early development. PTPN is also supported by IOPRI, the government funded research institution.

3.2.8 Actors in the supply chain of palm oil in Indonesia

Actors in the palm oil chain in Indonesia can broadly be divided into primary stakeholders, which are involved directly in production and conversion, and secondary stakeholders, which have an interest in the sector and influence it in various ways (Figure 10).

Figure 10: Overview of stakeholders in the palm oil supply chain in Indonesia



[34] A total of 14 PTPN companies operate in the plantation sector (consolidated in 1996 from 32), 10 of which operate oil palm plantations.

At the plantation level, the main actors are plantation companies and the large corporations of which many are subsidiaries, the Indonesian state, and smallholders. Although there are hundreds of plantation companies operating private estates, a limited number of business groups control most of them. The largest business groups operating in Indonesia are a mixture of domestic and foreign interests; 50% (7.8 million ha.) of palm oil plantations in Indonesia are controlled by foreign investors from Malaysia, Singapore, US, UK and Belgium (Sawit Watch, cited in Wakker, 2005). Table 3 lists the largest companies by planted area and land holdings and also shows that there is a significant amount of land (3,866,268 ha in 2009) which is held by private sector companies but yet to be developed, representing future expansion.

Some plantation companies, such as London Sumatra, are also actors in the upstream supply of germinated oil palm seeds (USDA – FAS, 2007). Evidence suggests that there is considerable variation between the practices of these companies; while 16 companies in Indonesia currently have plantations certified by the RSPO (RSPO, 2011), described below,, other companies have attracted considerable criticism for their environmental and social practices (see, for example: Greenpeace, 2009; Marti, 2008)

Table 3: Private sector palm oil land holdings

Company/ group	Land bank (ha)	Planted area oil palm (ha)
Golden Agri/SMART	1,300,000	359,732
Indofood Agri Resources	570,000	374,000
Asian Agri	515,000	170,000
Wilmar International	573,000	n/a
Astra International	500,000	238,000
Minamas Gemilang	288,000	n/a
Ciliandra Group	278,000	86,000
Bakrie Sumatra Plantation	210,000	78,000
Tri Putra Agro Persada	200,000	120,000
Bumitama Gunajaya/ Harita Group	200,000	50,000
Duta Palm Group	200,000	54,000
Lyman Agro	190,000	40,000
Sampoerna Agro	182,000	78,000
Incasi Raya Group	174,000	36,000
Golden Hope	170,000	n/a
Total undeveloped oil palm (ha)	***3,866,268***	

Source: Jakarta Globe (2009) cited in Winrock (2009)

In addition to private business groups, the state-owned PTPN group controls 670,000 ha of land, producing 2.39 million tonnes of CPO in 2009 (IPOB, 2008). As described in section 3.2.7, smallholders are accounting for an increasing share of palm oil production in Indonesia. Smallholders fall into two groups: 'plasma smallholders' who operate in formal partnerships with oil palm companies in NES schemes and independent smallholders.

The large, integrated business groups also control the majority of CPO processing mills. The vast majority of mills are associated with plantation areas owned by the same company. Larger plantations and NES schemes have their own palm oil mills, while smaller plantation companies and independent smallholders sell their FFBs to their larger neighbours. The largest plantations' mills also have integrated refineries and in some cases oleochemical and biodiesel plants. Several of the large palm oil producers initially announced plans for biodisesel investment (Grain, 2007)[35], although most appear to have subsequently shelved or scaled down these plans; the only company currently producing biodiesel on a large scale is Wilmar.

The secondary stakeholders fall into a number of groups. Firstly, the interests of different groups involved in the palm oil supply chain are represented by various bodies. Producers' interests are represented by producers associations, notably the National Palm Oil Association (GAPKI), which represents 30% of national CPO industry (Jakarta Post, 2009_6) and the Indonesian Palm Oil Farmers Association (APKASINDO). In 2007, the *Asosiasi Produsen Biofuel Indonesia* (APROBI) was established as an industry body representing biofuel producers specifically.

Numerous government ministries have an interest in and influence over various parts of the palm oil chain. Oil palm plantations, for example, are a concern of both the Ministry of Forestry and the Ministry of Agriculture. CPO production and refining is part of the mandate of the Ministry of Industry and the Ministry of Trade. Indonesia's policies on biofuel development require the involvement of an even wider range of government agencies. A National Biofuels Development Team (TINMAS BBN), was established in 2006, charged with designing and advising on biofuel policy, although this group is now defunct; the Coordinating Ministry for Economic Affairs plays the coordinating role in biofuel development, supply and utilisation, in which the Ministry of Energy and Mineral Resources, and specifically the Directorate General for Oil and Gas play particularly important roles[36].

In addition to government ministries, the Indonesia Oil Palm Research Institute (IOPRI), a non-profit research institute fully funded by the government and the Plantation Crops Advisory Service (Dinas Perkebunan), also government funded, play supporting roles to state owned plantation companies in particular. Meanwhile the Agency for the Assessment and Application of Technology (BPPT) has an important role in biofuels research. There is, however, no coordinated bioenergy research agenda or dedicated bioenergy research centre in Indonesia. The Indonesian Palm Oil Board is also government funded and brings together stakeholders from throughout the supply chain.

[35] At an event held in Jakarta in 2007, 67 agreements for biofuel development were signed (USDA FAS. 2010. Indonesia Biofuels Annual. Jakarta)
[36] Presidential Memorandum No. 1/2006 defined roles for a large number of other ministries in implementing biofuel policies

A significant number of social and environmental NGOs are engaged in the palm oil sector, primarily at the production level, and many have become actively involved in the biofuels debate in Indonesia. These include international and national organisations which primarily perform campaigning and advocacy roles, along with local NGOs, which often engage directly with smallholders.

An association gaining in prominence in the Indonesian palm oil sector is the Round Table on Sustainable Palm Oil (RSPO). Most of Indonesia's large estate companies have joined, although a minority have had their plantations certified. The stated objective of the RSPO is to promote "the growth and use of sustainable oil palm products through credible global standards and engagement of stakeholders" (RSPO). The forum brings together stakeholders involved throughout the supply chain along with NGOs, and has adopted a set of principles and criteria relating to environmental and social aspects of palm oil production. While the RSPO is undoubtedly playing a role is setting standards within the sector, the association has also attracted criticism on issues such as the enforcement of standards and the over representation of corporate interests (WRM, 2010).

A separate sustainability scheme, Indonesia Sustainable Palm Oil (ISPO) is in the process of being developed. This government-funded scheme has also developed a set of principles and criteria and is currently (July 2011) being trialled in a number of plantations. It is the government's intention that this scheme will become mandatory for all Indonesian palm oil producers (Jakarta Post 2011).

3.3 Case Study at the regional level: North Sumatra Province

3.3.1 Location and land use

The province of North Sumatra lies on the island of Sumatra. Covering an area of 70,787km^2, it spans the width of the island from the Straits of Malacca to the Indian Ocean. North Sumatra is bordered by Aceh province to the Northwest and Riau and West Sumatra to the Southeast (Figure 11). In the southwest of the province is a range of mountains that stretch the length of Sumatra, while in the east is a broad area of coastal lowlands. The provincial capital Medan (population in 2010: 2.1 million[37]) is located in the east, inland of the main port of Belawan. North Sumatra is divided into 23 Regencies and 7 Municipalities.

[37] Population of Kota Medan according to the 2010 census. The greater Medan area extends into the surrounding district so estimates of the population are often larger than this.

Figure 11: Map of North Sumatra

3.3.2 Economy and poverty

North Sumatra's GRDP in 2010 was €22.7 billion[38], making it the third largest regional economy outside Java. With an average growth rate of 6.08% per annum between 2005 and 2008, the province is also one of Indonesia's fastest growing regional economies. In 2009, manufacturing contributed the largest share of GRDP (23.3%), followed by agriculture (23%), trade, restaurant and hotels (19%) and other services (10%). Agriculture is the most important sector in terms of employment, employing 49.7% of the workforce (60 – 90% outside major cities) (BPS SUMUT). Furthermore, agricultural commodities, particularly palm oil, rubber, tobacco, coffee and tea, are key exports from the province.

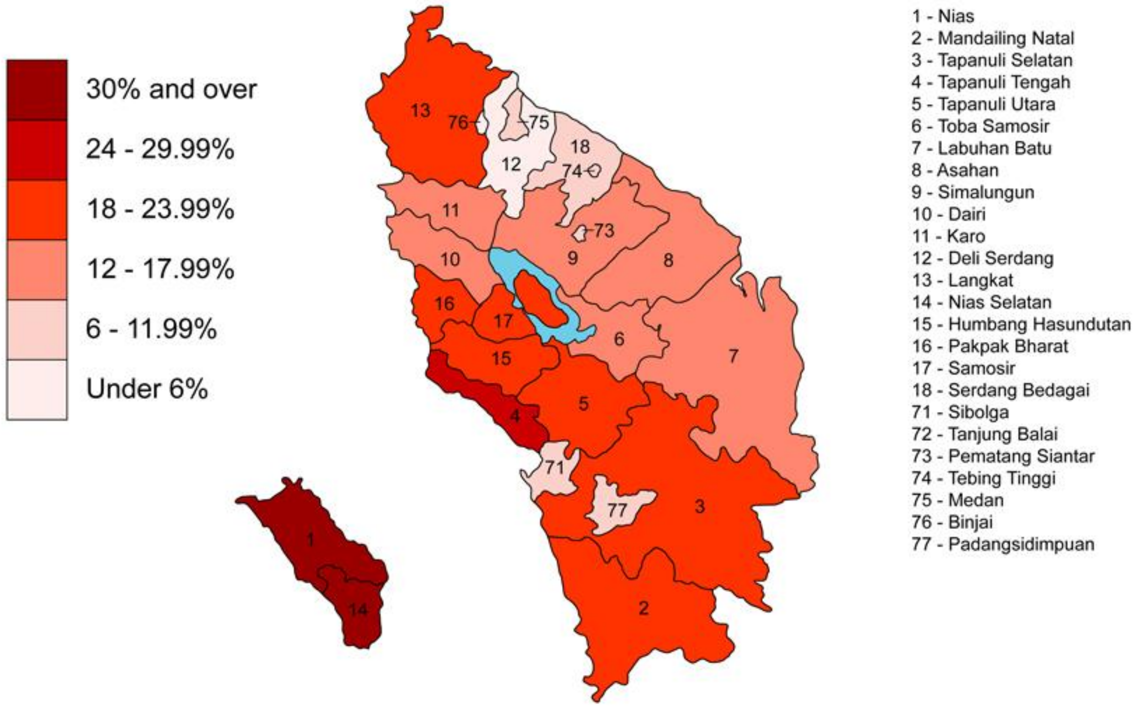
The total labour force in 2009 was 6.3 million; this equated to a labour force participation rate of 69.14%. 59% of the labour force is male and 41% female. The open unemployment rate in the province as a whole was 8.45% in 2009, slightly above the national average of 7.87% in the same year. Unemployment rates show marked disparities between districts, with the highest levels found in the west in the province.

The income poverty rate in North Sumatra was 11.51% in 2009, marginally higher than nearby provinces of Riau and West Sumatra, but below the national average of 14.15%, and significantly lower than neighbouring Aceh (BPS). Poverty rates in rural and urban areas are similar (11.56% and 11.45% respectively). Poverty in North Sumatra has declined steadily in recent years, from 16.74 % in 1999

Poverty rates within North Sumatra also show significant variation between districts, with patterns echoing unemployment distribution (Figure 12). In general the highest rates are found in the west of the province, peaking on the island of Nias: 33.84% of people in Nias Selatan were living below the poverty line in 2007. In cities, and in the east of the province, particularly close to Medan, poverty rates are significantly lower: in Deli Serdang, the district surrounding Medan, the poverty rate was 5.67% in 2007.

[38] Current market prices, 'Very provisional' figures

Figure 12: Poverty rates in North Sumatra by district

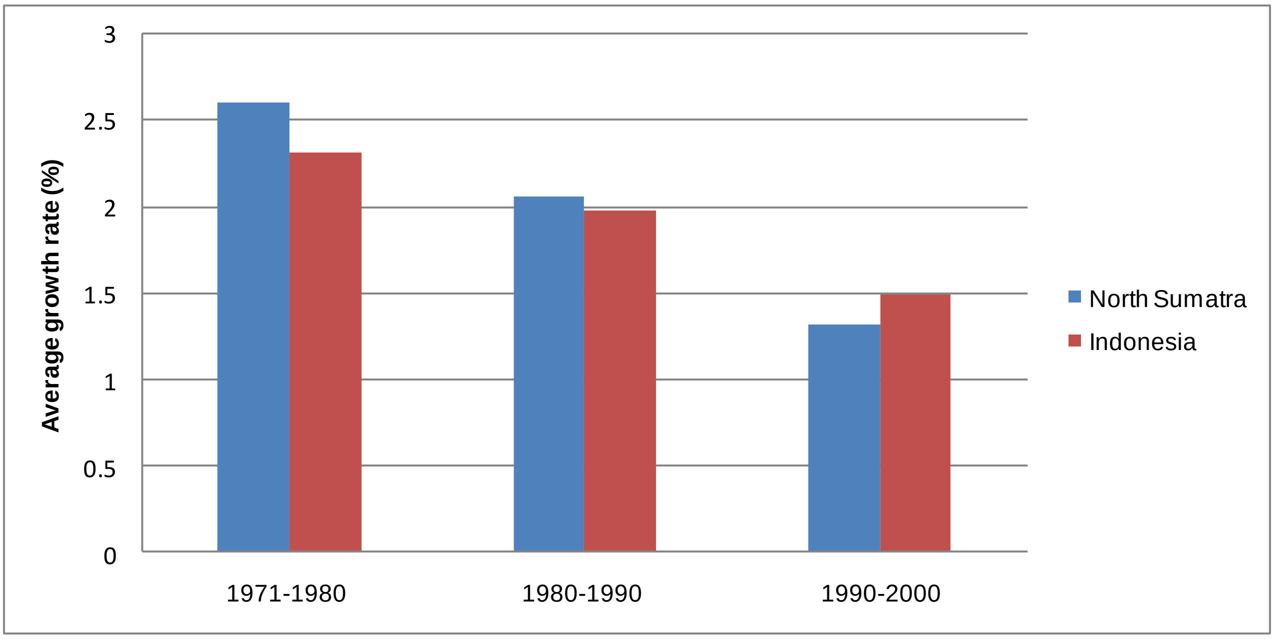


Source: data from BPS SUMUT

3.3.3 Population

North Sumatra's has a population of 12.9 million (2010 census) with an average annual growth rate of 1.57% between 2000 and 2008. Population growth rates in North Sumatra have slowed in recent decades, and are now below the national average (Figure 13). This is primarily a result of negative rates of net migration, discussed further in section 4.3.2. Average population density is 185 people per sq. km. with the highest densities occurring in urban areas and in the east of the province.

Figure 13: Population growth rates, North Sumatra

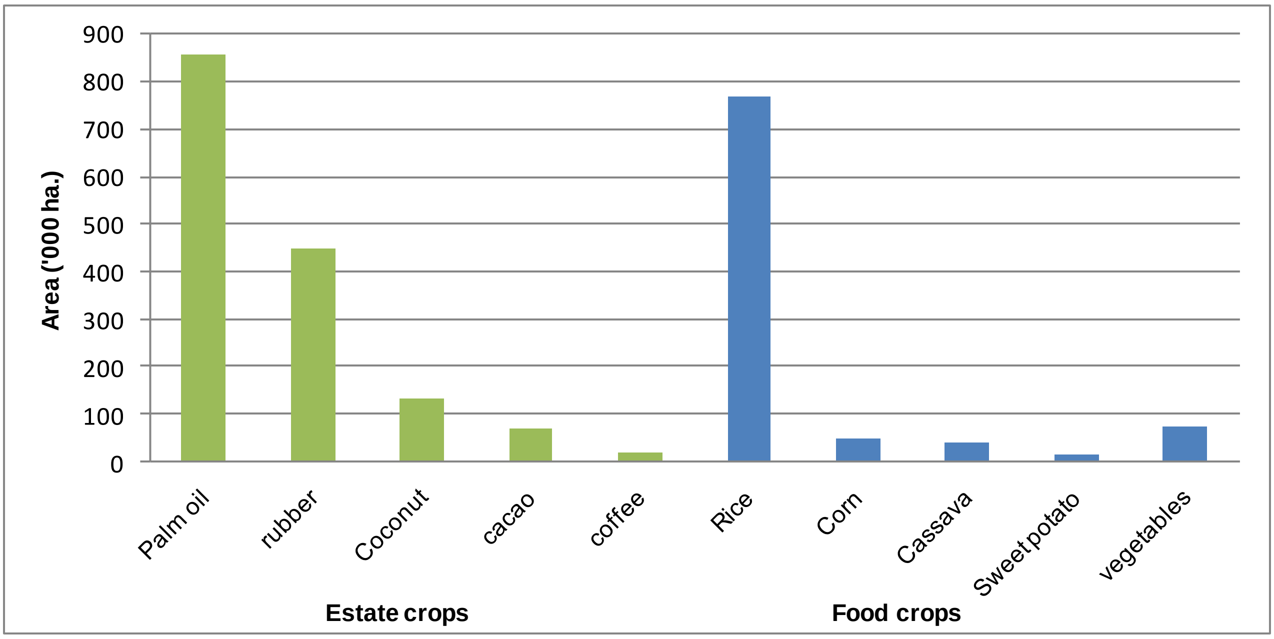


Source: BPS SUMUT

3.3.4 Agricultural sector

The agricultural sector is an important contributor to both GRDP and employment in North Sumatra. The sector contributed 23% of GDRP in 2009, and employed 46.7% of the workforce (BPS SUMUT); the latter figure includes both smallholder farmers and workers on commercial plantations.

Figure 14: Cultivated area of plantation and food crops

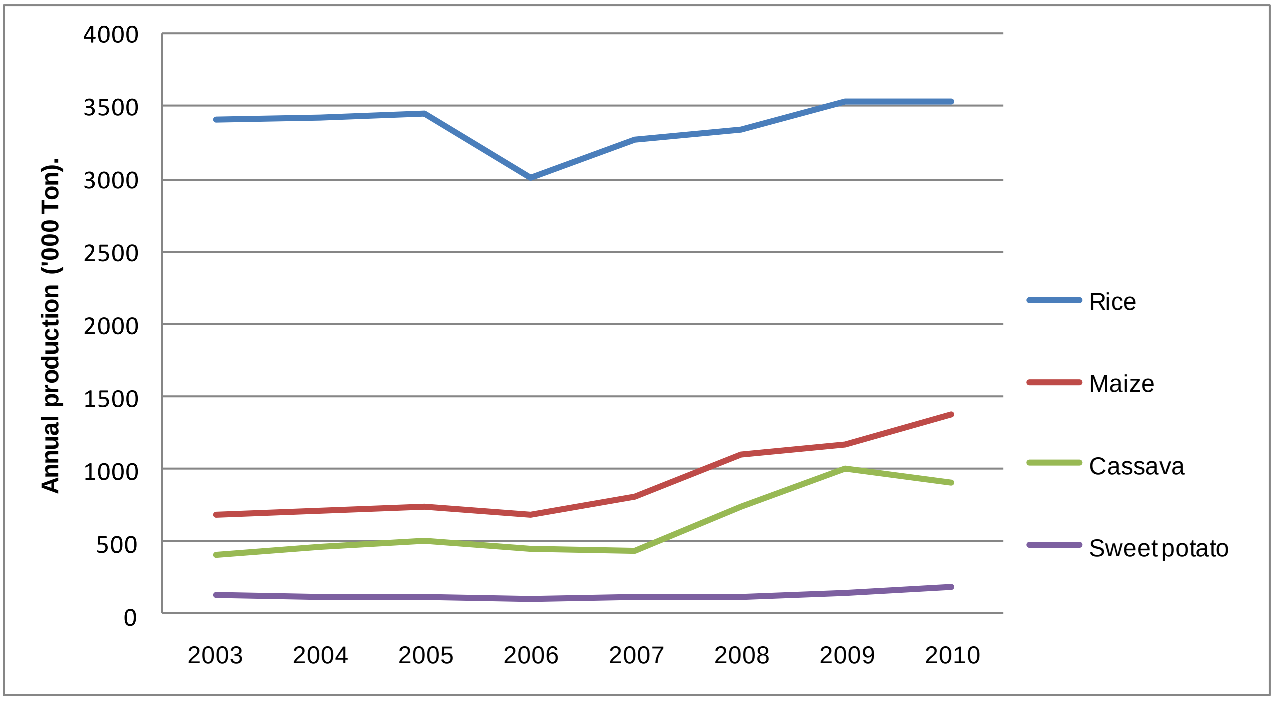


Source: Data from the Ministry of Agriculture

Plantation crops constitute a significant proportion of North Sumatra's agricultural sector, with palm oil dominating in terms of cultivated area (Figure 14) and economic importance. Although many rubber plantations have been converted into more lucrative palm oil plantations, rubber remains a significant contributor to the province's agriculture sector, and is cultivated on 449,182 ha.

Amongst food crops, rice is dominant, cultivated on 768,407 ha. (2009) of land, which is predominantly wetland rice. The total area of land dedicated to rice production across the province has declined slightly over the last 20 years (see Figure 17), although overall production has not changed significantly over this time period (Figure 15). Other food crops have seen modest increases in production in recent years. Issues surrounding land conversion and food security are discussed further in section 3.3.6.

Figure 15: Production trends of key crops, North Sumatra



Source: Data from the Ministry of Agriculture

3.3.5 Forestry sector

North Sumatra had a total of 2,862,850 ha designated as forest land in 2009, comprising only 2.3% of Indonesia's forest area. Although much of the region's forest was cleared in previous decades, forest area is still in decline, reducing from 3,676,188 ha in 2000. Data suggests that this forest loss was entirely from production and conversion forest; areas designated as protection and conservation forest have increased slightly between 2000 and 2009 (from a combined 1,656,804 ha. to 1,774,400 ha).

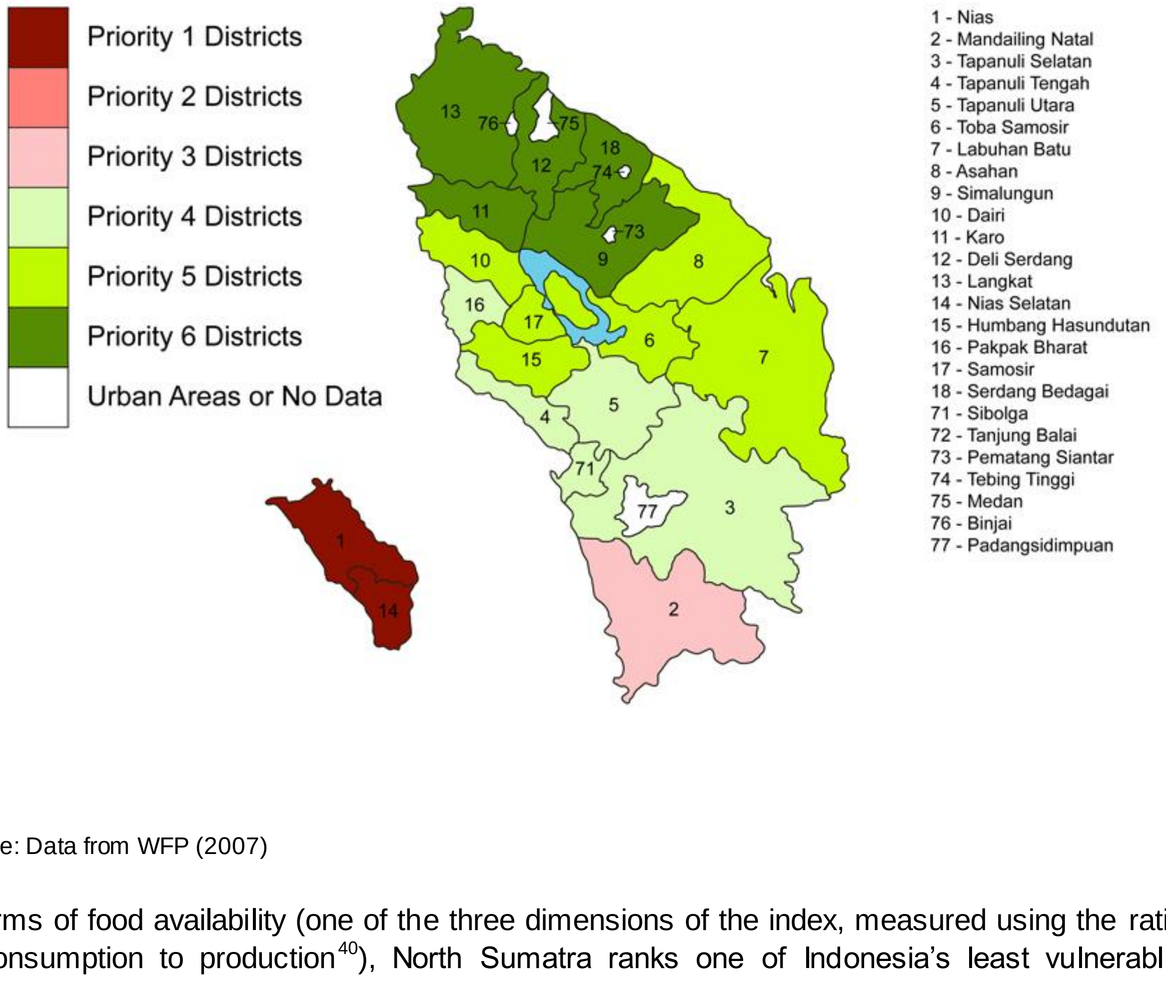
Trends in North Sumatra's forest products sector echo those seen nationally. Production of sawnwood and pulp dominates the sector, and both of these products have seen increases in production in recent years: between 2006 and 2009, sawnwood production increased from

112,939 M^3 to 205,162 M^3 and pulp increased from 147,282 ton to 164,430 ton. Production of other products, including plywood, has declined in recent years (BPS SUMUT).

3.3.6 Food security

Indicators relating to food security do not give a conclusive picture of the situation in North Sumatra. According to the World Food Programme's composite food security index[39], the districts of North Sumatra are mostly priory 4 – 6 in terms of vulnerability to food insecurity (on a 6 point scale). The exceptions to this are the districts on the island of Nias and Mandailing Natal in the South West of the province which are priority 1 and 2 respectively (indicating high levels of vulnerability to food insecurity,

Figure 16: Vulnerability to food insecurity in North Sumatra



Source: Data from WFP (2007)

In terms of food availability (one of the three dimensions of the index, measured using the ratio of consumption to production[40]), North Sumatra ranks one of Indonesia's least vulnerable

[39] Based on indicators of three dimensions of food insecurity: Food availability; food access and food utilisation.

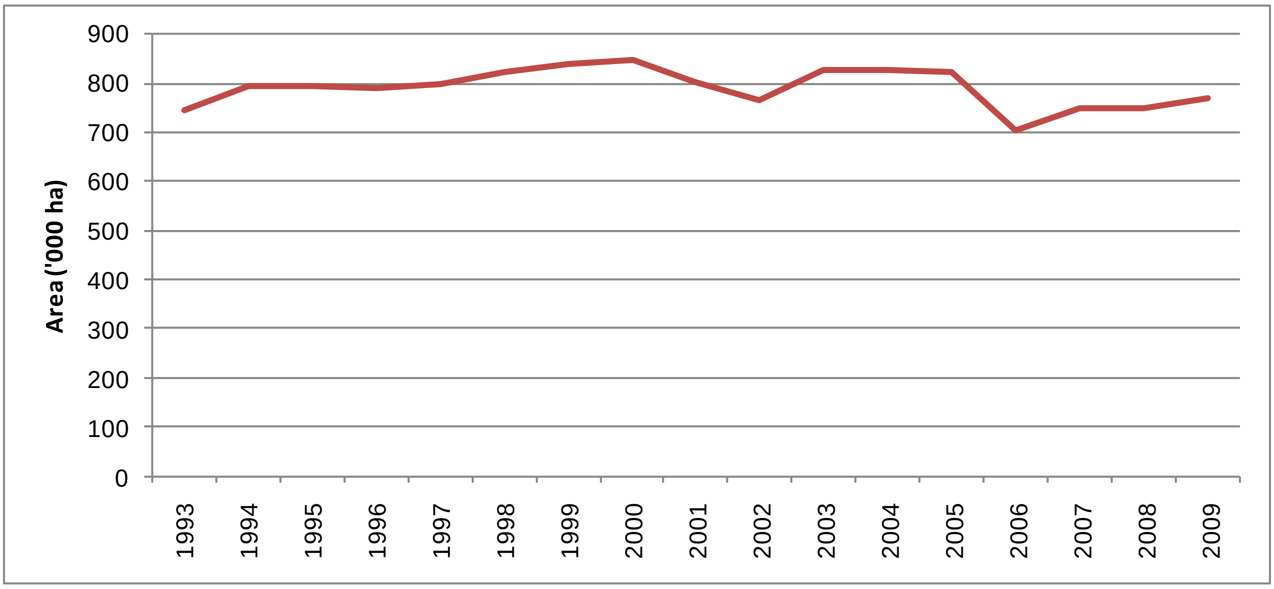
[40] Per capita normative consumption to production ratio, based on cereal and tuber production.

regions: all districts, with the exception of Nias, ranked below 0.75 in 2007. This indicates that the majority of districts are self sufficient in food production, and have a food surplus. As noted in section 3.3.4, the region's total rice production has not seen any significant changes between 2003 and 2010, and production of other key food crops has increased slightly. Nevertheless, there are indications that total rice producing area does appear to be declining slightly (Figure 17), which may have longer term implications for food availability.

Some districts, notably Mandailing Natal, but also others including Tapanuli Selatan and Tapanuli Utara, have higher levels of overall vulnerability to food insecurity than their food availability score would suggest. This indicates that the food issues in these districts are related to food access (primarily a function of poverty) or food utilisation. As noted in section 3.3.2, poverty rates are highest in districts in the south and west of the province.

One indicator used for food utilisation is % of underweight children below 5 years of age. Across North Sumatra as a whole, this appears to be an issue of concern with 22.7% of children underweight and 43.10% displaying stunting. These are higher than the national average rates of 18.4% and 36.8% respectively. In two districts, rates of underweight children are classified by the WFP as critical, and in another nine they are considered severe.

Figure 17: Area of rice producing land, North Sumatra



Source: Data from the Ministry of Agriculture

3.3.7 Energy sector

North Sumatra has some fossil fuel reserves, although these are only minor contributors to Indonesia's energy resources. The region has greater potential in renewable energy, particularly geothermal, although this is largely unrealised.

The province's oil reserves in 2005 were 45.28 million stock tank barrels (MMSTB), of which 34.90 MMSTB were proven reserves. Gas reserves in the same year totalled 8 MMSTB and were in rapid decline. Oil and gas reserves are concentrated onshore, particularly in the Rantau oil field. The region has small potential coal reserves, but there is no coal production in North Sumatra (Mining and Energy office, SUMUT)

In 2005, the region installed hydro power capacity, which was connected to the national grid, stood at 97.5 MW, primarily from Lau Renun and Sipansihaporas plants. Hydro power potential in North Sumatra is significantly higher than this, at 3,051 MW. The region also has relatively large geothermal potential; in 2005 the reserves were estimated to be 2 GW and the total resource 3.67 GW, representing 11.67% and 11.19% of national geothermal potential respectively. This potential has yet to be realised, however, and the region currently has no geothermal production.

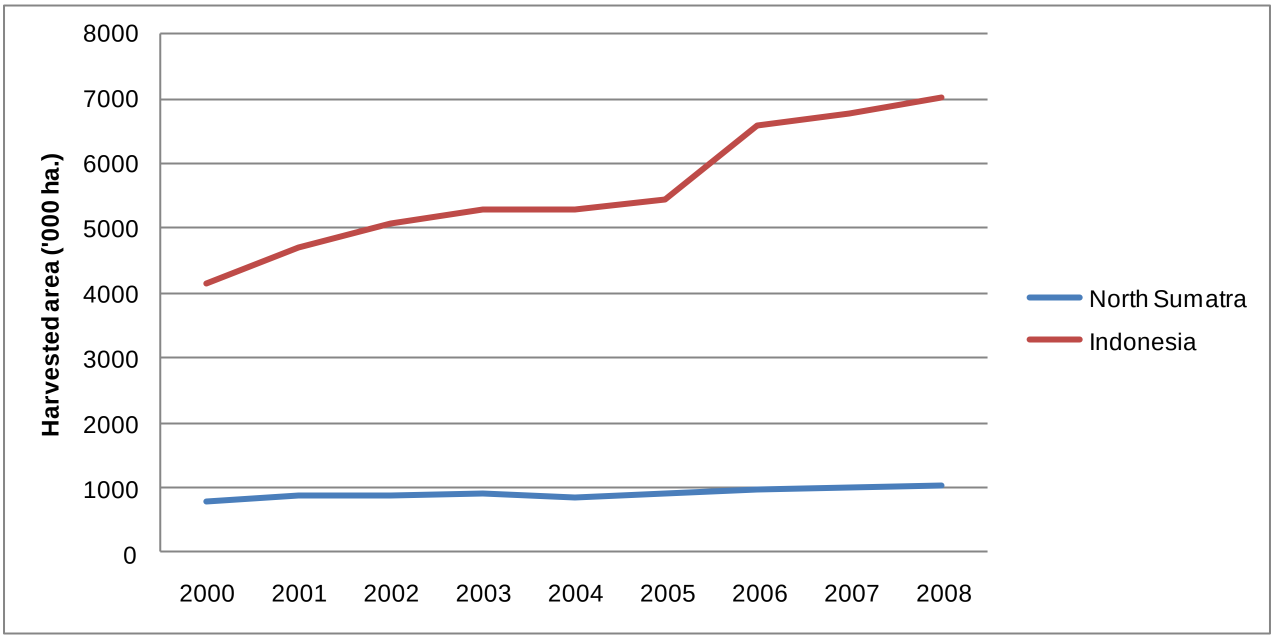
In terms of electricity distribution, North Sumatra performs better than the national average, with only 7.42% of households lacking access to electricity in 2008, compared to a national average of 8.53%. The region has also improved its electricity distribution in recent years: in 2004, 11.99% of households were without electricity (Susenas data).

3.3.8 Palm oil production in North Sumatra

The most recent data indicates that North Sumatra has an estimated 1,026,644 ha of oil palm harvested area, producing 3,200,700 tons annually[41] (Ministry of Agriculture). North Sumatra was among the first provinces in Indonesia to be developed for palm oil production, with the first plantations established during the colonial era. After 1968, during the Suharto era, North Sumatra's oil palm plantation area was significantly expanded, mainly through investment in state-run companies. Much of the plantation development in the region also took place under the Nucleus Estate and Smallholder Scheme (NES) (see section 3.2.7) (van Gelder, 2004). This initiative not only increased the overall plantation area and saw a greater role for private companies in the sector, but also meant that smallholders became increasingly important to oil palm cultivation in North Sumatra.

[41] 2008 preliminary figures.

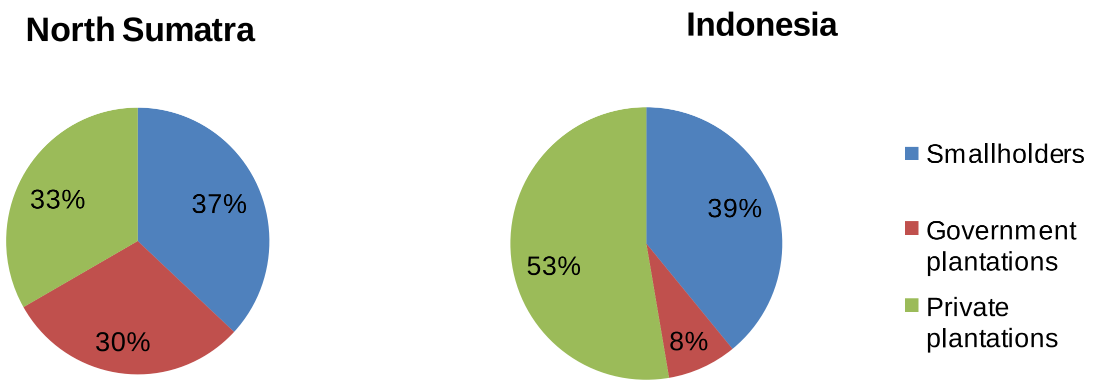
Figure 18: Changes in palm oil producing area (2000 - 2008)



Source: Data from the Ministry of Agriculture

Continued increases in palm oil production since the mid 1980s have rested primarily on large scale land conversion and expansion of plantation area. Until quite recently, plantation areas in North Sumatra have continued to be expanded, although as availability of large areas of contiguous land in Sumatran provinces has declined, the rate of conversion has slowed (Figure 18). While land shortage may have slowed the expansion of large private estates, it seems to have encouraged the involvement of independent smallholders in the sector, who are able to cultivate smaller plots of land (ibid). Smallholders cultivate an estimated 37% of the oil palm area in North Sumatra (slightly lower than the average for Sumatra of 43% (IPOB cited in Sheil et al 2009), and evidence suggests that the area cultivated by smallholders is expanding more rapidly than that occupied by other groups of producers (World Bank, 2010). The history of palm oil development in North Sumatra means that state owned plantations (which controlled 304,770.52 ha. of oil palm area in 2008 (BPS SUMUT)) are over represented in terms of cultivated area relative to Indonesia as a whole (Figure 19).

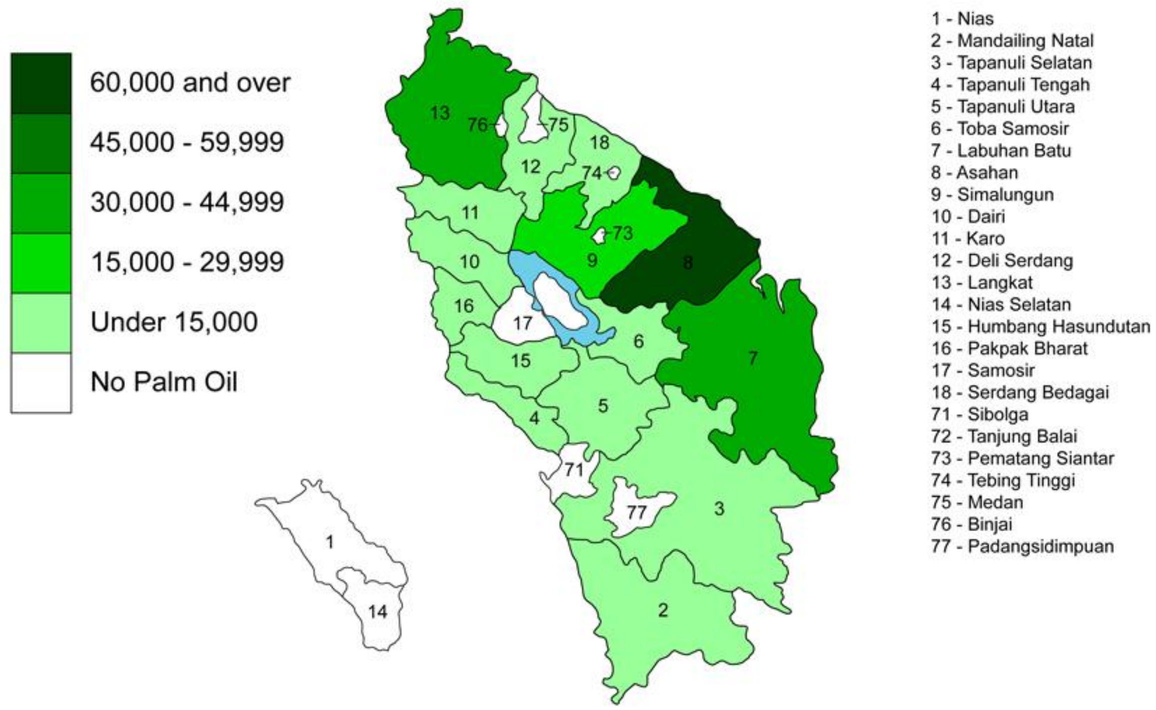
Figure 19: Comparison of palm oil area by ownership category



Source: Data from BPS SUMUT and Ministry of Agriculture

Although data for total palm oil area per district is not available, the main producing areas are in the east of the province, concentrated in the districts of Asahan, Labuhan Batu, Langkat and Simalungun. This distribution is apparent from Figure 20, although this only shows data on smallholder areas.

Figure 20: Smallholder palm oil in North Sumatra - total planted area (ha)



Source: Data from BPS SUMUT

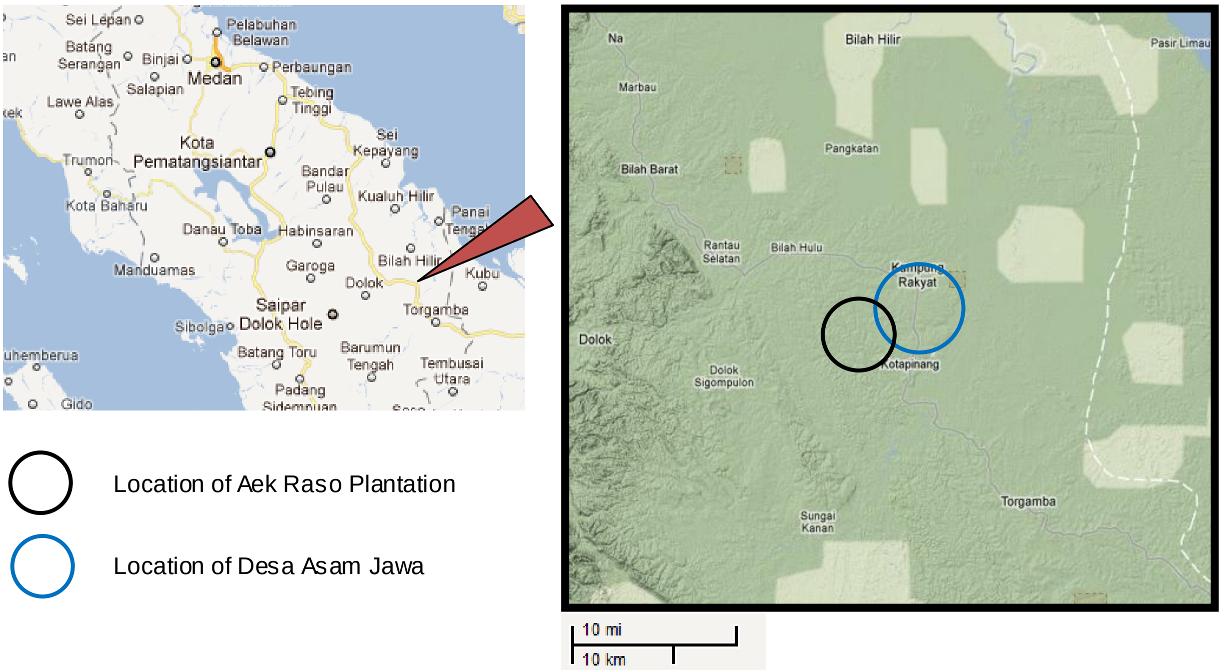
IOPRI data on from 2006 indicated that North Sumatra had a total of 86 palm oil mills (total capacity not indicated). It is also thought that a significant number of the 57 independent mills recorded by the Ministry of Agriculture in 2006 are in North Sumatra (World Bank, 2010). In addition to milling capacity, North Sumatra has facilities for palm oil refining and downstream processing, along with supporting infrastructure; the port of Belawan is a main transportation hub in the region. 'Industrial clusters' focused on the palm oil sector are currently being developed in the province, notably the Sei Magkei Integrated Sustainable Palm Oil Industrial Cluster (SM-ISPOIC) and the North Sumatra Palm Oil Valley.

3.4 Biomass production case study at the local level 1 Aek Raso Plantation

3.4.1 Location and description of the Case Study

Aek Raso Plantation is located in Torgamba sub-district of Labuhan Batu Selatan (Figure 21). The district lies in the south of North Sumatra province, close to the border with Riau. Land use in this area is dominated by palm oil plantations, as is evident from Figure 21.

Figure 21: Location of Aek Raso Plantation and Desa Asam Jawa



Source: Google maps

The main plantation (*inti*) occupies 3,781.69 ha, in addition to plasma areas totalling 7,247.84 ha. Both the *inti* and plasma areas were established between 1983 and 1985 on state forest land. Prior to plantation establishment the land was covered by natural forest. The plantation is owned by PT Perkebunan Nusantara III (PTPN III), one of Indonesia's 14 state owned companies operating in the palm oil plantation sector; Aek Raso is one of 34 plantations owned by PTPN III.

The *inti*'s planted area is 3053.5 ha; of which 2957.9 ha is currently mature (land is also used for a nursery and buildings/roads). The planted area has undergone several stages of expansion, with new plantings being undertaken in all but two years between 1985 and 1996. The company is now undertaking replanting of the *inti*. The earliest developed plasma areas are also almost due for replanting. Smallholders were planning replanting but had not decided how this was going to be done[42].

Aek Raso's plasma scheme was developed under a version of the NES programme (see section 3.2.7). This particular scheme was targeted at migrants and was developed in three phases. By the end of the third phase, the total number of plasma smallholders numbered 1,749, comprised of two areas: Plasma A and Plasma B. The plasma smallholders were therefore predominantly migrants to the area, with most coming from other parts of North Sumatra. Smallholders were described as predominantly poor and previously landless[43]. Aek Raso plantation and plasma scheme were established on state land and there were apparently no pre-existing land claims[44]. This scheme therefore differs from more recent 'plasma' type schemes which involve communities ceding land to companies and receiving smaller plots in return.

Land clearance and planting was done by the company in both the *inti* and plasma areas, beginning in 1985. The plasma areas remained under company management for the first seven years, before management was handed over to smallholders. During this initial period, the migrants worked as labourers on the plantation and received training in oil palm cultivation. After assuming responsibility for management, smallholders began to repay the cost of establishing plasma areas and the initial management expenses: 30% was deducted from each FFB sale until the debt was repaid, at which point smallholders received the titles to their land. Repayment typically took five years, although this depended on the productivity of individual plots.

After repaying the loan, smallholders were given a choice of whether to continue their contract to supply Aek Raso Mill; 410 of the 1,749 plasma smallholders remain under this contract, which is now the only relationship between the company and the plasma smallholders. Most farmers belong to a cooperative (KUD), through which FFBs are sold to the mill. In addition, there are 27 *kelompok tani* (farmers groups), which provide support to farmers.

3.4.2 Description of the production system

Yield levels

Average yield in the *inti* was 1.572 ton FFB/ha/month (18.86 ton/ha/year)[45]. Yield levels vary according to year of planting: areas planted in 1990/1991 have the highest yields of 1.89 – 1.7

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[42] Smallholders did say that they were not interested in engaging with the plantation company for support with replanting and were to private sector providers for planting material. The reasons for this were unclear.
[43] No data was available about the previous socio-economic status of plasma smallholders.
[44] Use of state controlled land doesn't necessarily mean that there were no customary rights claims over the land prior to plantation establishment. However, according to interviews this was not the case for this plantation.
[45] All yields in the production case study are quoted in t/FFB/ha. To convert these figures into CPO yields requires that the oil extraction rate (OER) be factored in. Oil extraction rates also vary between groups of producers due to quality of FFBs, ranging from 18% for low yielding smallholders to 24% for the most productive and well managed estates (Abdullah and Wahid, 2008)

ton/ha/month (22.68 – 20.4 ton/ha/year). In the plasma, reported yields were slightly lower, but not significantly so. Among the five plasma farmers interviewed, monthly yields ranged from 1.5 – 1.2 ton/ha (18 – 14.4 ton/ha/year) with an average yield of 1.42 ton/ha/month (17.04 ton/ha/year). Plasma smallholders therefore report higher and more consistent yields than independent smallholders in the same area. Differences in production levels between smallholders were reportedly a result of differences in land contour rather than variations in management practices.

Land clearance/planting

All land clearance and planting for both the inti and plasma was done by the company. Forest land was opened in stages as new planting was done[46]. Land preparation also involved spreading dolomite and digging drainage ditches. Planting is preceded by staking out the land in a triangular pattern. Superior planting material (DXP) from the Indonesian Oil Palm Research Institute (IOPRI), Marihat and Socfindo (plantation and seed producing companies) is used throughout the estate. Original planting in the estate was at a density of 127 trees per ha. More recent planting is reportedly done at varying densities depending on the seed origin. While the trees are young, cover crops are used to reduce soil erosion (Figure 22).

Figure 22: Newly planted area of Aek Raso Plantation

Fertiliser use

Fertiliser application in the inti is determined by the results of soil analysis tests. Application of inorganic fertilisers is done on average twice a year, and supplemented by use of empty fruit bunches from the mill. Fertiliser dosage per year in 2009 is shown in Table 4.

[46] Land clearance technique was not specified. It is likely that fire was used for at least some land clearance as plantation establishment preceded zero burning regulations.

Table 4: Fertilser use on Aek Raso plantation

	Mature areas		Immature areas	
Type of fertiliser	Fertiliser dosage per tree per application (kg)	Fertiliser use per ha. per year (kg)*	Fertiliser dosage per tree per application (kg)	Fertiliser use per ha. per year (kg)*
Urea	-	-	2.0	254
TSP	-	-	0.75	95.25
MOP	-	-	1.5	225
Dolomite	2.5	317.5	2.25	
PHE	0.25	31.75	-	-
NPK.15.12.22+TE	4.0	508	-	-
Borate	-	-	0.75	95.25

Source: Aek Raso Plantation data *Based on 127 trees per ha.

In the plasma areas, soil analysis tests were also conducted until farmers had repaid their loans, although this is no longer the case. Fertiliser use among the plasma farmers interviewed showed less variation than amongst the independent smallholders; three of the five used similar quantities of combined NPK, one used additional quantities of separate inorganic fertilisers and one was using organic fertiliser. Farmers reported having to increase the quantity of fertiliser used as the trees aged: from two applications per year up until the trees reached 17 years, to three applications in the years since.

Weed and pest control

In both the *inti* and plasma, weed control is primarily done through herbicide spraying; unlike the independent smallholders, the plasma smallholders interviewed all used herbicides twice a year. The main herbicides used in the inti were glyphosate and Gramoxone (paraquat); plasma smallholders variously used Herbatop (paraquat), Ally (metsulfuron-methyl) and Gramoxone (paraquat).

The only reported issues with pests concerned caterpillars. Three of the plasma smallholders reported experiencing problems with caterpillars, which was dealt with by requesting that the company undertake fogging. No particular problems with pests or diseases were mentioned by the management of the *inti,* who reported that pesticides are rarely used. The costs provided by the *inti* did, however, include a relatively small amount for pest and disease control.

Irrigation and drainage

Irrigation is not practiced in either the inti or plasma areas, although small ditches have been dug to aid drainage. No long term problems were reported with water availability in either *inti* or plasma interviews.

Harvesting

Harvesting in both the inti and plasma is done manually using an *egrek* (for taller trees) or *dodos* (for younger, shorter trees). This involves cutting FFBs (each weighing between 15 and 25 kg) from the tree using a long pole with a knife attached. In the inti, harvesting of each area of the plantation is done on a rotation system of 5/7 or 6/7 (five or six days of harvesting in each area, then 6 days off before the next harvest begins). In the plasma, each farmer harvests, on average, once every two weeks.

Labour

Company employees working in the inti are broadly divided into two categories: the management team and 'implementing workers' (field and administration staff). There are 10 members of the management team, and 377 field and administration staff (Table 10 provides a breakdown of specific roles). Within the field, *mandors* (foremen) supervise daily work. All workers are '*karyawan tetap'* ('fixed' workers); no causal or daily labour is used.

Similar to the independent smallholders, most smallholders (four out of five of those interviewed) hire one or two casual labourers to perform harvesting and maintenance tasks. Interviews indicated that the use of women's labour seemed to be less common than in Desa Asam Jawa.

3.5 Biomass production case study at the local level 2: Desa Asam Jawa

3.5.1 Location and description of the Case Study

The case study village, Desa Asam Jawa is also located in the Torgamba subdistrict of Labuhan Batu Selatan district (Figure 21). The village has good infrastructure, being situated along a major national highway and is located 34km from the subdistrict capital, Torgamba. It also lies in close proximity to a number of palm oil plantations including Aek Raso plantation (case study 1). The village land is relatively flat and low lying, with some areas of wetland; soil is sandy and considered unsuitable for many other agricultural uses, including rice cultivation.

The village has a long history of settlement, and the residents are considered to be 'original' (as opposed to migrants). Oil palm is also well established; the crop has been grown in the village since 1986, with interviews suggesting that planting peaked around 1989-1990. Cultivation began shortly after the establishment of the nearby PTPN III plantation, with villagers appearing to benefit from the 'spread effects' of knowledge and technology transfer from the plantation. Prior to oil palm, most villagers cultivated rubber. Reasons given for converting rubber plantations to oil palm were mainly economic: palm oil was perceived to be a more profitable crop and offered an opportunity to increase incomes, whereas at the time of conversion latex prices were low and many of the villagers' rubber trees were old and low yielding. Management of oil palm was also viewed as being easier than rubber.

Of the total area classed as village land (6,600 ha), the majority is occupied by commercial plantations (4,767 ha). Of the remaining land used by villagers, the largest proportion is used for smallholder oil palm (1,220 ha). The remainder of the land is used for cultivating rubber and for housing and infrastructure. Typical smallholder plots range from 1.5 – 4 ha. Although no data was available on the precise number of oil palm farmers in the village, this translates into an estimated 500 smallholder plots. The total population of the village was 15,464 in 2010[47]. Given

[47] Village data obtained from Desa Asam Jaw a village office.

an estimated 3,362 households in the village (based on average household size of 4.6 people[48]) this equates to 22% of households cultivating oil palm. Based on interviews, it appears that all farmers have formal titles to their land. The maximum age of trees is 25 - 26 years, and the majority are mature.

3.5.2 Description of the production system

Yield levels

The average yield per ha amongst the five farmers interviewed was 1.132 ton FFB/ha/month (13.58 ton/ha/year) (Table 5). A key observation, however, was that reported yields varied significantly between farmers. The farmer with the highest yield reported average production of 2 t/ha/month (24 t/ha/year), whereas the lowest yielding farm reported average production of 0.33 t/ha/month (3.96 t/ha/year). These variations may be attributed to a number of factors, particularly the age of trees at the time of the survey, the quality of planting material used, and the management practices employed. The farmer with the highest yields, for instance, had used certified seeds produced by Marihat, had had the soil on his farm tested, and was applying fertiliser according to recommendations. These practices were not universal in this village, as noted below. The most significant factor determining the low yield of farmer 3 was the fact that his farm was only recently established and 2/3 of his trees have yet to begin producing. It should also be noted that interest in maximising yields varied amongst farmers; those with other significant sources of income displayed low motivation for improving management practices. One of the farmers interviewed mentioned advice received from agricultural extension worker who came to the village, indicated that farmers have received some formal guidance in oil palm management.

Table 5: Production figures provided by farmers in Desa Asam Jawa

	Farmer 1	Farmer 2	Farmer 3	Farmer 4	Farmer 5	Average
Farm size	4ha	2ha	3ha	2ha	1.5ha	2.5 ha.
Trees per ha.	143	115	120	115	150	129
% mature/% immature	100% mature	87% mature/13% immature	33% mature/67% immature	100% mature	100% mature	-
Age of trees	21 years	12 years/3 years	5 years/3 years	21 years	20 years/10 years	-

48 Average household size in Labuan Batu Selatan in 2009. BPS-Statistics of Sumatera Utara Province

Reported production						
Max. production over the last year (T/ ha/month)	2.5	1.5	0.43	1.6	1.67	1.54
Min. production over the last year (T/ ha/month)	1.625	0.45	0.17	0.9	0.87	0.83
Average production (T/ ha/month)	2	1	0.33	1	1.33	**1.132**

Land clearance/planting

Of the five farmers interviewed, four indicated that their land had previously been used entirely or partially for cultivating rubber, with one describing the previous land use as 'bush land'. Land preparation prior to planting oil palm involved clearing of the old rubber trees and in several cases burning of the remaining vegetation. It appears that famers purchased seedlings from different sources; three of the farmers interviewed mentioned that seedlings were bought from plantation companies, suggesting that they were 'improved varieties'. Planting was done by staking out the land, digging holes, planting the seedlings, then applying fertiliser. Average density of planting was 129 trees/ha, which is around the recommended density[49].

Fertiliser use

Fertiliser use is one of the key determinants of palm oil yield. Again, practices differed greatly between the farmers interviewed. Most use some combination of inorganic fertilisers (either combined NPK or a combination of urea, KCL, TSP, MOP and dolomite). Two farmers had recently begun using an organic fertiliser (no details given). Frequency of fertiliser application ranged from an average of once every 3 months to once every six months, although application was not routine for several of the farmers. Only one of the farmers had had a soil test done; for most, fertiliser application (frequency and selection of fertilisers) depends more on the relative cost and their budget availability, as fertilisers are the largest component of their operating costs (see section 4.2.4).

Weed and pest control

Weed control is another factor influencing yields, and again practices varied between farmers. Three of the farmers interviewed indicated that they use herbicides, mentioning Gramoxone (paraquat), Noxone Gramoxone (paraquat) and Round up (glyphosate), although quantities and frequency of use appeared to vary significantly. Where herbicides were used they were applied using a manual sprayer. In addition to, or in instead of herbicides, weeds are cleared manually from around the trees. The need for weed control reduces over time as trees mature and

[49] Based on discussions with fieldworkers

ground shade increases. The only pests reported were rats, pigs and monkeys, which were particularly a problem during the early years of establishment when the seedlings were most vulnerable. These pests were either trapped, or in the case of rats, poisoned. No farmers reported using pesticides.

Irrigation and drainage

Irrigation is not practiced in this village but small ditches have been dug to aid drainage. Similarly with the neighbouring plantation, water shortages were not reported to be a long term problem.

Harvesting

Harvesting takes place, on average, twice monthly. Harvesting is done manually using simple tools, in the same way as in the plantation.

Use of labour

All the farmers interviewed hired labour for harvesting and maintenance activities on their farms. Most employed either one or two labourers on a casual basis from within the village. Some of the farmers reported that they had done the work on their farms themselves during the first few years, but as all of those interviewed are involved in other employment they no longer have time to do this. In addition, all of the farmers noted that their wives undertook unpaid work when time allowed. The tasks most commonly done by women were weeding, gathering harvested bunches and book keeping.

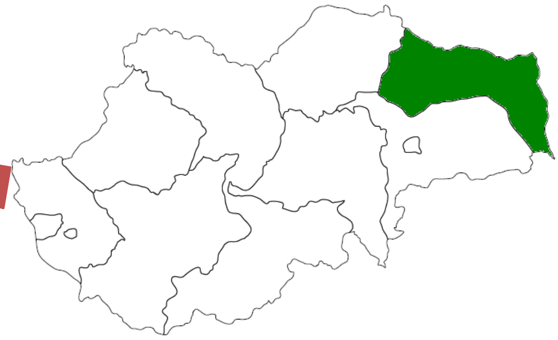
3.6 Biomass production case study at the local level 3: Harapan Makmur

3.6.1 Location and description of the Case Study

Harapan Makmur village is located in the Tanjung Jabung Timor district of Jambi Province, also on the island of Sumatra (Figure 21). The village is situated in a zone of low lying wetland, close to the Batang Hari River, which provides a main source of transportation. The village has no direct access to major roads. The area is artificially drained by a network of canals, constructed in the 1970s.

Figure 23: Location of Harapan Makmur

Location of Jambi Province



Location of Tanjung Jabung Timor

Case study location

Source: Google maps and satellite image

Much of this area, including the case study village, was settled in the 1970s by migrants from Java and Sulawesi; the government's transmigration programme at the time offered land and support for rice cultivation. Prior to settlement, land in this area was forest; the land was cleared by the government prior to the migrants arriving and the first migrants established paddy fields. Villagers reported that they found the land unsuitable for rice cultivation, which had only been a limited success; a trend over the years has been a decline in the amount of village land devoted to rice, despite continuing government support. Other crops including coconut have been attempted over the years but have reportedly not been successful.

Palm oil cultivation began in the village in 2005. Villagers were aware of the success of the crop elsewhere and made the decision to attempt to grow the crop independently; they have received no government support for palm oil cultivation. A majority (65%) of the village's 1500 ha. is now utilised for palm oil. Rice is cultivated on 15%, with the remaining 20% used for rubber and other crops. The crop has also been chosen by a majority of villagers: of approximately 700 villagers, 400 are currently cultivating palm oil, on a typical plot of 2 ha (Although some farmers have acquired additional land and cultivate larger plots, up to 7 ha). The maximum age of trees is 6 years, and around 30% are mature[50].

[50] Data based on estimates by village head.

Each farm in this village is independently owned by a single farmer. Farmers cultivate their own land using family labour; there was little use of hired labour. Farmers have formal land titles, having been allocated plots of land as part of the transmigration scheme. Palm oil now provides the main source of income for the majority of villagers. Other crops and sources of income include: rubber, rice and areca nuts (betel nuts). With few other economic opportunities in this area, a minority of farmers have other jobs (approximately 30%). Home gardens, managed by women, also provide food and occasional income from the sale of crops such as chillies and fruit.

3.6.2 Description of the production system

Yield levels:

Current average FFB yields in this village were reported to be around 0.8 ton FFB/ha/month (9.6 ton/ha/year), which are the lowest expected yields from oil palm cultivation, even in the context of low yielding smallholders. These low yields can be attributed to a number of factors. Significantly, the oil palm plots in this village are still in their early years of production and have yet to reach peak harvest[51]. In addition, low yields also appear to result from a range of factors related to sub-optimal management practices. It is important to note that there is diversity in management practices, even between farmers in the same village, but no farmers were observed or reported to be following best practice in any aspect of farm management. Until very recently, farmers had received no support with palm oil cultivation, either financial or technical. A local NGO has, however, recently started working with farmers in this village.

Land clearance/planting

Most of the land converted to palm oil in this village had been previously used for rice cultivation and land clearance was therefore not required; in fact in most cases oil palms were initially planted within the rice fields. On most plots observed, planting was done in a way likely to reduce yields. The recommended planting interval is 9m, with a density of approx. 130 trees per ha. However, on most plots observed, trees were planted significantly closer than this, at around 140 trees per ha, and in places interspersed with other tree crops such as rubber. Many farmers continued to cultivate rice around the oil palm trees during the first few years of growth prior to them becoming productive (Figure 24). Moreover, the seeds used are of poor quality. Farmers reported buying seeds by the can; these are not ‘improved seeds’ and are significantly cheaper (see section 4.2.5). It was estimated by field workers that improved planting materials alone could increase annual yields by around 1.5 ton/ha.

[51] The oldest trees in the village were 5 – 6 years old. Peak harvest doesn’t occur until year 8 – 9.

Figure 24: Recently planted oil palm trees surrounded by rice (Harapan Makmur)

Fertiliser use

Fertiliser application, as in Desa Asam Jawa, is variable. Farmers currently apply a mix of inorganic fertilisers[52], although were keen to produce and use organic fertiliser. Most farmers were reportedly not using the correct composition or applying fertiliser frequently enough; optimal fertiliser use requires regular application (every 3 – 5 months), whereas most farmers were only applying fertiliser ever 4 – 6 months, and that the composition be adjusted across the life cycle of the plantation. In particular, it was noted that farmers were using significantly less dolomite (lime) than was recommended on the acidic wetland soils. Many farmers are reportedly unaware of these recommendations and made decisions about fertiliser use based primarily on cost.

Weed and pest control

Weed control was generally done manually; herbicides were used occasionally by some farmers, but this was not routine. Poor weed control was another factor affecting yields. There was no use of pesticide by farmers in this village, but no problems with pests affecting crops were reported.

Irrigation and drainage

A key issue in the case study location is drainage management; the area is wetland and prone to water-logging. Many farmers had constructed drainage canals but this was not universal (Figure 25). Farmers with waterlogged soil were observed to have limited success in cultivating oil palm.

[52] Mixture of urea, SP, KCL and Dolomite (lime)

Figure 25: Drainage ditch, Harapan Makmur

Harvesting

Timing and frequency of harvesting is dictated primarily by the availability of transport, provided by the buyers of FFBs. Harvesting also requires coordination between farmers located along each canal. These constraints mean that harvesting is conducted approximately twice a month, at prearranged times. Harvesting is done manually using either a dodos or an egrek.

Use of labour

The majority of farmers in this village do all farm work themselves. Only farmers with larger plots (7ha) hire labour; labourers were hired from within the village and were reportedly farmers who had been unsuccessful with palm oil production on their own farms. Again, women commonly undertook unpaid work on the farms, usually weeding and book keeping.

3.7 Biomass conversion case study at the local level: Aek Raso palm oil mill

3.7.1 Location of the Case Study

Aek Raso palm oil mill is located within Aek Raso plantation, and has been operating since 1996. It was built to process FFBs from the plantation, but also sources from plasma smallholders and some small private plantations (Table 6). The mill is also owned by PTPN III, one of 11 mills owned and operated by the state owned enterprise.

The mill sources the majority (55%) of its FFB supply from its own plantation, with 29% sourced from plasma smallholders through the KUD (cooperative) and the remaining 16% purchased from other sources (independent smallholders and small private plantations) which sell directly to the mill. The mill does not use agents to source FFBs.

Table 6: FFB sources for Aek Raso Mill

Source	Average % of FFB purchase	Average annual purchase (t.)[53]
From own plantation	55%	67,228
from plasma	29%	35,448
from other	16%	19,557
Total	100%	122,233

Source: Data provided by Aek Raso Mill

The mill sells CPO both domestically and for export. CPO destined for export is sold to a sister company in Dumai, Riau, from where it is shipped. Domestically, CPO is also sold to refineries owned by Wilmar, Musim Mas and MNA, where it is further processed.

3.7.2 Description of the mill

The mill's capacity is 30 Mt FFB/hour, which is smaller than average; most commercial mills in Indonesia range from 30Mt-90Mt/hour capacity. The mill operates on average 22 days per month (approximately 264 days in a year). During peak production season, the mill operates at almost full capacity, 24 hours a day. Its average operating capacity is around 70%. The main product of the mill is Crude Palm Oil (CPO). It sells palm kernel to neighbouring mills that have equipment and production lines for Palm Kernel Oil (PKO). It also sells excess shells and fibre. The mill purchases an average of 463 t FFB/day and has an average daily output of 106.5 t CPO/day.

The mill's CPO yield is, on average, 23% of the weight of the FFBs (oil extraction rate), which is higher than many mills. As the majority of its FFB are received from the plantation, they are of higher than average quality. The production system in the mill follows the standard system for most palm oil mills in Indonesia (see section 3.2.3) (Figure 26), and the technology has remained the same since the mill was first built.

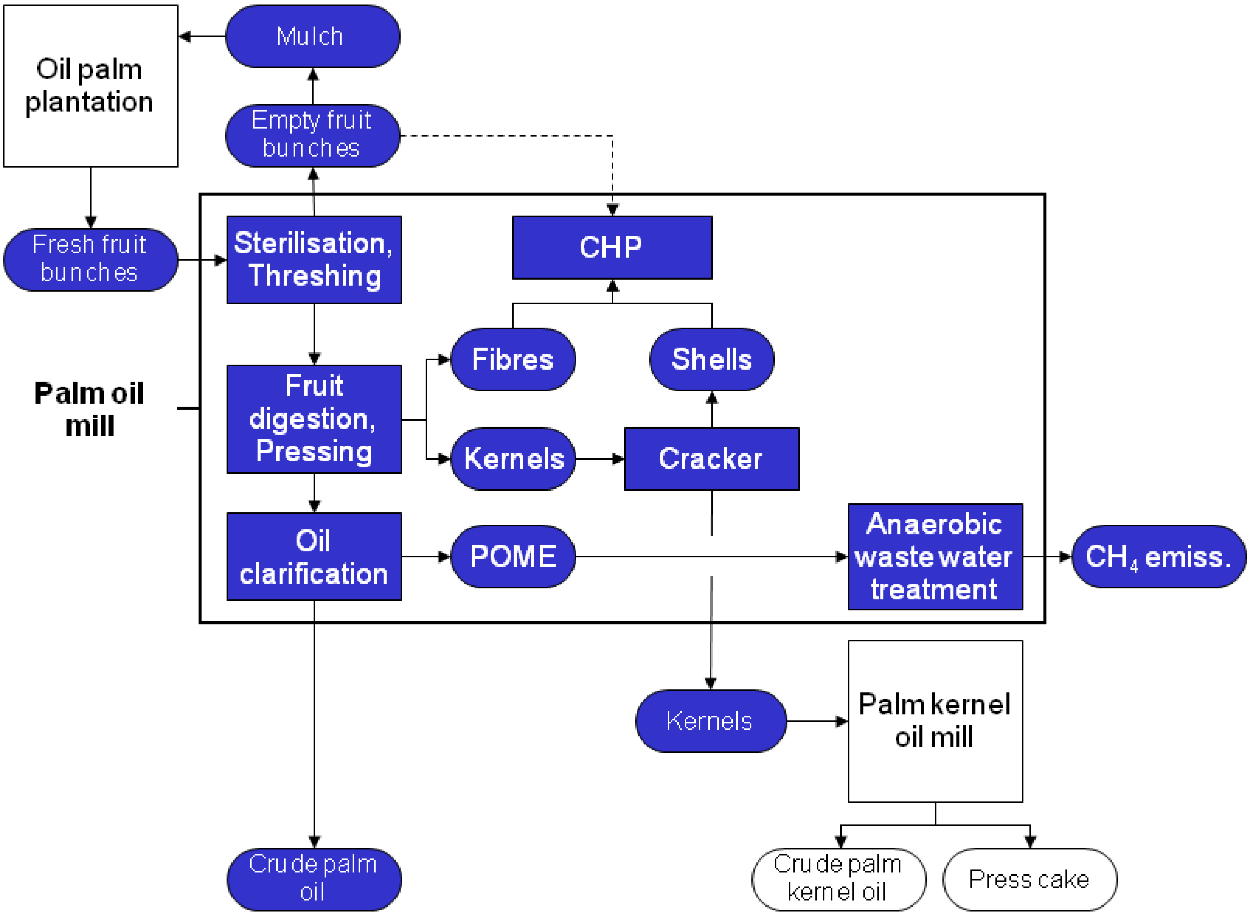
Table 7: Summary of production data for Aek Raso Mill

Capacity (t FFB/hour)	30
Total shifts per day	2
Total days per month	22
Average use of capacity	70%
Average t FFB/day	463
Average CPO yield	23%
Average CPO production (t CPO/day)	106.5

Source: Data provided by Aek Raso mill.[1]

[53] Assumptions of FFB requirements based on data in Table 7

Figure 26: Production process in Aek Raso mill



4. Socio-economic impacts of the palm oil chain

This section presents an analysis of key socio-economic impacts of the palm oil chain in Indonesia. These impacts are addressed at national, regional and local scales.

4.1 Method

At the national and regional scale, data has been collected through a desk-based review of publically available data and existing reports. Analysis of this data informed the selection of the chosen impacts and the design of the data collection for the local case studies. At the local scale, rapid impact assessment methods were used to collect data. For the smallholder case studies, semi-structured interviews were conducted with farmers, both individually and in groups. In the case of Aek Raso plasma farmers and farmers in Desa Asam Jawa, five farmers were interviewed individually in each location. In Harapan Makmur, a group discussion with eight farmers was followed with one on one interviews with two farmers. In the case of the plantation and the mill, information was obtained from interviews with estate and mill managers and with head office staff, in conjunction with data provided at the estate level. The information obtained allowed for the identification and understanding of the main socio economic impacts of relevance in each example.

The data collection for this study did not involve conducting a full field survey or social impact assessment, and the small sample size should be emphasised when considering the wider applicability of the findings. As no baseline datasets were available for any of the local case study locations, information about past conditions relied largely on people's memories. While this gives a sense of changes overtime, the inherent limitations of this method should be stressed.

This section is structured according to each of the selected categories of impacts: economics, employment creation and poverty reduction; working conditions; health; food security; land competition and conflict; gender issues and risks for smallholders. In most cases, impacts are addressed at each of the three scales: national, local and regional, and comments are made about the issue in the context of both production and conversion. The exception is the local case study of a biodiesel refinery, based entirely on desk based research, where only economic impacts are addressed. Little or no information was found to indicate the impacts of biofuel refineries on the other categories of impacts.

At the national level, relevant country level data is presented, along with a synthesis of Indonesia-specific findings for each impact. At the regional level, possible impacts of the palm oil chain are described for North Sumatra; this uses regional level data and other studies where available. At the local level, a description of the findings from each case study is presented, with any data provided. Where possible, an attempt has been made to quantify changes in impacts over time.

4.2 Economics

4.2.1 Macroeconomics in the palm oil chain in Indonesia

The economic significance of palm oil to Indonesia rests firstly on the contribution it makes to exports and GDP, secondly on its importance as a commodity for meeting domestic demand, and thirdly on its role in employment generation (USU, undated). This section addresses the first two aspects, along with the economics of biofuel production, while employment generation is covered in section 4.3. Investment in the palm oil sector in Indonesia primarily comes from the large business groups which dominate the sector and the government via state owned enterprises. Currently, the majority of investment is at the level of production, in palm oil plantations (and primary processing in mills). This is reflected in Indonesia's palm oil trade, which is dominated by exports of CPO rather than refined palm oil products.

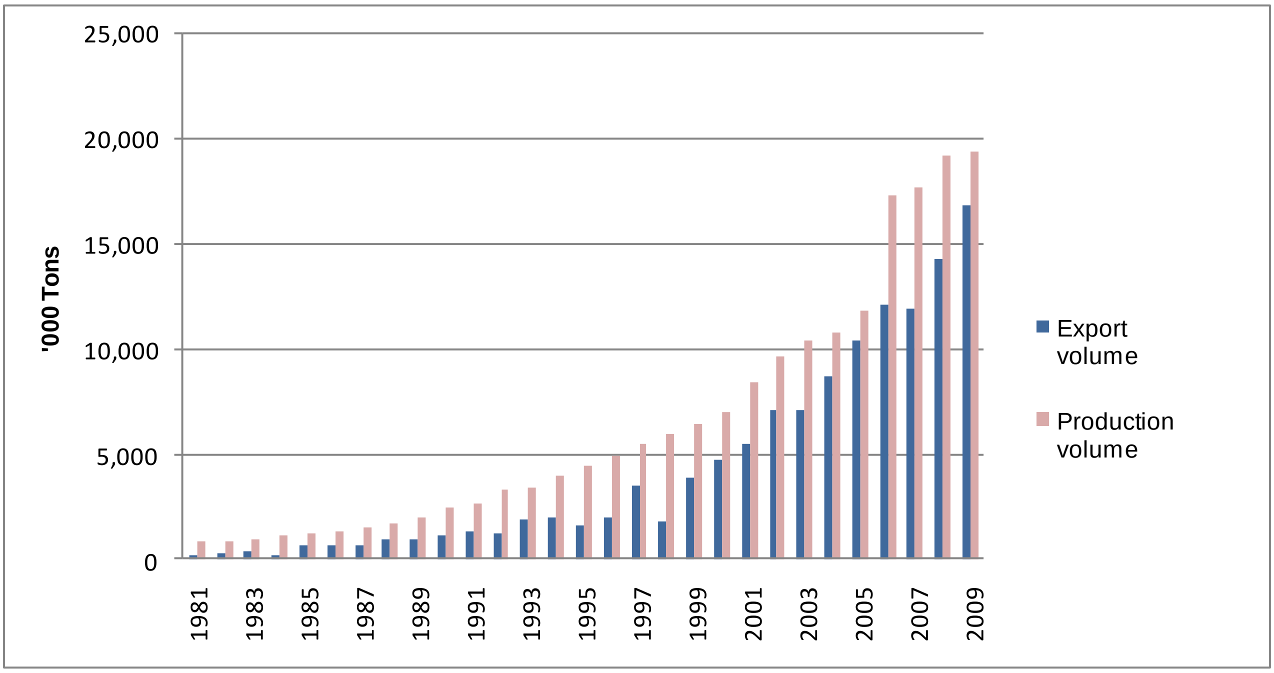
Domestic demand

Although palm oil is now primarily an export oriented commodity, domestic demand for the commodity as a cooking oil is significant, and growing. Abdullah and Wahid (2008) estimated that on average 3.2 million tons of CPO are required to meet domestic demand for cooking oil, based on per capita cooking oil demand of 12kg per year, of which 10.5kg comes from RBD olein (the rest mostly from coconut oil). In order to ensure that domestic supply is maintained, a palm oil export tax is in place, which is set monthly. Current regulations allow a tax of between 1.5% and 25% to be imposed[54], although during the financial crisis of 1997, a temporary export ban was imposed. Discussions surrounding the export tax now also focus on its role in encouraging the development of downstream processing in Indonesia, discussed below.

Palm oil exports

Data on palm oil exports, both in terms of volume and value, appears inconsistent between different sources. One reason for this appears to be that in trade statistics, CPO is counted together with refined palm oil and its fractions. Overall data on palm oil exports, however, show that both total exports and the export share of production have markedly increased over time (Figure 27); at least 70% of Indonesia's palm oil production is exported. In terms of value, palm oil generates 1/10 of Indonesia's foreign exchange receipts (Fischer, 2010) with CPO being Indonesia's largest export excluding the oil and gas sector. Indonesia is now the world's leading exporter of palm oil, capturing 44.7% of the market in 2008 (Ministry of Agriculture data).

Figure 27: Palm oil production and export volumes



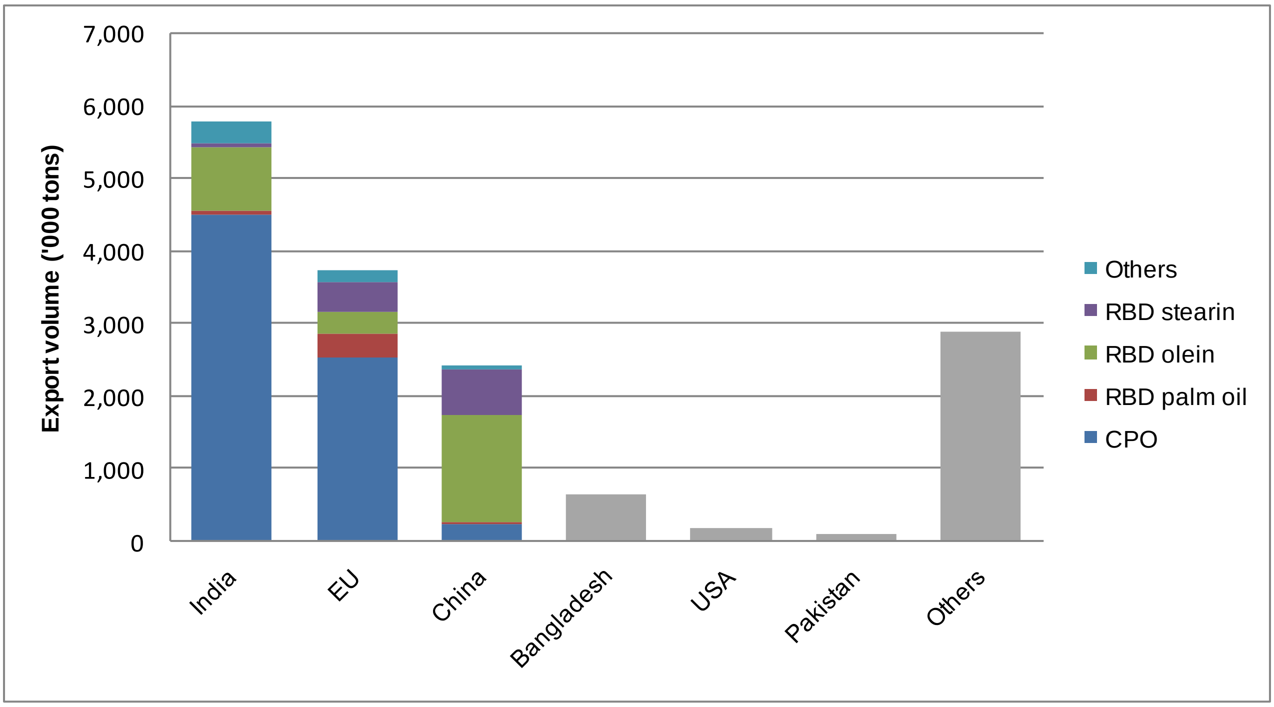
Source: Data from DG Estate Crops and Greenomics Indonesia (May 2010) based on Trade Ministry data

The largest share of Indonesia's palm oil exports is still CPO. GAPKI data for 2010 shows that CPO comprised 56% of palm oil exports (8,779,940 ton). Data disaggregated by both product type and main export markets shows that India is the largest market, purchasing 51% Indonesia's CPO (4,498,365 ton). Both India and the EU primarily import palm oil in its crude form. According to this data, China is an exception to this, importing predominantly refined products (

[54] Government Regulation No. 25/2005 provides the framing regulation for export tariffs for key food commodities. This appears to be currently under review.

Figure **28**).

Figure 28: Palm oil exports by market and product type (2010)



Source: Data from GAPKI (2011)

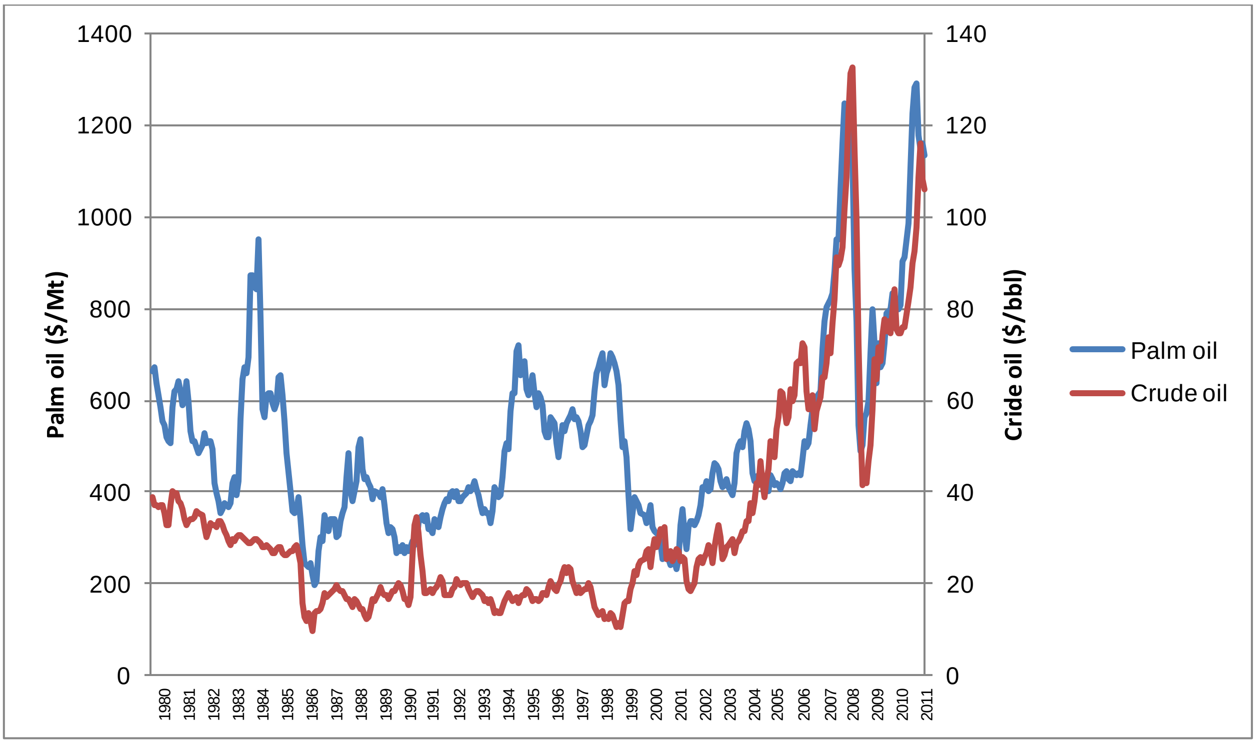
Indonesia's shares in the markets for processed palm oil downstream processing industry are much smaller than its main competitor, Malaysia. This means that Indonesia has been more vulnerable to fluctuations in CPO prices, and is also benefitting less from value added downstream processing. There has been a desire expressed by the government to develop more downstream processing facilities; an intention has recently been voiced to offer fiscal incentives and restructure the export tax to encourage investment. Challenges for expansion of downstream processing in Indonesia include power shortages and poor infrastructure, increasing the costs of processing and transporting goods (Taylor, 2011).

Palm oil prices

Revenues from exports are also heavily affected by palm oil prices. Palm oil is the lowest priced vegetable oil, but is still traded at a considerable discount in most years, mostly as a result of the trade policy of India (the largest market), which has a longstanding preference for soy (Thoenes, 2006).

Prices have been generally rising since 2001, but have become more volatile in recent years. CPO prices are now closely linked to oil prices (Figure 29) and rapid price rises in 2007 – 8 and again in 2010 – 2011 are correlated with spikes in energy prices. Vegetable oil prices have been generally strengthened by biodiesel demand, itself a result of oil prices. Although currently palm oil constitutes a minor share of vegetable oils used for biodiesel, it is highly substitutable for other oils such as rape seed and soy, which are diverted to biodiesel production.

Figure 29: Palm oil prices in comparison to oil prices



Source: Data from World Bank Commodity Report

Macro-economics of biofuels in Indonesia

The Indonesian Government's policy on biofuels and associated targets (described in section 3.1.9) anticipated that the development of biodiesel from palm oil would yield economic benefits for the country, primarily through job creation, boosting domestic demand for palm oil and reducing dependence on fossil fuels and the associated burden of fuel subsidies. As section 3.2.5 highlighted, however, production of palm oil based biodiesel has been much lower than anticipated; it can therefore be assumed that the expected economic impacts have yet to be realised.

The dominant influence on the fortunes of the biofuels industry in Indonesia is the economics of production; both CPO and oil prices determine the degree to which biodiesel production is profitable. Following initial industry enthusiasm in 2006, high CPO prices in 2007 and early 2008 made biodiesel production uneconomical; this led to high levels of unutilised capacity. The political context has also affected the confidence of producers and investors and affected incentives. The majority of biodiesel produced in Indonesia is sold domestically to state oil and gas company, PT Pertamina. Disputes over the purchase price by PT Pertamina have caused production to stall, while subsidy levels affect profitability (Sasistiya, 2010). Although there have been some improvements in the biodiesel pricing formula, and the biofuel subsidy has been implemented, this continues to act as a brake on the development of the industry[55].

Data on biodiesel exports indicates that Indonesia exported 42 and 200 million litres of biodiesel in 2006 and 2009 respectively (USDA – FAS, 2010). While data on destination markets was not available, it is understood that biodiesel was exported to Australia and the EU (Hanawi, pers. comm.). The change to EU RED in 2009, however, has prevented export of palm oil based biodiesel to the EU[56].

It is difficult to predict how Indonesia's biofuels industry will develop in the next few years. The economics of biodiesel production will continue to be important and government commitment to, and support of biofuels is seen by producers as being critical. Beyond the domestic market, the opportunities for biodiesel producers to export will depend both on conditions in export markets, including the acceptance of palm based biodiesel in European markets, along with the Indonesian export tax.

4.2.2 Economics in the palm oil chain in North Sumatra province

Despite being the centre of the palm oil industry, limited data was found at a regional level about the economics of palm oil production or conversion in North Sumatra. CPO contributes a significant share of the region's exports (approximately 42%), with refined oil and food products derived from CPO also contributing to export revenues (Table 8).

Table 8: Value of palm oil exports from North Sumatra (2009)

	Net weight (T)	Value ('000 €)	% of North Sumatra's exports
Unrefined vegetable fats and oils[57]	4,312,082	1,915,803	42%
Refined vegetable oils and fats[58]	247,629	109,659	2.4%
Margarine and shortening	210,780	118,062	2.6%

Source: Data from BPS SUMUT

[55] See Winrock 2009 for a breakeven analysis of biodiesel costs at various feedstock prices
[56] According to EU calculations, biodiesel derived from palm oil cannot be used in the Euro zone due to palm oil's carbon saving being below EU's threshold level at 39 percent. These calculations are disputed by Indonesian producers
[57] Category in trade statistics also includes other vegetable oils. CPO constitutes by far the largest share of this category
[58] Also includes other refined vegetable oils and animal fats

4.2.3 Microeconomics of palm oil production in Aek Raso plantation

Establishment costs:

Costs for establishment were unavailable. Establishment was paid for by the company, with plasma smallholders later repaying the cost of establishment of the plasma. Details of the amounts repaid were not available from either the plantation management or the smallholders.

Management costs

Inti

The data provided by plantation managers concerning input costs was in incomplete and did not allow for meaningful calculations. Secondary data gives some indication of the management costs in large estates. The data is Table 9 is based on a palm oil study undertaken between 2002 and 2005 and reported in Zen et al (2005). These costs have not been adjusted for subsequent inflation.

Table 9: Costs of production on palm oil estates

	Cost per kg/FFB (€/Rp)	Cost per ha (€/Rp)[59]
Harvesting cost[60]	0.0049	9.34
	60	113,160
Overheads	0.0016	3.08
	19.8	37,343
Capital[61]	0.00074	1.40
	9	16,974
Land[62]	0.0023	4.38
	28.2	53,185
Total cost	0.023	44.95
Including: upkeep, fertiliser, harvesting, overheads,	289.4	545,808

[59] Based on average yield of 18,860 kg/year
[60] Includes wages and other benefits for workers
[61] Interest charges on working capital
[62] Interest charges on the value of the land

capital, land

Source: Zen et al (2005)

Data made available on the plantation's annual labour costs was clearer. This included overall budgets for salary and benefits (including wages and extra allowances; overtime; incentive payments and annual leave) for the two main categories of employees described in section 3.4.2: management team and field and administration workers. As such, it is possible to calculate average salaries for employees in the two groups, although there is likely to be considerable variation within each category.

Table 10: Labour costs, Aek Raso plantation

Role	No. of workers	Salary and benefits	Total annual budget (€/Rp.)	Average annual salary and benefits per employee (€/Rp.)
Management				
Manager	1	• Wages and extra allowance • Premi* • Annual leave	79,358/963,701,585 757/9,187,178 3,487/42,347,460	7,936/6,370,158 76/918,718 349/4,234,746
Assistant manager	2			
Staff leaders	7			
Total	**10**		**83,602/1,015,236,223**	**8,361/101,523,622**
Field workers and administration				
Harvesters	143	• Wages and extra allowance • Overtime • Premi* • Annual leave	410,555/4,985,691,396 19,379/235,337,669 179,616/2,181,219,811 36,197/439,572,081	1089/13,224,645 51/624,236 476/5,785,728 96/1,165,974
Plant maintenance workers (etc.)	71			
Administrators	54			
Transportation workers	34			
Foremen	32			
Security	31			
School/mosque employees	10			
Health workers	2			
Total	**377**		**645,747/7,841,820,957**	**1,712/20,800,583**

Source: Aek Raso Plantation data *incentive payments based on harvest

Plasma

Costs for plasma farmers (Table 11) were calculated using the prices reported by farmers (for both inputs and cost of labour. No establishment costs are given as this was done by the plantation company.

Harvesting

The only physical inputs for harvesting are the tools *(egrek* or *dodos*), for which a cost is quoted based on one purchase every 10 years. It is assumed that only one piece of harvesting equipment is required per farmer. Labour costs for harvesting are paid per kg FFB. Farmers indicated that labour costs for harvesting are lower in the early years of production (€0.0082/Rp. 100 per kg) when the trees are shorter and FFBs easier to reach, and increase in later years to €0.011/Rp. 130 per kg when trees are taller and harvesting more difficult.

Application of fertiliser

Fertilizer costs used in the cost calculations are based on an average of the five farmers reported costs; there was less variation in fertilizer application practices amongst plasma farmers than amongst independent farmers. Labour costs are calculated per sack of fertiliser (50 kg.) based on an average of the rates quoted and an average of the number of sacks used per ha per year.

It is recommended that fertilizer application be adjusted over time. It is assumed in the cost calculations that for up to year 16, fertiliser application was 2/3 of current practice.

Table 11: Production costs, Aek Raso plasma smallholders

Expenses per hectare (€/Rp)[63]												
	Yield (m^3 or kg /ha)	**Field preparation**	**Planting material**	**Field clearing**	**Applying fertiliser**	**Weed control (spraying)**	**Weed control (manual weeding)[64]**	**Harvesting[65]**	**Pruning**	**Transport in field**	**Transport to mill**	**Average annual costs**
Year 1		Establishment and management done by *inti*										
Year 2 - 7												
Year 8 - 16	24,000				F: 148.13 1,798,830 L: 5.32 64,548	H: 23.96 291,000 T: 2.88 35,000 L: 34.59 420,000	L: 49.41 600,000	T: 1.98 24,000 L: 197.63 2,400,000	T: 0.25 3,000 L: 28.82 350,000	T: 2.47 30,000	158.11 1,920,000	**653.53** **7,936,378**
Year 17 - 25	17,040				F: 224.44 2,725,500 L: 8.05 97,800		L: 24.70 300,000	T: 1.98 24,000 L: 182.41 2,215,200	T: 0.25 3,000 L: 43.95 533,750		112.26 1,363,200	**661.94** **8,038,450**

L: Labour	F: Fertiliser
T: Tools	H: Herbicide

[63] Unless otherwise stated, assumptions are the same as for plasma smallholders
[64] No labour costs were given by farmers for this activity, although it is clearly done, either by farmers themselves or their wives. An opportunity cost of labour is included based on the daily rate of Rp. 50,000 for unskilled men's labour provided by farmers in Desa Asam Jawa. (note: costs would be lower if women's daily rate of Rp. 27,000 was used). The amount of weeding required is assumed to reduce over time as in Desa Asam Jawa.
[65] Based on labour costs of €0.0082 (Rp. 100) per kg in years 8 – 16 and €0.011 (Rp. 130) per kg in years 17 - 25

Weed clearance

The plasma farmers all use herbicides. Input costs therefore include both the herbicide itself and the spraying equipment. In addition to herbicide spraying, for which a labour cost applies, labour costs are provided for the manual clearance of weeds. This task focuses on the immediate area around the tree and costs are given per tree. Weed clearance was also commonly listed as one of the jobs done by women; wives of smallholders appeared to perform this task unpaid. As noted in section 3.5.2, weed growth declines over time, and labour costs for weed clearance when the trees are young is therefore higher than in later years. This change is factored into the cost calculations.

Transport

Costs for transporting FFBs include both 'in field' transport (moving the harvested fruit to the road/collection point) and transport from the village to the mill. The former is done using either an *angkong* (hand-pulled cart) or motorbike. The cost used in the cost calculations is based on the cost of an *angkong.*

The cost of transportation of FBs to the mill was a little unclear from the data provided by farmers. It appears that they are charged a rate per kg of FFB. Costs have been calculated using a rate of €0.0066 (Rp.80) per kg.

Other cost factors

Inti

The plantation's income comes from the sale of FFBs to the mill. Based on an average annual yield of 18.86 t/ha, total annual yield from the inti as a whole is 57,589 t. Using the same selling price as that reported by plasma farmers, this equates to €73,505,106 (Rp. 892,629,650,000) per year.

The only details of other cost factors provided by the inti were a figure of €6,405 (Rp. 77,782,300) for annual tax, land rent and levies.

Plasma

All plasma farmers have now completed repaying the plasma establishment costs. They therefore have land titles and owe nothing more on their land. Annual land tax was reported to be €2.88 (Rp.35,000) per ha.

Although three of the plasma farmers reported income sources from other employment, these were much less significant than for the independent farmers of Desa Asam Jawa (between €123.52 (Rp.1,500,000) and € 164.69 (Rp.2,000,000) per month). Income from FFB sales was therefore more significant to overall household income to these farmers. The prices received per kg FFB were slightly higher than those reported by the independent smallholders: between

€0.16 (Rp.2000) and €0.12 (Rp.1400) per kg[66]. There was also less variation in prices received, as four of the five sold FFBs through the KUD (cooperative). Accounting for these slightly higher selling prices and based on the average yield amongst plasma smallholders, average yearly income from FFB sales is estimated at €2,385 (Rp.28,968,000) per ha.

4.2.4 Microeconomics of palm oil production in Desa Asam Jawa

Costs for independent smallholders have been calculated in the same way as for plasma smallholders, with the exception of establishment and transportation costs. Broadly, costs were similar for the two groups, although independent smallholders had slightly lower costs in some areas, notably weed clearance, due to lower rates or herbicide use. Furthermore, as noted in section 3.5.1, there was less consistency of practices amongst the independent smallholders, resulting in more variation around the average cost for each activity, particularly for fertiliser application.

Establishment costs:

The primary inputs at the establishment phase (approximately years 1 – 3, until the trees become productive) are fertilizers and the planting material, which was purchased by farmers in this village as seedlings. The costs of planting material indicated by the farmers showed wide variation, depending on when the establishment was done and where the seedlings were purchased from. Due to this variation, and the difficulties farmers found recalling costs from over 20 years ago, secondary data has been used to estimate smallholder establishment costs[67]. In Table 12, costs are indicated for the entire establishment phase, although it should be emphasized that labour requirements, and costs, are highest in the first year when the land is cleared and planting is done. Throughout the cost calculations, an average of 130 trees per ha is assumed.

Transportation costs

The calculation of transportation to the mill differs slightly from the plasma farmers. Costs depend on the farmers' arrangements for selling the FFB harvest. Two of the farmers sold their FFB direct to the mill, organising their own transport. This involves renting a truck and paying an unloading fee. The remaining three farmers sold their FFB to a collector who charges a fee per kg of FFB for transport to the mill. The latter arrangement works out slightly more expensive for the farmers, but farmers explained that when yields are small it is not worth hiring their own truck. The costs used are an average of the resulting costs between the two practices. This village is located 7 km from the nearest mill, and the costs are based on this distance.

[66] This is likely to be a result of the greater bargaining power of the KUD over independent smallholders, who sell to the mill either individually or through intermediary buyers

[67] Costs used are those calculated by Papenfus (2000). These were based on field studies in Jambi and Riau in 1999 and apply to independent smallholders with similar characteristics to those in this case study (land owners, converting land from rubber to oil palm) although assumes 120 trees per ha as opposed to 130 in this example.

Table 12: Production costs, smallholders in Desa Asam Jawa

<table>
<tr><th colspan="13">Expenses per hectare (€/Rp)</th></tr>
<tr><th></th><th>Yield (kg /ha/year)</th><th>Field preparation</th><th>Planting material</th><th>Field clearing</th><th>Applying fertiliser[68]</th><th>Weed control (spraying)</th><th>Weed control (manual weeding)[69]</th><th>Harvesting</th><th>Pruning</th><th>Transport in field</th><th>Transport to mill[70]</th><th>Average annual costs</th></tr>
<tr><td>Year 1 - 3</td><td>0</td><td colspan="6">Establishment phase:
PM: 98.82/1,200,000
F/H: 346.57/4,208,700
T: 41.17/500,000
L: 64.23/780,000
C: 4.72/57,333</td><td colspan="3"></td><td></td><td>185.17
2,248,677</td></tr>
<tr><td>Year 4 – 7</td><td>10,800</td><td colspan="3" rowspan="3"></td><td rowspan="3">F: 246.58
2,994,366

L: 9.36
113,700</td><td rowspan="3">H: 7.04
85,500

T: 2.88
35,000

L: 5.48
66,500</td><td>L: 42.82
520,000</td><td>T: 1.98
24,000
L: 88.93
1,080,000[71]</td><td>na</td><td rowspan="3">T: 3.21
39,000</td><td>101.78
1,236,000</td><td>510.06
6,194,066</td></tr>
<tr><td>Year 8 - 16</td><td>19,000</td><td rowspan="2">L: 24.37
296,000</td><td>T: 1.98
24,000
L: 156.46
1,900,000</td><td rowspan="2">T: 0.25
3,000
L: 21.41
260,000</td><td>172.10
2,090,000</td><td>651.12
7,907,066</td></tr>
<tr><td>Year 17 - 25</td><td>13,580</td><td>T: 1.98
24,000
L: 111.83
1,358,000</td><td>126.37
1,534,560</td><td>560.75
6,809,626</td></tr>
</table>

L: Labour	F: Fertiliser	PM: Planting material
T: Tools	H: Herbicide	C: Capital costs

[68] As fertiliser application varied considerably and over time based on cost factors rather than best practices, current practices (and costs) are assumed for all years.
[69] Labour costs in years 4 – 7 are lower than in 8 - 25 due to more weed growth in the years before trees are established.
[70] Transportation costs based on kg transported and therefore vary with yields.
[71] Based on a labour cost of €0.0082 (Rp. 100) per kg - independent farmers did not indicate that labour costs increased in later years.

Other cost factors

All the farmers in this village own their own land. There is an annual tax of around €3.71 (Rp.45,000) per ha. One of the farmers had borrowed money in relation to oil palm, but details of repayments were not given.

Farmers' income is comprised of income from the sale of FFBs, along with income from other sources. Amongst the farmers interviewed, FFB sales contributed the smaller share. Income from FFB sales was variable, both over time and between farmers. FFB prices fluctuate; the most significant, but not only, determinant being CPO prices. Prices for farmers in this village had ranged from €0.16 (Rp. 2000) to €0.07 (Rp. 900) per kg. FFB. These fluctuations translate into variable household income, but based on a mid-point selling price and average yield, farmers were earning, on average, €1,622 (Rp. 19,691,000) per year from the sale of FFBs. Variations between farmers resulted both from differences in yield and from differences in the price received for FFBs. Two of the farmers received the mill buying price by selling directly to the mill. The other farmers used agents, and therefore received a slightly lower price per kg.

All farmers had other income sources from employment or trading. In some cases this income was substantial: two of the farmers reported earning over €660 (Rp.8,000,000) per month from other sources. In all cases income from other sources was higher than that from FFB sales. This may well be a factor explaining the limited motivation by some of the farmers to maximize yields.

4.2.5 Microeconomics of palm oil production in Harapan Makmur

The calculation of costs in Harapan Makmur was done in the same way as for the other smallholders, with the exception of labour costs. As noted in section 3.6.2, use of hired labour was far less common in this village than in Desa Asam Jawa. The only activities for which a specific labour costs was given was harvesting, which was paid at a rate of €0.0082 (Rp. 100) per kg and 'distribution' (gathering and loading FFBs onto boats, see Figure 30) at €0.0041 (Rp.50) per kg. For all other jobs, labour costs are based on number of days spent per ha. and calculated as an opportunity cost using a daily rate of €2.88 ()[72] (Table 13).

Establishment costs:

The costs of establishing oil palm included the cost of seeds and the cost of labour for preparing the land and planting. The cost for land clearance is quoted as '*tenaga borongan'* (payment for the job as a whole). As all farmers in this village owned their land prior to establishing oil palm, there was no cost involved for the land itself and there were no reports of farmers having to borrow money in order to establish oil palm in this village. Over the first four years, until trees become productive, there are additional costs for the purchase of fertiliser and in some cases herbicide (and associated labour costs for application). These inputs comprise by far the largest share of the costs during the first four years (81% of the total)[73].

[72] This figure was provided in interviews as the typical daily rate for unskilled agricultural labour in this area.

[73] As farmers in village have only recently established oil palm, the establishment costs given are likely to be more accurate than those provided by farmers in Asam Jawa. These costs are therefore used in preference to secondary data.

Figure 30: FFB transportation by boat (Harapan Makmur)

Other cost factors

All the farmers in this village own their own land. There is an annual tax of around €1.48 (Rp.18,000) per ha. None of the farmers had borrowed money in relation to oil palm.

Farmers' main income is comprised of income from the sale of FFBs. It was estimated the one third of farmers in the village have another source of income, mostly from hiring out boats or working as motorcycle taxi drivers. A few were formally employed, mostly as civil servants. Within the time period that the farmers in this village have been cultivating oil palm, FFB prices and therefore incomes have risen (from around €0.03 (Rp. 350) to €0.09 (Rp. 1100) per kg). Nevertheless, these farmers sell their FFBs for below the factory gate price. Their isolation from the nearest mill means that they are dependent on a chain of buyers who purchase FFBs from the village. This factor, along with the villagers' lack of organisation contributes to their weak bargaining position. It is also likely that the FFBs produced here are penalised on quality grounds; mills routinely pay less for unripe or poor quality FFB which are common from independent smallholders. At the time of visiting (February 2011), farmers were being paid €0.09 (Rp. 1100) per kilo of FFBs. This contrasted with plasma smallholders elsewhere in Jambi receiving €0.13 (Rp. 1626) per kilo.

Based on an average yield of 9.6 ton FFB per year, at the selling price of €0.09 (Rp.1100) this equates to an annual income from FFBs of €870 (Rp.10,560,000) per ha. At the lower end of the range of prices given (€0.03 / Rp. 350), annual income would be only €277 (Rp. 3,360,000) per ha. Estimated annual costs are €340 (Rp. 4,212,000) per ha, leaving much smaller profit margins that for the other groups of farmers.

Table 13: Production costs, smallholders in Harapan Makmur

Expenses per hectare (€/Rp)													
	Yield (kg /ha/year)	Field preparation	Planting material	Field clearing	Applying fertiliser	Weed control (spraying)	Weed control (manual weeding)	Harvesting	Pruning	Transport in field	Transport to mill[74]	Average annual costs
Year 1 - 3	0	***Establishment phase:*** PM: 7.72 93,750 F/H: 398.31 4,837,000 T: 29.85 362,500 L: 57.64 700,000										**164.51** **1,997,750**
Year 4 – 7	9,600				F: 122.36 1,485,960 L: 11.53 140,000	H: 11.38 138,040 T: 2.88 35,000 L: 11.53 140,000	L: 34.59 420,000	T: 1.98 24,000 L: 79.05 960,000[75]	L: 28.82 350,000	T: 3.21 39,000	L: 39.53 480,000	**346.84** **4,212,000**

Table...

L: Labour	F: Fertiliser
T: Tools	H: Herbicide

[74] Transportation costs based on kg transported and therefore vary with yields.
[75] Farmers do not pay transportation costs but do pay labour costs (€0.0041/ Rp. 50 per kg FFB) for loading FFB onto boats.

4.2.6 Microeconomics of palm oil conversion in Aek Raso Mill

The initial investment cost in the mill was estimated at between €6.2 and 8.2 million (Rp. 75 – 100 billion) (30 t/hour capacity) in addition to €82,000 – 165,000 (Rp. 1 – 2 billion) for the purchase of land. The construction of the mill took almost 2 years.

The main input cost for the mill is the purchase of FFBs (see Table 14). FFB prices are set monthly by a price setting team at provincial level according to a formula based on current CPO and PKO prices, along with average OERs. Buying prices are also adjusted according to FFB quality (unripe bunches have a lower CPO yield and therefore command a lower price). Although likely to be less of a problem that for independent mills, the mill did report that receiving feedstock with a variety of levels of maturity was sometimes an issue. The mill did not report any problems sourcing sufficient quantities of FFB to maintain production, although there have been occasions when supply has exceeded the mill's capacity and FFBs have been diverted to other mills.

Payment for FFBs depends on the source. FFBs purchased from plasma or private sources are paid for at the mill level, from mill managers' budget. Payment for FFBs from the company's own plantation comes directly from head office. In Table 14 costs are calculated based on the total FFB used, with figures in parenthesis indicating the amount purchased at the mill level.

Table 14: Input costs for Aek Raso Mill, 2010

Input costs	Unit cost (€/Rp)	Amount purchased per year	Total annual cost (€/Rp)	Price (€/Rp per t CPO)[76]
Electricity	0.13 1546 per kwh	989,485 kwh[77]	125,969.37 1,529,744,057	4.48 54,408
Feedstock (FFBs)		122,232 t (55,004 t)	15,601,372.84[78] 189,459,600,000 (7,020,617 85,256,820,000)	554.89 6,738,497 (249.70 3,032,323)
Laboratory costs	-	-	61,505.56 746,909,877	2.19 26,565
Maintenance (buildings and machinery)	-	-	380,702.20 4,623,162,838	13.54 164,431
Management costs	-	-	319,114.29 3,875,252,919	11.35 137,830
Labour costs (workers)	-	-	290,365.58 3,526,134,980	10.33 125,413
Fuel and lubricants	-	-	13,519.33 164,175,676	0.48 5839

[76] Based on annual production of 28,116 T. CPO
[77] Total amount used: 47,979,642 kw h. Value: € 6,108,189 (Rp. 74,176,498,704)
[78] Based on FFB buying price of €0.13 (Rp.1550)

Chemicals and other supplements (used in production process)	-	-	22,389.06 271,887,797	0.80 9670
Transportation costs	-	-	72,956.08 885,962,403	2.59 31511
Total			**16,384,624.23** **198,971,230,547**	**600.65** **7,294,164** **(295.46** **3,587,990)**

Source: Data provided by Aek Raso mill

Description of labour costs

There are a total of 72 employees at the mill, all of which are '*karyawan tetap'* (fixed workers). There are no casual, daily or contract workers used. Average monthly wages for each group of workers are shown in Table 15. In addition to wages, workers receive housing, healthcare, children's education and other bonuses. The total labour costs including these extra benefits are also indicated in Table 15.

Table 15: Labour costs for Aek Raso Mill, 2010

Function	Number of workers	Average wage €/Rp./worker/ month	Average total wage costs €/Rp./month	Average total monthly benefits €/Rp	Average total labour cost €/Rp./month
Management	8	1,646.93 20,000,000	13,175.47 160,000,000	13,417.39 162,937,743	26,592.86 322,937,743[79]
Skilled labour	15	452.91 5,500,000	6,793.60 82,500,000	5,298.56 64,344,581 (82.79 1,005,384 per worker)	24,197.13 293,844,581[80]
Unskilled labour	49	247.04 3,000,000	12,104.96 147,000,000		
Total workforce	**72**		**32,074.04** **389,500,000**	**18,715.95** **227,282,324**	**50,789.99** **616,782,324**

Source: Data provided by Aek Raso mill

Other cost factors

Income from CPO sales is variable depending on the price of CPO. At the time of the survey (June 2011) the selling price of CPO was €653 (Rp. 7,930,000)/ton. Over the last year, selling prices have ranged from €559 (Rp.6,800,000) to €658 (Rp.8,000,000)/ton. Based on a mid-point selling price and an average monthly production of 2343 ton, average monthly income

[79] Total costs for management include salaries, business trips and 'general costs'. It is not clear exactly what these costs include.
[80] Total labour costs for non management workers no disaggregated into skilled and unskilled.

from the sale of CPO is €1,427,743.55 (Rp. 17,338,200,000) (€17,132,922/Rp. 208,058,400,000 per year).

Other sources of income for the mill come from the sale of palm kernels, shells and fiber. At the time of the survey, the selling price for kernels was €461.14 (Rp. 5,600,000)/ton, for shells it was €27.09 (Rp. 329,000)/ton and for fiber €8.47 (Rp. 102,820)/ton. Annual production of kernels is around 4,488 tons, which equates to an annual income of approximately €2,069,203 (Rp. 25,132,800,000). Unfortunately, while production of shells and fibre can be estimated, it is not clear what proportion of these bi-products are sold, so income from these sources cannot be calculated (Table 16).

Table 16: Sources of revenue for Aek Raso mill

Product	Total amount produced (ton per year)[81]	Amount sold (% of total)	Unit selling price (€/Rp per t)	Total income (€/Rp)
CPO	28,116	28,116 (100%)	609.37 7,400,000	17,131,313.92 208,058,400,000
Palm kernels	4,488	(100%)	461.14 5,600,000	2,069,603.14 25,132,800,000
Shells	7,945	unknown	27.09 329,000	?
Fibre	15,890	unknown	8.47 102,820	?

Source: Data provided by Aek Raso mill

Data on other costs incurred by the mill included insurance, at €20,663.81 (Rp. 250,936,752) per year, and annual depreciation costs of €283,717.10 (Rp. 3,445,397,321).

4.2.7 Microeconomics of palm oil conversion to biofuel

The costs involved in biodiesel refineries are heavily affected by the scale of the plant; this determines the investment costs but also the extent to which economies of scale can be realised. There was also suggestion from interviews that government regulation plays a role in determining costs at different scales[82]. The data used in this section is adapted from a feasibility study by the Ministry of Agriculture for a 60,000 t/year refinery. According to interviews, economies of scale are not fully realised under 100,000 t/year capacity[83]. It should be assumed that for a larger-scale refinery investment costs would be higher and processing costs somewhat lower than the costs that follow.

Investment costs

[81] Amounts estimated using IOPRI data on amount of bi products generated per ton. FFB. Estimates based on 122,232 t FFB
[82] Interview at PTPN II indicated that for small scale plants using biodiesel product internally (within the company) pay a 'transfer price' for CPO from the company's own plantations, whereas large scale plants selling CPO commercially are obliged to buy CPO at the market price, which is higher. It was not possible to establish the details of this regulation and it may only apply to state owned companies.
[83] Interview with PTPN II

The investment costs listed in Table 17 consist of project costs and working capital. The cost of building the plant itself comprises approximately 75% of the project costs, a figure which is consistent with estimates found elsewhere (ref).

Table 17: Biodiesel refinery investment costs

Investment Cost[84]	OSBL (Rp/€)	ISBL (Rp/€)	Total (Rp/€)
Pre project expense	3,413,200,000 281,065.76		3,413,200,000 281,065.76
Land	2,760,000,000 227,276.89		2,760,000,000 227,276.89
Water treatment	920,000,000 75,758.96		920,000,000 75,758.96
Loading arm	11,040,000,000 909,107.57		11,040,000,000 909,107.57
Power plant	15,927,406,961 1,311,569.40		15,927,406,961 1,311,569.40
Plant	-	147,200,000,000 12,121,434.24	147,200,000,000 12121434.24
VAT 10% and other tax	3,406,060,696 280,477.86	14,720,000,000 1,212,143.42	18,126,060,696 1,492,621.28
Project cost	**37,466,667,657** **3,085,256.44**	**161,920,000,000** **13,333,577.66**	**199,386,667,657** **16,418,834.11**
Interest during construction			**17,410,714,986** **1,433,714.92**
Total project cost			**216,797,382,643** **17,852,549.03**
Working capital[85]			57,229,724,407 4,712,678.95
Financial cost			**8,220,813,212** **676,956.84**
Total investment			**282,247,920,262**

Source: Data from Ministry of Agriculture (2006)

Operational costs

The cost assumptions used in this analysis were based on costs in 2006. The key variable in these costs, as noted elsewhere, is the cost of CPO, which constitutes approximately 86% of the variable costs and 73% of the total production costs according to this analysis. The CPO

[84] Assumption: capital is derived from loans and equity with the Debt Equity Ratio (70:30).
[85] Includes costs of procurement of raw materials, auxiliary materials, labor and operational costs during the establishment period.

price assumed in the original analysis was €329.39 (Rp 4,000,000) per ton; current price is around €576.43 (Rp. 7,000,000) per ton, which is included below for comparison. Most biodiesel plants are owned and operated by vertically integrated companies which also have palm oil plantations. Note that these costs assume that the plant is operating at full capacity (60,000 ton/year).

Table 18: Biodiesel refinery operational costs

Description	Consumption	Unit	Price/Unit (Rp./€)	Total cost (Rp./€) *Current CPO price*
Variable Costs				
Raw material /Chemical				
CPO	1.07	Ton/Ton B-D	4,000,000 *(7,000,000)* 329.39 *576.43*	256,800,000,000 *(449,400,000,000)* 21,146,632.56 37,006,606.98
Methanol	0.115	Ton/Ton B-D	2,760,000 227.28	19,044,000,000 1,568,210.55
KOH	0.016	Ton/Ton B-D	7,360,000 606.07	7,065,600,000 581,828.84
H2SO4	0.001	Ton/Ton B-D	1,380,000 113.64	82,800,000 6818.31
Additional material 1	0.003	Ton/Ton B-D	16,560,000 1363.66	2,980,800,000 245459.04
Additional material 2	0.001	Ton/Ton B-D	11,960,000 984.87	717,600,000 59091.00
Sub Total				**286,690,800,000** ***(479,290,800,000)*** **23,608,041.30** ***(39,468,015.72)***
Utility and Consumption				
Steam 5 bar	0.67	Ton/Ton B-D	150,000 12.35	6,030,000,000 496,550.60
Electricity	67.15	kWh/Ton B-D	552 0.05	2,224,008,000 183,139.72
Cooling water	1.68	m3/Ton B-D	460 0.04	46,368,000 3,818.25
Processing water	0.17	m3/Ton B-D	9,200 0.76	93,840,000 7727.41

Leftover water	0.17	m3/Ton B-D	13,800 1.14	140,760,000 11591.12
Liquid nitrogen	0.84	kg/Ton B-D	2,760 0.23	139,104,000 11454.76
Others	2.1	Rp/Ton B-D	23,000 1.89	2,898,000,000 238,640.74
Sub Total				**11,572,080,000** **952,922.60**
Total Variable Cost				**298,262,880,000** ***(490,862,880,000)*** **24,560,963.90** ***(40,420,938.32)***
Fixed Costs				
Work force	1	Rp/Year	4,600,000,000 378,794.82	4,600,000,000 378,794.82
Monitoring and overhead	1	Rp/Year	2,300,000,000 189,397.41	2,300,000,000 189,397.41
Maintenance	1	Rp/Year	529,759 43.62	529,759 43.62
Insurance	1	Rp/Year	3,680,000,000 303,035.86	3,680,000,000 303,035.86
Lab/Quality Control	1	Rp/Year	2,208,000,000 181,821.51	2,208,000,000 181,821.51
Marketing expense	1	Rp/Year	1,380,000,000 113,638.45	1,380,000,000 113,638.45
Others	1	Rp/Year	1,840,000,000 151,517.93	1,840,000,000 151,517.93
Depreciation	Straight line			21,679,738,264 1,785,254.90
Interest		Rp/Year		18,248,864,568 1,502,733.78
Total Fixed Cost				**55,937,132,591** **4,606,238.28**
Total Production Cost				**354,200,012,591** ***(546,800,012,591)*** **29,167,202.18** ***(45,027,176.60)***

Source: Data from Ministry of Agriculture (2006)

Other cost factors

Revenue depends primarily on the price of biodiesel. PT Pertamina (the state owned oil and gas company) is the only domestic blender of biofuels, and therefore their biodiesel purchase price is a key factor influencing profitability and therefore incentives for biodiesel production for the domestic market. The price offered by Pertamina has been the subject of much disatisfaction amongst biodiesel producers, who have argued that the formula used to calculate the buying price, which is based on the Ministry of Trade's export tax valuation, undervalues their product[86]. At the time of the analysis outlined here, the domestic biodiesel buying price was €590.92 (Rp. 7,176,000) per ton. Current information suggests that the average biodiesel buying price in the first half of 2011 has been around €905.81 (Rp. 11 million) per ton (Wahyuni, 2011).

Biodiesel refineries can also produce and sell glycerine and potassium sulphate as a side product of the biodiesel manufacturing process, which represents an additional stream of revenue. The analysis estimated that sales of these products would amount to €1,354,570 (Rp. 16,449,600,000) and €200,367 (Rp. 2,433,216,000) respectively.

4.3 Employment generation and poverty reduction

4.3.1 Employment generation in the palm oil chain in Indonesia

Arguments supporting the expansion of palm oil in Indonesia frequently refer to the importance of the crop as a generator of employment in rural areas and as a tool for poverty reduction. These same arguments have been made in support of biofuel promotion. There is, however, a lack of accurate data on the aggregate impacts of palm oil production on both employment and poverty reduction in Indonesia, and very little data was found specifically on employment in palm oil conversion facilities. In addition to the question of overall employment, other issues to be considered include the net employment impact of oil palm, which depends on the intensity of the plantation as well as the land uses that are being replaced, and issues of wages and security of employment. This section presents a synthesis of the available evidence from Indonesia.

Estimates of employment in oil palm cultivation in Indonesia vary widely. Total employment may be anywhere from 1.7 million to 3 million jobs (Wakker, 2005; DG Estate Crops, 2007, cited in World Bank, 2010) with additional employment in processing and associated activities. Estimates of the intensity of employment in oil palm cultivation also vary: The Ministry of Agriculture estimates that one person is employed for every 2 ha (cited in World Bank, 2010), whereas Barlow et al (2003) calculated that in 2002, an average oil palm plantation employed one person per 3 ha. In PT SMART plantations however, the figure in 2007 was one person for every 6.7 ha in 2007[87] (PT SMART, 2008 cited in World Bank, 2010). While the intensity of employment in oil palm is higher than plantations in Malaysia, which employ an estimated one person per 12 ha. (Barlow et al, 2003), these figures are lower than some other competing land uses. Nevertheless, the scale of palm oil production in some regions means that palm oil is

[86] This view was expressed by producers during personal interviews.
[87] These variations may be largely attributable to variations in employment intensity during the life cycle of a plantation.

estimated to support up to 57% of the population is Riau and between 10% and 50% of the population in a further 11 regions (Winrock, 2009).

Variations in estimates of the intensity of employment in oil palm plantations may be partly explained by the fluctuations in employment over the life cycle. Tomich, et al (1998), cited in Papenfus (2000), estimated that on large estates, the establishment phase (4 years) requires a total of 532 person days per ha with most labour being required in the first year, in contrast to the operational phase, which requires 83 person days per ha per year. Many of the jobs created in the initial stages of plantation establishment are therefore temporary; designated settlers are often contracted as workers during this phase (Barlow, et al 2003). Marti (2008) also highlights the fact that during times of higher labour demand casual day labourers (*buruh harian lepas)* are often used, who benefit from few of the protections afforded workers with contracts.

Wages paid to plantation workers is a contentious issue. No accurate data could be found on average wages of plantation workers, although Marti (2008) cites evidence that wages for contracted work are frequently at or below the minimum wage, while data from the Consortium for Agricultural Reform (KPS) indicated that casual workers earn €41.17 - 62.58 (Rp.500,000-760,000)/month on average and have to work longer hours to meet minimum wage standards. Moreover, minimum wage standards are disputed as they are, on average only 90% of the Reasonable Cost of Living Index (KHL) (Primanita, 2011).

Indonesia's biofuels plans also include targets for employment creation and poverty reduction, both important elements of the policy rationale. 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, mostly due to associated plantation expansion (Timnas, 2006; Dillon et al., 2008). Targets for 2025 suggest that biofuel sector will by employ 7.25 million people as direct employees and another 167,000 people through indirect knock-on effects (Andriani et al, 2010). Data indicating the degree to which these targets are being met is not available. However, the slow growth of the biofuels sector overall means it is likely that job creation directly attributable to biofuel production is also lower than anticipated.

In addition to employment creation, questions surround the extent to which palm oil production contributes to poverty reduction in rural areas. These impacts are a function not only of the wages earned by plantation workers, but also the contribution of FFB sales to smallholder household incomes, together with other benefits which may be associated with plantation development such as infrastructure and service improvements. The issue of whether the introduction of palm oil is associated with increases in the cost of living is also relevant to questions about poverty reduction.

Studies which have attempted to assess the overall role of oil palm in alleviating poverty have come to different conclusions. Susilo's (2004) study looked at poverty rates in two oil palm producing communities in Sumatra. His findings suggested that communities with oil palm were relatively better off than those without: in the two districts studied, there were lower than average proportions of poor people. The same study also concluded that oil palm producing communities have a relatively better income distribution than those producing other commodities, with a gini coefficient of 0.36, in comparison to rubber and cocoa development projects, which he found to have gini scores above 4.0.

These conclusions appear to be supported by a World Bank study (2010_2), which estimated correlations between increases in oil palm activity and changes in poverty (both absolute rates and depth), changes in districts mean household expenditure and inequality. Using district level data, the study found that increases in palm oil production were associated with significantly increased performance in poverty reduction. Districts which experienced increases in palm oil production between 2005 and 2008 displayed poverty reduction rates 10 to 12 times greater than districts without oil palm. Moreover, it was found that these poverty reduction effects were mainly attributable to smallholders: a one percent increase in smallholder oil palm fruit production was found to contribute a 0.08 to 0.15 percentage point decrease in the headcount poverty rate.

Other studies have drawn more ambiguous conclusions. Kessler et al (2007) tracked changes in a number of socio-economic indicators, including the Human Poverty Index (HPI), in several regions of Indonesia with oil palm in various stages of development. The results showed that some of the regions had fared better than the national average, while others had fared worse.

Analysing the impact of oil palm on smallholder incomes specifically raises a number of questions, which have been addressed in various studies. Firstly, there is evidence to suggest that relative to competing livelihood strategies, oil palm compares favourably in terms of income. Hardter et al (1997) found that average income from oil palm is significantly higher than income from subsistence farming or from competing cash crops. In 2006, annual returns to farmers from oil palm were €688 from oil palm, compared to €288 from coffee, €407 from maize and €105 from rubber. Other studies, however, present contradictory findings; a collaborative study by the World Agroforestry Centre and other research groups found that smallholder rubber agroforestry using clonal planting material was substantially more profitable than large scale oil palm monoculture (Tomich et al, 1998 cited in Marti, 2008 p. 62).

Income from oil palm is also variable over time, both due to fluctuations in the price of FFBs, and as a result of yield variations over the life cycle of the plantation; Rist et al (2009), found that the farmers with larger areas and those saddled with more debt were affected more by price fluctuations. Yields, and therefore incomes, also vary significantly between smallholders; Zen et al (2005) found variations of at least 50% around mean plasma yields.

Studies which have looked at the longer term economic impacts of NES on smallholders have drawn reasonably positive conclusions. Zen at al (2005) found that, although there were exceptions, most farmers in plasma areas established up to the mid 1990s were doing well by the mid 2000s; this study estimated a mean internal rate of return (IRR) of plasma areas of 15% over 28 years.

4.3.2 Employment generation and poverty reduction in the palm oil chain in North Sumatra province

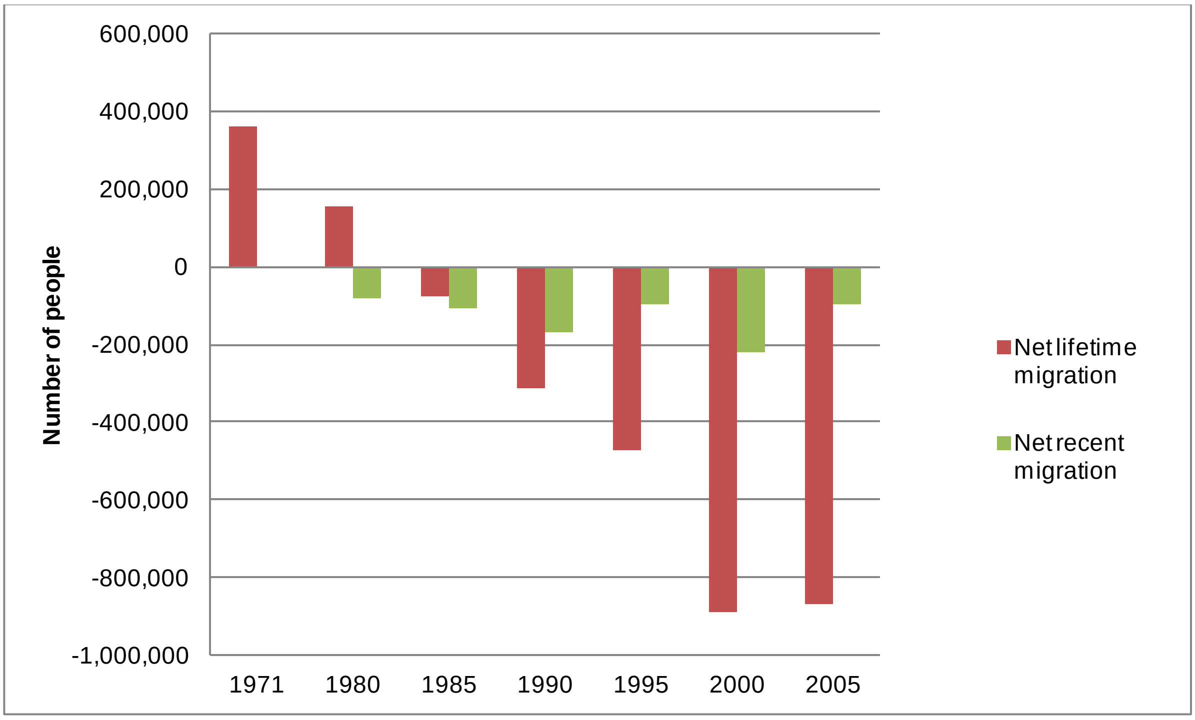
No specific data was found on the number of people employed in the palm oil sector in North Sumatra. Using Barlow's (2003) estimation of 1 worker per 3ha, a plantation area of 646,791 ha[88] would equate to 215,597 plantation workers. This is, however, likely to be an over

[88] Plantation area of private and government plantations combined (excluding smallholder areas). This is likely to be an over estimation of the current workforce as most plantations are well established and therefore employ a significantly lower number of people per plantation area. This was the case for the case study plantation area (see section...).

estimation of the current workforce as most plantations are well established and therefore employ a lower number of people per plantation area. This was the case for the case study plantation (see section 4.3.3). In addition to large scale plantations, 379,853 ha are cultivated by smallholders. Based on a plot size of 3ha this equates to approximately 126,617 smallholders[89]. Many independent smallholders also employ workers, especially those who have other sources of employment or who cultivate larger areas.

To put these approximate figures in context: North Sumatra has a labour force of 6.3 million, with 532,427 people unemployed in 2009 (63% in rural areas). There is limited potential for expansion of large scale plantations in the region, hence plantation employment is likely to remain relatively constant; the potential for future employment generation by plantations in North Sumatra therefore appears to be low. This is reflected in the migration figures for North Sumatra (Figure 31) while in the past the region was a target for migrants, since the mid 1980s the province has seen negative net migration rates.

Figure 31: Net Migration North Sumatra



Source: Data from BPS SUMUT

It is also possible that existing plantation employment in the region may be being eroded. Situmorang (2010) reports that the trend of casualisation of employment is prevalent in the region. A review of take home pay in a selection of the region's private plantations found that casual workers were earning an average of €41.17 - 57.64 (Rp. 500,000 - 700,000) per month. These wages were insecure and variable depending on the number of days of work. For context, the minimum wage in 2008 (the year of this study) was €72.96 (Rp. 886,000). This increased to €85.27 (Rp. 1,035,500) in 2011 (Kompas, 2011).

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[89] This is also likely to be an over estimation. While 2ha appears to be the most common plot size, many independent smallholders cultivate more than this.

Table 19: Examples of wages in palm oil plantations, North Sumatra

Name of Plantation	Working Status and average monthly take-home pay	Percentage of basic needs covered
PT Buana Estate	**Permanent Workers**: €193.68 (Rp. 2,352,000)[90]	Sufficiently covered
	Casual Workers: €49.41 - 57.64 (Rp 600,000-700,000)	50-60% covered
PT Soeloeng Laoet	**Permanent Workers:** €189.40 (Rp. 2,300,000)	Sufficiently covered
	Casual workers: €49.41 (Rp. 600,000) (variable)	Around 60%
Plantations in Aek Loba Asahan ***PT Graha Dura*** ***RGM (Raja Garuda Mas) now Asian Agri*** ***Socfindo***	No permanent workers. **Casual workers:** Daily wage between €1.65 (Rp. 20,000) and €4.12 (Rp.50,000), from which they pay lunch and transport to the field (3 – 5 days per week)	Insufficient

Source: Situmorang (2010)

Greater potential for income improvements and employment generation appears to lie with smallholders. Between 2006 and 2009, total smallholder area in the province expanded by an average of 9875 ha per year. This represents expansion of existing plots but also suggests that a significant number of farmers are establishing palm oil each year. The question of whether this expansion has much potential to reduce poverty is debateable: the districts with the largest areas of smallholder oil palm (Asahan, Langkat and Labuhan Batu) all had moderate poverty rates, while the districts with the highest poverty rates (Nias and Nias Selatan) have no smallholder palm oil (see Figure 12. and Figure 20). Furthermore, evidence from the case studies suggests that farmers establishing oil palm independently are not amongst the poorest and often have additional sources of income (see section 4.3.4). This finding is supported by other studies, which have found that the benefits of smallholder oil palm accrue to those above a certain threshold of agricultural skill and income (Andriani, 2010).

Employment creation by smallholders is an issue which appears to be under researched, despite the fact that in case study 2 use of hired labour from within the village was prevalent. The question of whether smallholder expansion offers significant potential for reducing rural employment rates deserves further investigation, although it should be noted that these 'jobs' were casual and poorly paid and don't provide the occupational benefits of formal employment. This suggests that this is not a sustainable solution to the region's unemployment issues.

[90] All wages given for permanent workers include a basic wage in addition to bonus/incentives

As at the national scale, no data was found on the extent to employment created by palm oil conversion in North Sumatra.

4.3.3 Employment generation by palm oil production in Aek Raso plantation

Employment on the *inti* is comprised of 10 management level positions and 377 field and administration level jobs (implementation staff). This equates to 0.003 management positions and 0.1 implementation jobs per ha. These figures are considerably lower than the data for average labour intensity given elsewhere, which suggests that plantations typically employ 0.33 workers per ha (see section 4.3.1). This may be partly because this plantation is well established and employs fewer workers than during the establishment phase,

Data provided by the plantation does not allow for calculation of wages for individual groups of employees. However, it does indicate that the average monthly wage of a management level worker is €661.31 (Rp. 8,030,847) with an additional €35.36 (Rp. 429,455) in benefits. For implementation workers, monthly wages are, on average, €90.75 (Rp. 1,102,054) with an additional €51.99 (Rp. 631,328) in overtime and benefits[91]. Although there is likely to be significant variation in wages, particularly within the latter group, it was stated that all workers earn above the provincial minimum wage of €79.46 (Rp.965,000). These figures suggest that the workers on this plantation earn less than the permanent workers in the KPS study (Table 19), although their basic needs are covered all workers have security of employment. Workers are also covered by social insurance ('*Jamsostek*'), which covers healthcare, retirement, occupational accident and death.

It is also difficult to determine the exact number of jobs of various skills levels. A number of the roles listed as implementation jobs are likely to be unskilled (plantation maintenance, security and transportation workers, amounting to a total of 136 workers), other roles, such as harvesters (143) and administrators (54) are viewed as requiring a higher level of skill.

In addition to the employment created by the *inti,* 1,749 plasma farmers were supported by the development of this plantation. During the first seven years these farmers were employed as labourers; since then they have been farming their own smallholder plots with a secure source of income from the sale of FFBs. Prior to the establishment of the plantation, all plasma farmers interviewed described their employment situation as 'working odd jobs' and all were landless. In 1990, immediately prior to assuming control of their plots, the farmers claimed that their average monthly income was around €24.70 (Rp. 300,000) per month. As the minimum wage in 1990 was €3.05 (Rp. 37,025), these estimates seem high. Today, farmers earn an average of 4,282,000 from the sale of FFBs. After the average estimated monthly cost of inputs has been deducted, average household income is €143.62 (Rp. 1,744,130) per ha (€287.25/Rp. 3,488,260 for a typical 2ha plot)

4.3.4 Employment generation by palm oil production in Desa Asam Jawa

Questions about the employment and income impacts of palm oil in this village should address both the impacts of the crop on the smallholders themselves, and the additional employment generated within the village.

[91] Extra benefits are divided into fixed and non-fixed benefits, although from the data provided it is not possible to disaggregate them. The minimum wage threshold is based on the value of basic wage plus fixed benefits (Minimum Wage Report, 2010)

In terms of the smallholders themselves, all farmers stated that they were better off now than before cultivating oil palm, when most were growing rubber. No reliable data is available at the village level on changes in incomes over time. When asked, farmers claimed that in 1990, prior to establishing oil palm, an average total monthly income was €107.05 (Rp.1,300,000). Again, these estimates seem very high, although do suggest that oil palm was established by more wealthy farmers. Today, the average monthly income from FFBs is 1,640,916 per ha. After the cost of inputs has been subtracted, the average monthly income for a farmer cultivating a 2 ha plot is €176.79 (Rp. 2,146,896) (around 2/3 of the amount earned by plasma farmers in the same area).

In addition, most of the farmers interviewed had another source of income, although the importance of such sources varied significantly: between 87% and 39% was from other sources. Based on estimates from interviews, the range of income in the village is between €98.81 (Rp. 1,200,000) and €823.47 (Rp. 10,000,000) per month. None of the farmers suggested that they found the fluctuation in household income as a result of variations in FFB prices to be a particular problem. As noted, non are solely dependent on FFB sales for income and recent experience has been an upward trend in FFB prices.

The question of additional employment created by oil palm production in the village is difficult to answer with accuracy. Interviews suggested that palm oil has improved the overall employment situation in the village. Prior to palm oil (pre 1990) most people were working in rubber plantations or doing ‘odd jobs’. This observation appears contradictory, as oil palm is less labour intensive than rubber (Paperfus, 2000), but may be explained by the fact that smallholders themselves have increasingly taken other jobs, increasing employment for others in the village.

As described in section 3.5.2, most smallholders employ labourers from the village on a casual basis for tasks such as harvesting, applying fertiliser and clearing weeds. Based on farmers’ description of their practices, it is estimated that these management tasks create an average of 45 days of employment per ha[92]. in established oil palm farms. With a total of 1220 ha of oil palm, this equates to an estimated 57,900 days of employment per year across the village as a whole.

4.3.5 Employment generation by palm oil production in Harapan Makmur

As with Desa Asam Jawa, palm oil production contributes both to smallholder income and to some additional employment in the village. The latter is much less significant in this case as most work is done by the smallholders themselves. Hired labour is only used by farmers with larger farms, which comprise around 5% of the farmers and occasionally for harvesting and distribution by other farmers. Unskilled agricultural labour is paid at a rate of €2.88/Rp. 35,000 per day. Labours relying on this as a source of income would need to work 28 days a month to earn the minimum wage, which is unlikely. As noted in section 4.2.5, incomes from palm oil in this village are significantly lower the either of the previous examples: even at the higher end of the FFB price range, after costs have been deducted monthly income is only around €43.56 (Rp. 529,000) per ha.

[92] This is similar to the estimate cited in Papenfus (2000) of 51 person days per ha.

4.3.6 Employment generation by palm oil conversion in Aek Raso mill

Aek Raso mill has created 72 jobs, comprised of 8 management positions, 15 skilled and 49 unskilled jobs. This has remained unchanged since the mill opened. This equates to 0.26 managers and 2.13 other workers per ton FFB/hr capacity[93]. It is difficult to know how representative this is as data on average employment intensity in palm oil mills was not found.

Data on wages was provided as averages for each group of workers. This data suggested that all groups earned above the minimum wage, and were relatively well paid in comparison to plantation workers: unskilled workers in the mill were reported to earn €247.04 (Rp 3,000,000) per month. In addition, the value of other benefits was calculated to be €82.7 (Rp. 1,005,384) per worker. This includes the value of housing, health care, education and incentives. Again, workers were covered by social insurance.

The precise composition of the workforce was unclear from interviews, although it was indicated that most workers in the mill are local, while some are migrants from Java.

4.4 Working conditions

4.4.1 Working conditions in the palm oil chain in Indonesia

No national data was found relating specifically to working conditions in the palm oil sector; potential issues are highlighted by individual surveys and anecdotal evidence only. These findings, alongside generalisations about working conditions in Indonesia, give some indication of key issues in the sector. The key concerns pertain to freedom of association, use of child labour, occupational safety and health (OSH) and discrimination. Issues of forced labour seem to be less prevalent in the sector, although should not be ruled out.

Firstly, there is evidence that freedom of association, trade union rights and the right to strike are often curtailed. Some of these rights are restricted by law, but further limited in practice. A review by ITUC (2007) found numerous examples of anti-union discrimination and attacks on trade union organisers. The examples cited spanned several economic sectors, but included an example of a palm oil plantation company in Riau. Further examples have been documented by NGOs and trade unions (Situmorang, 2010).

The minimum working age in Indonesia is 15 years[94], although work between the ages of 15 and 18 is restricted. The 2003 Manpower Act does allow employment of children aged between 13 and 15 years for light work as long as the job does not stunt or disrupt their physical, mental or social development. Work in plantations/estates is included in the list of the worst forms of child labour[95]. The coverage, definitions and enforcement of this legislation has been criticised (ITUC, 2007) and child labour remains widespread in Indonesia, including in the agricultural sector. It is estimated that over 1.5 million children aged between 10-17 years are working in the agricultural sector, including plantations. Research has found that this is often a result of the poor quality and availability of schools, and a low priority given to education in rural areas (BSP-ILO, 2009).

[93] This is the standard figure used for determining a mill's capacity so may enable comparison of the intensity of employment between mills.
[94] ILO Convention No. 138 and ratified by Law No. 20 of 1999
[95] Presidential Decree No. 59 of 2002

Although data could not be found indicating the extent of child labour on palm oil plantations, a study in 2002 by the Directorate on Labour Inspection Norms of Occupational Safety and Health (cited by ILO, 2011) gave some indication of the type of work being undertaken by children. From the sample of 75 child workers on palm oil plantations (age 9 – 17): 85% worked as palm pickers, collecting loose palm fruits, carrying sacks of palm fruits to carts, and pushing carts to a collection site; nearly 90% had no training before working; average working time was more than four hours per day, without any regular break time.

Occupational safety and health is an issue throughout Indonesia, across most sectors. Indonesia faces problems with OSH enforcement including few competent inspectors, limited resources to conduct inspections, and limited follow-up inspections. These problems are particularly prevalent in rural areas (ILO, 2004). Data available on accidents indicates that in 2009, there were 10,034 work related accidents nationally, involving 7,394 people (DEPNAKER). Data is not, however, disaggregated by sector, and therefore is it not possible to establish the extent of issues in the palm oil chain. Key OSH risks in palm oil production are associated with agrochemical use (discussed further in section 4.5) and harvesting accidents. In palm oil mills, industrial accidents associated with use of heavy machinery are key risks.

Issues of discrimination also appear to be prevalent in the palm oil sector. As discrimination most commonly occurs on gender grounds, this issue is addressed in section 4.8.

4.4.2 Working conditions in the palm oil chain in North Sumatra province

The available data for North Sumatra suggests that many of the issues with working conditions identified at the national level are concerns in this province. No official data sets were found to indicate the extent of labour rights or OSH in the region; the available data comes from various individual studies undertaken in North Sumatra.

Data from 2009 indicates that in this year there was 426 work related accidents involving 424 people (DEPNAKER, 2009). The only data found on OSH in palm oil plantations specifically was collected by KPS. In 2008, it was found that across five estates in North Sumatra (PT Lonsum Turangi Estate, Socfindo Mata Pao, PTPN II Langkat, PT BSP and PT Anglo Eastern Plantations in Asahan) there were 47 occupational accidents over the year, consisting of two deaths (4.25%) 11 incidences of blinding by latex and resin (23.40%), and 32 light injuries (68.08%) (Situmorang, 2010).

According to KPS, there is only one union recognised by plantation employers in North Sumatra: SPSI (All Indonesia Workers Union). They have documented a number of incidents where plantation workers' rights to unionise have been restricted. No data was found that disaggregated either OSH or workers rights by production/conversion.

ILO data suggests that child labour in plantations in North Sumatra is widespread. The incidence of child labourers in the region's agricultural sector is the third highest in the country (155,196 children). A baseline survey undertaken in 2010 for an ILO programme on child plantation labour found that in Serdang Bedagai District, North Sumatra, 522 children from 500 households surveyed were working in the plantation sector (palm and rubber). Many children under 18 years old work as outsourced labourers or on family farms. The survey found that

75% of households allowed their children to work in the plantation sector because of their low income (ILO, 2010).

4.4.3 Working conditions in palm oil production in Aek Raso plantation

Data on the key OSH risks for plantation workers such as impacts of pesticide use and work related accidents were not made available by plantation management, although it was purported that data is kept on accidents at the plantation health clinic, and that most accidents are minor, generally associated with harvesting.

There is a policy on OSH at the plantation and personnel responsible for implementing it. Workers were observed to be wearing personal protective equipment, although interviews were not conducted with plantation workers and it cannot be confirmed whether OSH standards are universally applied.

According to the interviews, workers are part of a trade union (*serikat pekerja PTPN III)* and the plantation company does not impede workers' freedom of association. While there are no regular meetings between management and the union, according to managers the union representatives are free to approach them if workers have concerns. As interviews with workers or union representatives were not conducted, the claims of management could not be verified.

The composition of the workforce in terms of local:migrant workers was not established. There was no evidence of children working on the plantation.

4.4.4 Working conditions in palm oil production in Desa Asam Jawa

Data on frequency of accidents is not kept by smallholders. When asked, most reported that minor accidents happen occasionally, usually in the context of harvesting, but that these were not serious. The risks associated with herbicide spraying, however, are likely to be higher amongst smallholders than in plantations. Two of the three farmers using herbicides were applying paraquat, but displayed low awareness of the associated risks. Labourers undertaking spraying did not use personal protective equipment apart from gloves and took no other precautions when handling chemicals. There were also no precautions being followed for storage or labelling of chemicals, or for washing of spraying equipment, resulting in a risk of chemicals entering waterways.

It was not reported in the interviews that children were working on the farms. Excessive working hours for labourers did not appear to be a concern. Typical working days are 7 – 8 hours, but in most cases payment is arranged by task rather than per working day

4.4.5 Working conditions in palm oil production in Harapan Makmur

As with Desa Asam Jawa, accident records were not kept and adequate precautions were not followed for herbicide spraying (although some farmers reported covering their faces when spraying). Typical working days are 6 hours, which are shorter than when villagers were cultivating rice.

4.4.6 Working conditions in palm oil conversion in Aek Raso mill

As with Aek Raso plantation, data on work related accidents was not made available by the management, but was kept at the plantation health clinic. It was purported by management that accidents are rare. The mill reportedly implements the SMK 3 management system: *Sistem Manajemen Kesejahteraan Kerka* (Work Safety and Welfare Management System), although documentation related to this was not seen. As with the plantation there is an OSH policy and responsible personnel. OSH measures are focused on workers in the loading room, who are instructed to wear PPE (helmet and glasses); again the extent of policy implementation cannot be verified.

Mill workers belong to the same union as workers in the plantation, and similar answers were given by mill management regarding freedom of association. As mill workers were not interviewed, again this was not verified. Standard shifts are 8 hours, with overtime reported to be optional.

4.5 Health issues

4.5.1 Health issues in the palm oil chain in Indonesia

The development of palm oil is credited with both positive and negative implications for the health of local communities in Indonesia. Many large plantations build health clinics, which are generally available, free of charge, for workers and plasma smallholders. In rural areas with limited public health facilities, and for low income workers, such provision can be significant. No data was found to measure the impact of plantation based health services at any scale.

Oil palm cultivation is also, however, associated with negative health impacts, primarily resulting from the application of fertilisers and pesticides. Without the systematic use of personal protective equipment and in the absence of rigorous health and safety systems, chemical use can result in breathing problems and skin and eye complaints (see Marti, 2008 for anecdotal evidence). In particular, the use of paraquat as a herbicide is widespread on Indonesian plantations and amongst smallholders, which, although legal, has attracted controversy for its associated health impacts., which can include eye injuries, nosebleeds, skin irritation nausea, and vomiting[96].

No data was found on the extent of problems resulting from chemical use or other occupational health and safety lapses, nor were any studies found which specifically addressed the use of personal protective equipment in Indonesia. However, a study of paraquat use amongst smallholders in Malaysia found that around 1.3% of farmers experienced the health problems noted above (Shariff and Rahman, 2008).

At the conversion stage, the main potential health concerns are related to lack of occupational safety and health, and to health issues associated with palm oil mill effluent disposal into waterways. Do data was found to indicate the scale of problems associated with water contamination from untreated POME, although evidence suggests that despite improvements over recent years, problems persist (Marti, 2008).

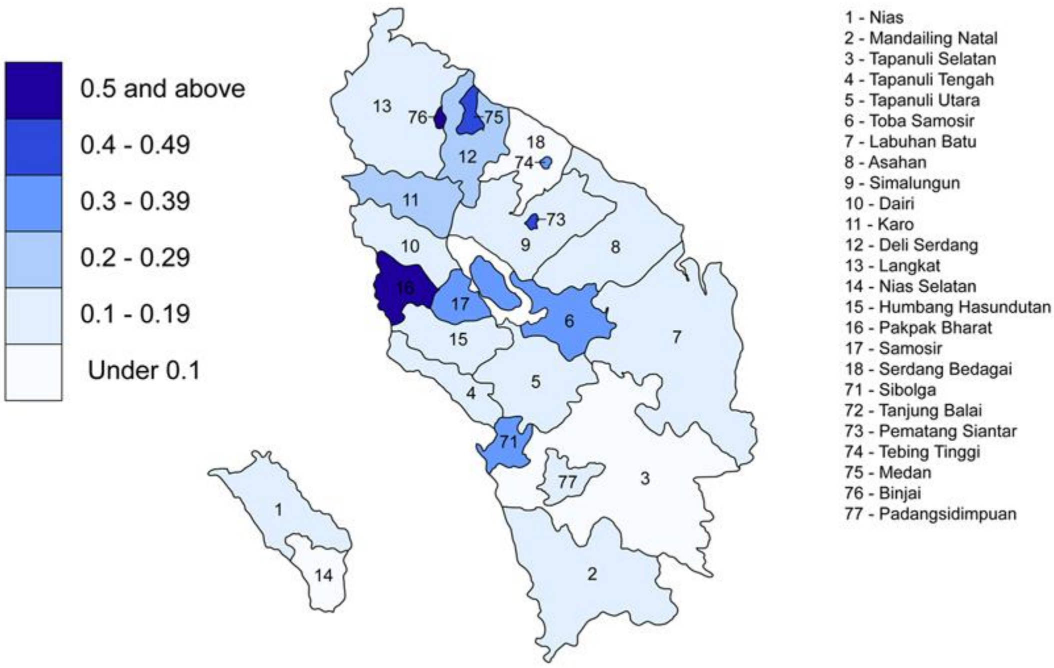
[96] See, for example: Berne Declaration http://www.evb.ch/en/p5790.html

As measures to address OSH related issues, including those related to chemical use have been addressed in the previous section, this section will concentrate on provision of health care and questions about more general palm oil related health impacts.

4.5.2 Health issues in the palm oil chain in North Sumatra province

Data on provision of health care in North Sumatra suggests that public facilities in the province are on par with the national average: each *puskemas* (public health centre) serves an average of 26,443 people, in comparison to a national average of 27,406 (BPS). Each health centre is supported by two or three sub-centres. There are a total of 2868 doctors (excluding dentists), with an average of 0.22 doctors per 1000 people, slightly lower than the national average of 0.3 doctors per 1000 people.

Figure 32: Number of doctors per '000 people, North Sumatra



Source: data from BPS SUMUT

These averages, however, disguise significant disparities between districts (Figure 32). Health services and doctors are concentrated in the urban areas of the province. In some rural districts, doctor to '000 patient ratios are as low as 0.06. In the rural districts in the east of the province where palm oil plantations are concentrated, access to public health facilities appears to be lower than average: in key palm oil producing districts of Labuhan Batu, Asahan and Langkat, each *puskemas* serves an average of around 38,000 people, and doctor to patient ratios are 0.16, 0.13 and 0.11 doctors per '000 respectively.

Although no data is available on the provision of health services by palm oil plantation companies, this picture suggests that additional facilities for plantation workers may play a significant role in supplementing public health care provision.

4.5.3 Health issues in palm oil production in Aek Rasa plantation

Similar to many plantations in Indonesia, Aek Raso provides free healthcare to its employees and to plasma smallholders associated with the plantation. This takes the form of a primary health care clinic. The most commonly used services were reportedly checkups, immunisations and pregnancy care.

The situation regarding public health provision in the local area was unclear from the data provided. Doctor to patient ratios in Labuhan Batu Selatan are 0.14 doctors per patient and district level data indicates that there are 11 *puskemas* in the district as a whole, each serving 25,500 people. On the other hand, data collected at the local level[97] suggested that there are 7 *puskemas* in Torgamba subdistrict alone, which would mean each serves an average of 14,016 people. Further investigation would be required to establish the extent of health care provision in this area and the value of the plantation health clinic in this context.

No other health issues were reported by plantation management or plasma smallholders in relation to palm oil production.

4.5.4 Health issues in palm oil production in Desa Asam Jawa

As the plantation health clinic only serves employees and plasma smallholders (other members of the community were reportedly able to use the services for a fee) this provision was not significant for the smallholders in Desa Asam Jawa. None reported making use of the plantation facilities. As such, palm oil development has had no direct impacts on access to health care. According to locally provided data, this village appears to be relatively well served for health care, having one *puskemas* and 7 supporting services. The increases in income associated with palm oil development may have increased people’s ability to pay for health care, although this is speculation.

There were no health issues reported as a result of palm oil production, either by smallholders or the neighbouring PTPN III plantation. It was reported that there had been a past issue of water contamination from effluent from Aek Raso mill, but this was not a source of drinking water and no health issues resulted.

4.5.5 Health issues in palm oil production in Harapan Makmur

Harapan Makmur village is not located close to any large private or state owned plantations, and has therefore not been impacted by related improvements in health service provision. District level data indicates that each *puskemas* serves an average of 12,074 people, which is lower than in North Sumatra (BPS, Jambi). However, due to this area’s isolation accessing health care can be difficult.

[97] Data made available by the village office

Farmers did not report any other direct or indirect impacts on health or access to health care associated with palm oil in this village although discussions in a neighbouring village suggested that there were concerns about contamination of waterways (used for washing and cooking) with agrochemicals.

4.5.6 Health issues in palm oil conversion in Aek Raso mill

The health care provision for workers at the mill is the same as for plantation workers. No health issues were reported by management, but this was not verified by workers.

4.6 Food issues

4.6.1 Food issues in the palm oil chain in Indonesia

As described in section 3.1.7, food security in Indonesia varies significantly between provinces, with problems being more acute in East Indonesia. Some of the regions categorised as chronically food insecure, such as South Sumatra and Central Kalimantan, are also key palm oil producing regions; it is in these regions where the impacts of palm oil production on food security, both positive and negative, are perhaps most likely to be seen. While the expansion of oil palm plantations has the potential to impact food security at different scales, the links between the two variables are complex and also variable between regions.

In some regions, land used for oil palm was previously used for food production. This has been highlighted as a concern in Jambi in particular (Wirasaputra et al, 2009) where there is now a deficit in cereal production, a situation that has been attributed largely to expansion of palm oil producing area (WFP, 2007). Even in regions where oil palm is not replacing food producing land on a large scale, the land used often supports the livelihoods of many rural people. When land is converted to oil palm, local people lose the benefits of mixed livelihood strategies and the autonomy associated with traditional subsistence practices (World Bank, 2010, Orth, 2007), potentially increasing their vulnerability to food insecurity. On a national scale, palm oil is considered a key food commodity for its use as a cooking oil and export tariffs are used to protect domestic supply. There is concern that if a large scale move towards biofuels gains traction, this will lead to conflicting demands on CPO and threaten the supply for food uses (Barichello and Patunru, 2009).

In contrast, in regions with a surplus of production over consumption, the development of palm oil may bring associated infrastructure improvements which would allow farmers to access markets. The income benefits of converting food producing land to oil palm mean that farmers are able to buy food and increase their food security. On the other hand, the transition from being net producers to net consumers of food leaves people vulnerable to high food prices.

4.6.2 Food issues in the palm oil chain in North Sumatra province

As described in section 3.3.6, the dimension of food insecurity which appears to be most acute in North Sumatra is food utilisation, indicated by the nutritional status of children in particular. In some districts, access to food also appears to be an issue due to higher poverty rates. Food availability, indicated by ratio of consumption to production, appears to be less of an issue in North Sumatra than elsewhere in Indonesia; production of rice has remained reasonably constant, and production of other food crops has increased slightly (Figure 15).

Questions about the current and potential future impacts of palm oil production on these dimensions of food insecurity, even at the regional scale, are not straightforward, and the following is largely speculative. The dimension upon which palm oil production most obviously impacts is food availability, primarily through conversion of land previously used for food production. While expansion of large scale plantations in the region has slowed, land conversion by smallholders is continuing. Although there is no data on previous land uses of oil palm land, there is evidence that the area of land used for rice production in the region as a whole is in decline (Figure 17); some of this may well have been converted to oil palm. The trend of smallholders converting rice paddies to more profitable oil palm has been documented elsewhere (Wirasaputra et al 2010 and case study 3) and anecdotal evidence suggests that this may also be the case in North Sumatra (Situmorang, 2010). Moreover, evidence from KPA suggests that impacts of palm oil plantations on water availability, irrigation systems and pest populations may be affecting food production locally (ibid). These factors may suggest potential future issues with food production in the region.

The possible implications of palm oil production on other aspects of food insecurity are less obvious. The impacts of palm oil on access to food are mainly a function of its impacts on poverty, which, as discussed in section 4.3.1 are not entirely conclusive. Moreover, the districts in which food access is more of an issue, particularly those in the south and west of the province, have much lower levels of palm oil production. The most significant issue relating to food security, the poor nutritional status of children, is a concern across the province, in both palm oil and non palm oil producing districts. This issue is most difficult to connect to palm oil directly, being attributable to factors such as educational status and position of women.

4.6.3 Food issues in palm oil production in Aek Raso plantation

The land used for Aek Raso plantation was previously state forest land, and was reportedly not used for food production. It therefore does not appear that plantation development has had any impact on food availability. As plasma farmers were previously landless, they did not have to give up food producing land in order to cultivate palm oil. The improved incomes brought by the NES scheme mean that they are economically better off than they were prior to growing palm oil (although, as noted in section 4.3.3, there is uncertainty over exact income increases). This is likely to have meant that their access to food has increased. During the first few years after establishment, often highlighted as a time of vulnerability to food insecurity for plasma farmers, they were employed as labourers on the inti. The terms and wages for this period were unclear.

4.6.4 Food issues in palm oil production in Desa Asam Jawa

The introduction of palm oil had no apparent impacts on food availability in Desa Asam Jawa. Previous to oil palm, most of the village land was used to cultivate rubber. It was reported that the last time rice was grown in the village was in the 1930s as land is generally unsuitable for rice cultivation. Other food crops are grown in gardens but these do not appear to have been sacrificed in order to grow oil palm.

Again, it can be assumed that the main way in which palm oil production has affected food security is through its impact on incomes. Interviews suggested that households in this village were spending an average of 20% of their income on food, significantly lower than the province average of 63.2% (BPS SUMUT). This is consistent with assumptions about their higher than average socio-economic status. Interestingly, estimates provided in interviews suggested that households had seen little change in the proportion of income spent on food since 1990 (16% spent on food in 1990). This may be due to the rising cost of food, although again estimates should be treated with caution.

4.6.5 Food issues in palm oil production in Harapan Makmur

The situation in Harapan Makmur is quite different to that in Asam Jawa, and illustrative of the issues highlighted in relation to land conversion in Jambi. Most oil palm land in the village was previously used for rice production, and it is estimated that a total of 975ha of rice producing land in the village has been lost since 2005. Land is being converted in this way throughout much of Jambi, to the point where there is now a deficit in food production in the region.

According to the farmers, however, they had struggled to cultivate rice successfully since moving to the village as transmigrants in the 1970s. Although the crop generally provided for subsistence needs there was little left to sell. They have therefore been keen to try other crops and were enthusiastic about the opportunity to increase incomes through growing oil palm.

The overall impacts of this land conversion on food security in the village are difficult to assess. Firstly, the crop is still in its early years of production, so many farmers are in a transitional phase where trees are yet to produce or production is still low. Most negotiate this stage by continuing to grow rice around the trees: this ensures a continuation of food production but is sub-optimal for both crops, and can jeopardise palm oil yields in the early years[98]. Secondly, farmers have had highly variable levels of success with oil palm so far. While some are seeing reasonable early yields, other examples were seen of farms with trees in their fifth year which had yet to start producing. These differences are due to a number of factors, described in section 3.6.2, but do mean that the expected income benefits of palm oil have not been felt by all farmers. Some farmers who had been unsuccessful with the crop were found to be working as labourers on larger or more successful farms.

The diversity of experiences were difficult to quantify during limited farmer interviews, but do suggest a number of potential impacts on food security in this village.

4.7 Land use competition and conflicts

This issue is only addressed at the production stage, and at the local scale was only considered for Aek Raso plantation (case study 1). Although it is possible that land competition may occur between smallholders, this was not found to be an issue in either Desa Asam Jawa or Harapan Makmur.

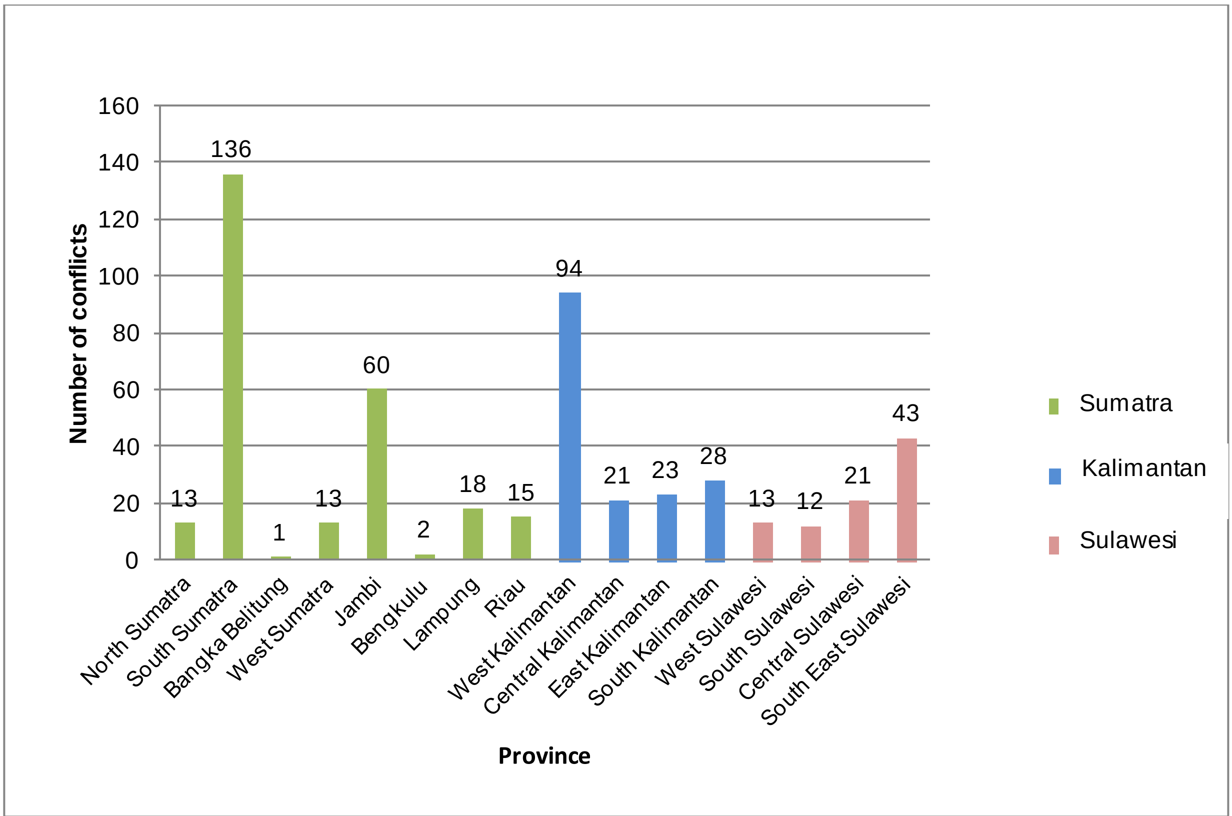
[98] Reported by field workers

4.7.1 Land use competition and conflicts in the palm oil chain in Indonesia

Social conflict between palm oil companies and communities is an issue of concern in Indonesia and has been a focus of campaigns by NGOs in the sector. As described in section 3.1.6, many of these issues are rooted in the weak legal status of community land rights in combination with weak governance. In 2010, Sawit Watch recorded 660 active social conflicts across the country relating to palm oil companies; an upward trend from previous years (in 2009, 240 conflicts were being monitored) (Kompas, 2011).

Data from 2008 indicates that most regions hosting palm oil plantations have experienced some level of social conflict, but that in that year conflict was concentrated in South Sumatra, West Kalimantan and Jambi (Figure 33). Both private and state owned companies are implicated in social conflicts.

Figure 33: Oil palm related conflicts by province (2008)



Source: Sawit Watch (2008) Data Kasus Konflik 2008

Most conflicts centre on disputes over land rights or unfulfilled promises. Rist et al (2010) identifies the sources of most conflicts as being: lack of clarity of development contracts; issues related to local governance; unfulfilled promises by government and companies; unclear land tenure and changing land values. Marti (2008) adds to this list: legacy conflicts resulting from historical grievances; more recent conflicts resulting from present company practices in acquiring land; conflicts stemming from the impacts of transmigration and environmental degradation.

Conflicts frequently persist for several years, and in many cases become violent, involving police, armed security and the military. Local level conflicts also have an impact on the palm oil sector itself. In addition to reputational risks, conflicts with communities lead to difficulties in establishing plantations, increased need for security and lost harvests, which all add to companies' costs and reduce revenues (Marti, 2008).

4.7.2 Land use competition and conflicts in the palm oil chain in North Sumatra province

According to Sawit Watch data, North Sumatra has a lower incidence of palm oil related conflicts than many other provinces, with 13 active conflicts being monitored in 2008 (Figure 33). Evidence found about conflicts in the region suggests that most are the result of historical grievances between companies (both state owned and private) and local communities. During Suharto's New Order period (1967 – 1998), rights for companies to acquire and open land for plantations were strengthened, to the detriment of community rights over land. Most palm oil plantation establishment in North Sumatra occurred during this period, and it seems likely that several current conflicts are a legacy of grievances over land acquisition from this time.

Situmorang (2010) describes a protracted dispute in Langkat Regency involving a private company, PT Buana Estate, which has been in conflict with a peasant group, KTMIM (Peasant Union) since 1985. In 2007 this escalated, resulting in violence and 47 arrests. There is also evidence of another long running conflict in Deli Serdang, involving state owned company PTPN II. KPS also reports that plantation expansion into surrounding agricultural land has led to disputes over water use and pest proliferation (ibid).

Conflicts related to present company practices of land acquisition, which are often given a high profile in NGO campaigns, are less of an issue in North Sumatra.

4.7.3 Land use competition and conflicts in palm oil production in Aek Raso Plantation

There have been no reported conflicts associated with Aek Raso plantation in relation to land rights. The only issue raised in interviews with surrounding communities (during data collection for case study 2) concerned a complaint about POME contaminating local water sources[99]. The context of the plantation's development means that the risk of conflict has been low from the outset. Both the main plantation and plasma areas were developed on state forest land, which appears not to have been encumbered by pre-existing land claims or customary rights. As far as it can be established, there have been no acquisitions of land from surrounding communities; the plasma scheme was focused on landless migrants, who were therefore not surrendering any land for the plasma development, as has been the case elsewhere.

4.8 Gender issues

4.8.1 Gender issues in the palm oil chain in Indonesia

Gender disaggregated data is not available at any level for plantation employment. Information about possible gender issues in the palm oil chain in Indonesia comes from anecdotal evidence

[99] Details of the dispute over mill effluent were not obtained from mill management as the issue was raised by the community subsequent to the mill visit. A full analysis of the plantation's development was not conducted. This would be necessary in order to confirm the situation with regard to the plantation's land use and any land acquisitions.

only. Marti (2008), for example, draws attention to evidence of gender inequality in plantation employment. He reports that women are often employed to do tasks perceived as 'easier', and therefore lower paid and without bonus systems associated with 'men's work'. He also suggests that there is a preference for employing women as causal labourers to avoid paid time off for menstrual leave.

Another issue is the gender dimension of health issues related to work on plantations. Health risks associated with agrochemicals are higher for women, especially when pregnant or breastfeeding. Marti (2008) also notes that as women are also more likely to be illiterate and therefore unable to read labels, they may be more at risk from chemicals stored in the home.

In the absence of gender related data related to the palm oil sector, it is worth providing some context to the situation regarding gender inequality in Indonesia as a whole. In 2002, the last time it was calculated, Indonesia's GDI[100] score was 90% of its HDI score. This placed Indonesia 91st out of 144 countries assessed in terms gender equality in basic human development. Indonesia still lags behind many of its neighbours in indicators of gender equality; women have a lower literacy rate, fewer mean years of schooling and smaller share of earned income. Indonesia's GEM score[101], a measure of women's empowerment was 0.546 in 2002, placing it 33rd out of 71 countries[102] (UNDP, 2004).

Data on women in the workforce indicates that labour force discrimination is prevalent in Indonesia. Women comprise 38% of the labour force, and are more likely to be unemployed than men: in 2008, the female unemployment rate was 9.7% in comparison to 7.6% for men (Dep. Nakertrans, 2011). In the formal sector, women receive lower wages: women earn on average 76% of what men earn and 80% of the difference between men's and women's wages is due to the unequal treatment of women (World Bank, 2011_2). It has also been found that women receive significantly lower salaries than men for the same work done (CEDAW, 2007 cited in ITUC, 2007) and that the gaps are wider in rural areas (Feridhanusetyawan et al, 2001).

Women are concentrated in low-skilled and lower paid occupations. Although no reliable data was found, women are also core participants in the informal economy, with its associated insecurity and lack of legal recognition, and are more likely to be doing unpaid work; around 18% of working women are unpaid (ADB, 2006).

Given this context, together with the male dominated nature of employment in the palm oil sector, described in the following case studies, it seems likely that the development of the industry is doing little to contribute to gender equality in Indonesia.

4.8.2 Gender issues in the palm oil chain in the North Sumatra

Again, there is no gender related data available at the regional level related to the palm oil chain. The overall picture of gender inequality in North Sumatra is worse than in the country as a whole. In 2002, the region's GDI score was 87.1% of its HDI score in the same year, placing it

[100] The Gender-related Development Index (GDI), measures achievement in the same basic capabilities as the HDI (life expectancy, literacy, education and standards of living), but takes note of inequality in achievement between women and men.
[101] The Gender Empowerment Measure (GEM) is a measure of women's agency. It combines inequalities in three areas: political participation and decision making, economic participation and decision making, and power over economic resources.
[102] UNDP do not assess Indonesia's GEM for the Human Development Report; this figure and ranking is based on BPS calculations.

20th amongst 30 Indonesian provinces, while its GEM score in the same year was 48.4, placing it 17th (BPS-BAPPENAS).

40.6% of the workforce in North Sumatra is female, slightly higher than the national average. Consistent with data on the national scale, unemployment is more prevalent amongst women with a female unemployment rate of 10.5% (in comparison to male unemployment of 7%). 50.5% of the jobseekers in this year were female.

4.8.3 Gender issues in palm oil production in Aek Raso plantation

The labour force in Aek Raso plantation is overwhelmingly male (97%). Although the data provided by management does not provide a gender breakdown by role, it was stated that all 10 women employed at the plantation work in administration roles. Women are not represented amongst the management, and it was stated that women do not do field work as the work is not thought suitable for them. While this does mean that issues concerning chemical exposure can be assumed not to be relevant in this case, it does reflect entrenched ideas about gendered employment roles.

Data on wages did not allow for men and women's pay to be compared, although management asserted that women earn the same as men doing similar jobs. As no interviews with workers were conducted, this cannot be verified. There is no policy on equal opportunities or sexual harassment; it was claimed that there are no problems with these issues at the plantation.

As in the main plantation, there are is a clear gendered division of labour on plasma smallholder farms. It was initially stated by the (male) farmers that women do not work on the farms, as the work is considered too difficult for them. It was explained that these decision were made through negotiation between spouses. Upon further questioning, it was admitted that women do occasionally help out on their family farms, usually clearing weeds by hand and book keeping. All farmers described the women's role in the village as 'housewives' and none mentioned that their wives work outside the home.

4.8.4 Gender issues in palm oil production in Desa Asam Jawa

The gender division of labour amongst independent smallholders is similar to that in the previous examples. Most manual work on the farms, and all hired labour, was again done by men, but in this village the use of unpaid women's labour appeared to be more prevalent. Although the role of women in the village economy was again described by all farmers as being 'housewives' all mentioned that their wives help out with tasks on the farm when they have time, most commonly clearing weeds (manually), gathering FFBs after harvesting and bookkeeping, described as 'lighter work'. It did not appear that women were involved in spraying herbicides.

It did, however, emerge from interviews that the standard daily rate paid for unskilled women's labour was lower than that of men's: €2.22 (Rp 27,000) in comparison to €4.12 (Rp. 50,000).

4.8.5 Gender issues in palm oil production in Harapan Makmur

The situation in the second independent smallholder village mirrored the other examples. Women provide occasional unpaid labour on family farms, while men do most of the manual work, including herbicide spraying. Although it was reported that hired labour on palm oil farms is almost always done by men, it was noted that the standard daily rate for unskilled labour is the same for men and women at €2.88 (Rp. 35,000) per day.

4.8.6 Gender issues in palm oil conversion in Aek Raso mill

Employment at the mill is also overwhelmingly male dominated (86%). The four women working at the mill are employed in service roles to do book keeping and waitressing. No women work on the mill floor or in management. Again, gender disaggregated data was provided on wages.

There are no equal opportunities or sexual harassment policies at the mill, but management stated that there has never been a problem with these issues. It was also stated that some roles are not considered suitable for women on health grounds. It was felt that women should not work in the boiler or loading rooms as those jobs involved exposure to ash and heat and required a lot of energy.

4.9 Risks for smallholders

As noted previously, smallholders occupy 41% of oil palm land in Indonesia, an area which is increasing at around 12% a year. They also have the lowest average yields per ha. Smallholders are therefore seen as an important channel through which to increase the socio-economic benefits of palm oil, and also to potentially reduce land conversion by increasing yields (IFC, 2011). However, a number of challenges and issues exist, which limit the potential for these benefits to be realised and present risks to smallholder livelihoods. As these issues have been discussed elsewhere in the report, this section provides a summary of the key challenges, then assesses case study evidence for each of the local level smallholder production units.

The first issue is the limited access to inputs, knowledge and capital faced by many smallholders, especially those in more isolated areas (see section 3.2.7). Access to improved and genuine planting material is a key issue for many smallholders. The main centre of seed producers and research institutes is in North Sumatra; farmers outside this province often rely on travelling salesmen and are unable to distinguish quality planting material (Zen et al, 2005). This issue significantly affects yields and incomes as farmers are locked into cultivating low yielding trees for the entire cultivation cycle (IOPRI, 2011). Lack of access to extension services or other sources of advice mean that farmers also often lack knowledge about good management techniques, again limiting yields. Problems accessing credit can also be a concern for some smallholders, even those in cooperatives, due to lack of collateral.

Another issue affecting smallholder income, highlighted by Susilo (2004) is the way in which FFB prices are determined. While farm gate prices are based on two week averages, prices fluctuate daily, causing gaps between the current market price and prices received by farmers. Marti (2008) goes further, citing sources suggesting that farmers are losing 23% of their revenues to companies due to policies and practices in the setting of FFB prices, including unfavourable terms of trade. FFBs from smallholders are also often unripe, resulting in them being penalised on quality grounds. A further issue in some areas is smallholders' reliance on middlemen to sell FFBs, which again reduces their income. This is particularly a concern for farmers who are isolated, or in areas with a lower number of mills (Setera Jambi, pers. comm.)

Risks highlighted for plasma smallholders often centre on the issue of debt. When entering into deals with plantation companies, NES smallholders are extended credit by banks, which is repaid through deductions on revenue from the sale of FFBs. The impact of debt on smallholders appears to vary between communities and over time. Chong's (2008) study found that there are significant variations in the deals offered to communities in terms of: the level of debt estimated by the company, the interest rate applied by the bank and the % of monthly net added value (NAV) or revenue that smallholders agree to allocate to the reimbursement of their loans (cited in Rist et al, 2010). Rist et al (2010) also found that debts presented more problems for smallholders in the first few years of repayment when production was low, or at times when CPO (and FFB) prices were low[103]. Moreover, as section 3.2.7 highlighted, with the decline in the proportion of estates' land allocated as plasma areas, the bargaining power of plasma smallholders has reduced.

4.9.1 Risks for smallholders in palm oil production in Aek Raso plantation

The key risk for plasma smallholders, unmanageable debt, was not reported to be an issue amongst the smallholders of Aek Raso. Most farmers were able to repay the establishment costs within around five years. As details of the deal offered to plasma farmers at the time of establishment were not available, it is not possible to compare them to deals offered to farmers elsewhere.

4.9.2 Risks for smallholders in palm oil production in Desa Asam Jawa

Three of the farmers interviewed reported that they had bought seedlings from plantation companies, indicating that they did not have a problem accessing inputs. Their proximity to Medan, the centre of the palm oil industry, means that these farmers have better access than most. Moreover, there was evidence that the nearby PTPN III plantation had benefited surrounding smallholders; one of the farmers worked at the plantation, and others mentioned that they had received advice from friends who worked there about palm oil cultivation.

This village is also connected by a major road to the nearest mill, which is 7km away. There are also two other mills in the local area. Although some farmers do sell to collectors, it appeared that the price they received was not significantly lower than the factory gate price. The risks for smallholders in this village, in the context of the issues discussed, therefore appear relatively low.

4.9.3 Risks for smallholders in palm oil production in Harapan Makmur

The issues faced by famers in Harapan Makmur were the most acute of the three groups of smallholders. A key issue was lack of access to inputs and information. Farmers had all used poor quality planting material; they had bought this from traders and were unaware that this would result in low yields Field workers estimated that the planting material alone had contributed to a 1.5T/ha annual reduction in FFB yields. Until very recently, information about

[103] See Feintrenie et al (2009) for calculations of debt repayments under a variety of scenarios.

palm oil cultivation had been word of mouth from other farmers. This appeared to be another contributing factor to the low yields in this village.

As described in section 4.2.5, the isolation of this village from the nearest mill, reliance on middlemen for FFB sales and lack of organisation amongst farmers all meant that the FFB prices received was below that received elsewhere, and meant that potential income benefits for these smallholders were not being realised.

4.10 Summary of measureable units and indicators

Assessing the degree of impact of palm oil production and conversion and monitoring changes over time requires indicators to be developed. Indicators may address both positive and negative impacts, but in all cases should refer to variables which can be directly observed. The intention here, where possible, is to identify variables which can be quantified (indicated in this section by Q). While this is possible for units such as number of jobs, or level of income, in cases where impacts are more qualitative, and this approach is not appropriate, suggestions are made of other ways in which impacts might be assessed (indicated by O). It should be remembered, however, that measuring socio-economic impacts is not an exact science, particularly where the intention is to establish causality, in this case with palm oil production and conversion.

In all cases, measuring and monitoring of indicators, and therefore impacts, requires appropriate sources of data. This will differ depending on the scale of the impact being assessed, but it is suggested that two main categories of data are necessary: firstly, national and regional datasets, primarily from publically available sources, collected through various surveys; secondly context specific data on individual production or conversion units, systems or villages in the form of a socio economic impact assessment. This section will firstly provide an overview of these two categories of data before going on to summarise both possible indicators and sources of data for each of the types of impacts being considered.

4.10.1 National and regional level data sets

Secondary socio-economic datasets can serve two main purposes: firstly, they may enable monitoring of impacts at larger spatial scales. This is important if cumulative impacts of the palm oil chain are to be assessed; for example in terms of total employment, or contribution to GDP. Secondly, they may be used to provide context to data collected for individual production or conversion units.

A number of types of types of data can be identified, which may be useful to varying degrees.

- Datasets generated by socio-economic surveys with national coverage, such as SUSENAS[104] and SAKERNAS[105]. These surveys are conducted regularly and therefore allow for monitoring, but provide generalised data.
- Composite datasets designed to measure and monitor particular socio-economic issues, such as the UNDP's Human Development Index (HDI) and Gender Development Index

[104] Survei Sosial Ekonomi Nasional (National Socio Economic Survey)
[105] Survey Angkatan Kerja Nasional (National Labour Force Survey)

(GDI) and the WFP's Food Vulnerability Index. These are generated periodically, but less frequently than national surveys, and tend to concentrate on larger spatial scales.
- Data collected by organisations such as NGOs on particular issues of concern, such as social conflict or workers rights. While this can be useful as a monitoring tool, caution may be required in using data from particular interest groups. Methodology would also need to be considered carefully.
- Data collected for the purposes of particular studies, such as data on child labour or OSH. This data may address issues of interest more directly than some of the other sources, but will usually only give a 'snapshot' as data collection may not be repeated.
- Spatial data in the form of maps. This may in theory be useful to address land rights issues, although in practice available maps are limited. These issues are considered in section 4.10.8.

As this brief summary indicates, use of secondary data has a number of limitations. In general terms, the data collected may be of limited relevancy, especially when attempting to attribute particular socio-economic impacts to the palm oil chain specifically. It cannot be assumed that the required data is collected, especially with sufficient frequency to enable useful monitoring. Even where relevant data is available it has limited application at the local scale: even district level data does not allow for the impacts of a specific production or conversion unit to be directly monitored.

4.10.2 Socio Economic Impact Assessments

The second type of data is based on a context specific analysis at the local level in the form of a socio economic impact assessment (SEIA). This type of data collection is essential in order to attribute impacts directly to a particular production or conversion unit, to collect necessary data that would not otherwise be available and to monitor impacts over time. SEIAs serve a number of purposes: firstly, they enable baseline data to be collected, which is crucial for effective monitoring; secondly, they allow for the specific context of an operation to be better understood. This is particularly important when considering socio-economic impacts which may have complex chains of causality, such as food insecurity, or are embedded in local political and cultural contexts, such as social conflict. This context-specific analysis allows for impacts of an individual production or conversion units to be understood in a way that universally applied quantitative indicators may not. As an extension of this, an SEIA can help to identify both opportunities for positive impacts of a particular operation to be maximised as well as ways in which likely risks can be minimised. For the purposes discussed here, the baseline assessment needs to be complemented with a monitoring plan[106].

It should be noted that Indonesian legislation does require an impact assessment (AMDAL[107]) to be undertaken as part of the process of land acquisition for new plantations >3000 ha. This mainly concentrates on environmental impacts, but does include some requirements for socio-economic assessment. In reality, this assessment is rarely comprehensive and is done with little or no consultation with local communities. It should therefore not be considered sufficient for the requirements discussed in this section.

[106] See RSB, (2011$_{1)}$ for guidelines on social impact assessments in the context of certification standards.
[107] Analisis Mengenai Dampak Lingkungan Hidup – consists of three main documents; 1) Environmental Impact Assessment, 2) Environmental Management Plan, and 3) Environmental Monitoring Plan

4.10.3 Units and indicators to measure economic impacts

Economic impacts of the palm oil chain are significant at all scales (see Figure 45); from impact on GDP at the national scale to contribution to household income at the local level. The indicators and data used to measure these impacts will therefore depend on the scale being considered. Possible measurable indicators might include:

- % of palm oil contribution to GDP (Q)
- % of palm oil contribution to GRDP (Q)
- Contribution of FFB sales to household income (or or absolute value) (Q)

Measuring and monitoring these indicators requires disaggregated GDP and GDRP and export data. This was found to be challenging in some respects due to the categories applied. Data from GAPKI also indicates quantity and composition of exports. At the local level, this indicators can be measured and monitored through the SIEA.

4.10.4 Units and indicators to measure impacts on employment and poverty reduction

As discussed in section 4.3, the palm oil chain undoubtedly creates a significant number of jobs in rural areas. It may, as an extension, contribute to poverty reduction, although the causality here is less clear. On the other hand, the nature of this employment gives cause for concern, particularly in terms of causualisation and low wages. Given the overall goal that the palm oil chain should maximise opportunities for secure, decent employment, the following indicators are proposed:

- Number of jobs created[108] (Q)
- Ratio of fixed contract : casual/daily workers (Q)
- Wage levels paid to workers, including casual workers (Q)
- Income earned by smallholders from the sale of FFBs (Q)

Key labour force data is collected twice a year through SAKERNAS (National Labour Force Survey). This provides information about the labour force and unemployment, disaggregated along various lines (age, gender etc) and is available down to the district level. Although data is given for employment by sector, categories are too broad to identify employment in the palm oil sector specifically (this would fall under ‘agriculture, forestry, hunting and fishing’) (Dep. NAKERTRANS). Poverty rates are published annually based on SUSENAS data, and are available down to the district scale.

The utility of this data for assessing impacts of the palm oil chain is therefore limited. It also does not shed any light on issues of quality or remuneration of employment. These indicators would therefore need to be assessed at the local level through company records and interviews with employees.

4.10.5 Units and indicators to measure impacts on working conditions

The key issues identified in relation to working conditions related to concerns about restrictions on labour rights, use of child labour and lack of occupational health and safety. These issues are more difficult to quantify, although limited data does exist, outlined below. They also have limited relevancy at the regional and national scale. It is therefore suggested that indicators

[108] Note: establishing the number of jobs created at a national and regional level was difficult, which may limit this indicator.

related to working conditions should be framed in terms of level of compliance with an accepted standard, and applied only at the level of individual units. The question of the how the accepted standard is defined is addressed in section 6.2.

- Number of work related accidents (Q)
- Level of provision of OSH systems, training and protective equipment (O)
- Extent to which legal requirements for social security payments and accident insurance are complied with (O)
- Extent to which trade union rights are respected (O)
- Extent to which industrial relations disputes are dealt with in accordance with the law (O)
- Extent to which child labour laws are complied with (O)

National level data sets related to working conditions (for example on accident rates) are again too general to be meaningful. Individual surveys were found which give slightly more information about the state of labour rights and working conditions in the palm oil sector (see section 4.4.1) but these were 'snapshots' with limited coverage. More useful is perhaps the efforts of some NGOs, such as KPS, which is engaged in monitoring of working conditions in the palm oil sector. This data collection is not, however, as systematic as that collected about social conflicts (section 4.10.8), and is primarily focused on North Sumatra.

The focus of measuring and monitoring working conditions therefore lies at the local scale, through interviews with workers and reviews of documentation. While some metrics could be developed (such as number of accidents), quantifiable indicators would not be appropriate for many of the issues identified.

4.10.6 Units and indicators to measure impacts on health

The impacts identified related to health included both possible benefits of palm oil operations on local health care, and negative impacts associated with chemical use in particular. The former impact is difficult to reduce to an indicator as the value of health care provision will depend on the local context; in an area with accessible health care (determined from district and sub-district level data) it may add little value. Indicators are perhaps more appropriate for monitoring possible health concerns such as:

- Number of workers reporting health concerns related to agrochemical use (Q)
- Level of compliance with a given standard for waste treatment and disposal (O)

There is clearly an overlap between indictors related to health and some of those identified under working conditions. Again, data at the local level would come from interviews with workers and local communities and company documentation.

4.10.7 Units and indicators to measure impacts on food security

Impacts related to food security are some of the most difficult to reduce to universal indicators. As discussed in section 4.6, food security is multidimensional and context specific; considering any single metric in isolation risks misinterpreting the bigger picture. For example, a reduction of food producing land may reduce food availability, but if incomes are increased as a result, this loss may be offset with an increase in food access. Impacts may also differ significantly between scales: in Jambi, for example, the cumulative impact of individual farmers' decisions to convert rice producing land in order to increase income from palm oil has led to a deficit of cereal production across the province as a whole. Given this complexity, the following indicators should be treated with care.

- Conversion rates of food producing land
- Poverty rates
- % of household income spent on food
- % of underweight children below 5 years of age

Given the complex nature of impacts on food insecurity, at the national and regional scales there is particular value in using a specifically designed composite index. The WFP has developed a composite Food Security Index, which has so far been published twice for Indonesia: in 2005 and 2009. This index uses nine indicators pertaining to the three key aspects of food security: food availability, food access and food utilisation and an additional four indicating vulnerability to food insecurity. Although many of the indicators in isolation give little insight into food security, in combination they are judged to provide a holistic picture. The index is calculated down to the district level (Table 20).

Table 20: Indicators used in the WFP Food Security Index

	Dimensions of food insecurity			
	Food availability	***Food access***	***Food utilisation***	***Vulnerability to transient food insecurity***
Indicators	Per capita normative consumption to net 'rice + maize + cassava + sweet potato' availability ratio	Percentage of people below poverty line Percentage of villages with inadequate connectivity Percentage of households without access to electricity	Life expectancy at birth Children underweight Female Illiteracy Percentage of households without access to improved drinking water Percentage of households living more than 5 km away from health facilities	Natural disasters Rainfall deviation Percentage of damaged area Deforestation

Source: WFP (2007)

In addition to this composite index, the other quantifiable indicators listed above can be monitored to the district level. Data sources are: Ministry of Agriculture database (land conversion rates); SUSENAS (poverty rates and % of income spent in food) and district level health profiles (children's nutritional status). All of these datasets are updated annually.

At the local scale, the SEIA can provide the context specific analysis necessary for understanding local dynamics. It is suggested that some form of food security assessment be incorporated into the SEIA, such as that developed by the RSB (2011_2).

4.10.8 Units and indicators to measure impacts on land use competition and conflict

As section 4.7 described, most conflicts associated with the palm oil chain in Indonesia centre on disputes over land rights or unfulfilled promises. This is again a difficult issue to reduce to quantifiable indicators such as number of conflicts: the number of social conflicts related to palm oil increased markedly after the end of the New Order regime, but this was due to the shift in the political context, rather than as a result of a sudden worsening of company practices. The picture is further complicated by the Indonesia's system of land allocation, both in principle and in practice, which leads to conflicting land title claims; it is possible for a piece of land to have two or three title claims. With these issues in mind, it is suggested that indicators should focus on both establishing company's legal compliance (particularly in the process of land acquisition), and measuring and monitoring compliance against a standard of performance (in terms of community consultation and handling of conflicts if they do arise). This mainly concerns following the procedures for Free Prior and Informed Consent (FPIC). See, for example, Lehr and Smith (2010)

- The extent to which land acquisition followed the correct legal process (O)
- The extent to which community land rights are determined and mapped (O)
- The extent to which the principles of FPIC are followed in dealings with local communities and indigenous peoples, including when handling disputes (O)

Establishing land rights would be aided by accurate GIS maps of land title and tenure. Unfortunately, no such maps are publically available in Indonesia. The closest to this is information from the BPN agency, which provides land use related criteria; this can be used to determine whether companies have legal right to the land (Winrock, 2009). The other main source of information on conflicts is data collected by NGOs such as Sawit Watch and the Forest Peoples Programme, which regularly monitor land rights issues.

At a local level, establishing companies' legal rights to the land can be done through reviews of documentation, while interviews with surrounding communities can be designed to determine and monitor the level of community consultation and to company practices from the perspective of local stakeholders.

4.10.9 Units and indicators to measure gender impacts

Key gender related issues highlighted in the case studies were gender related discrimination in the workplace and gender related health impacts. It has been established that both palm oil production and conversion are heavily male dominated and evidence suggests that employment in the sector is underpinned by deeply rooted assumptions about what constitutes 'women's work' and 'men's work'. It is proposed that indicators should be designed to ensure that these assumptions do not result in women's right to health or equal treatment being jeopardised.

Some of these indicators may be quantified; in other cases it may be more appropriate to assess performance against a standard.

- Women's wages as a % of men's (doing work judged objectively to be similar) (Q)
- The extent to which equal opportunities are extended to women and men in the workplace (O)
- The extent to which women's reproductive rights are respected (O)

Some national data is disaggregated by gender, for example labour force data collected by SAKERNAS allows an overall picture of gender differences in employment by district. Composite indicators such as the GDI and GEM (see section 4.8.1) give basic insights into gender equality but are calculated rarely and only available at the province level. None of these data sets measure wage disparity between men and women or workplace discrimination.

At the local level, evidence could be sought through company records and interviews of wages paid by gender and measures taken to safeguard women's health (e.g. a policy that bans women spraying herbicides when pregnant or breastfeeding).

4.10.10 Units and indicators to measure risks for smallholders

This category of impacts is perhaps the most challenging to develop indicators for, for a number of reasons. This is mainly because many of the issues identified, particularly in the case of smallholders, result from a broad range of factors, including geographical location, provision of extension services and market power. As such, there is no one body (e.g. company or government) which can be identified as bearing responsibility for reducing these risks. Interventions can, of course, be made – NGOs in both Jambi and North Sumatra are helping smallholders to overcome some of the barriers they currently face, while IOPRI has introduced an outreach programme to help smallholders increase yields. These, however, are voluntary sources of support by outside parties. The actions required to address many of the issues faced by smallholders therefore differ fundamentally from those stated or implied in indicators for other categories of impacts.

The exception to this are those risks in which plantation companies or mills are directly implicated, such as the way in which NES style schemes are designed and information about them is disclosed, and the way in which FFB purchasing is arranged. This may be measured through interviews with smallholders and documentation of company practices.

- The extent to which plantation companies and millers deal transparently with smallholders

5. Environmental impacts of the palm oil chain

A number of environmental impacts are usually associated with the production and use of biomass for biofuel / bioenergy or biomaterial purposes. These include impacts on **human health** (release of toxic substances, emission of photooxidants and ozone-depleting gases), on the **quality of ecosystems** (release of toxic substances, emission of acidifying and eutrophying gases, land-use impacts on biodiversity, water and soil) on **climate change** (global warming) and on **resources** (non-renewable energy carriers and minerals).

Out of this list, Article 23(1) of the European Renewable Energy Directive (RED, 2009/28/EC) specifically mentions the impacts on global warming (greenhouse gas emissions) biodiversity, water resources / quality and soil quality (EP & CEC 2009).

Within the Global-Bio-Pact project, these four environmental impacts were addressed. The same environmental impacts have also been selected for the analytical framework within the FAO-funded Bioenergy Environmental Impact Analysis (BIAS) project (FAO 2010).

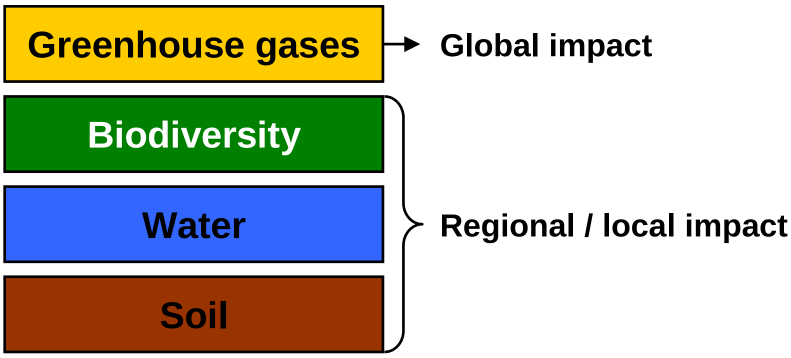


Figure 34: Environmental impacts assessed within the Global-Bio-Pact project (IFEU 2010)

Environmental impacts are occurring at different geographical scales, e.g. at global level (impacts on climate change and on the depletion of the ozone layer) or at regional and local level (impacts on biodiversity, water and soil).

Since the 1970s, environmental assessment has been developed as a systematic process to identify, analyze and evaluate the environmental effects of products or activities to ensure that the environmental implications of decisions are taken into account *before* the decisions are made. Environmental assessment allows effective integration of environmental considerations and public concerns into decision-making. There are several environmental management techniques (e.g. risk assessment, life cycle assessment, environmental performance evaluation, environmental auditing, and environmental impact assessment). Each of these techniques is appropriate for specific situations.

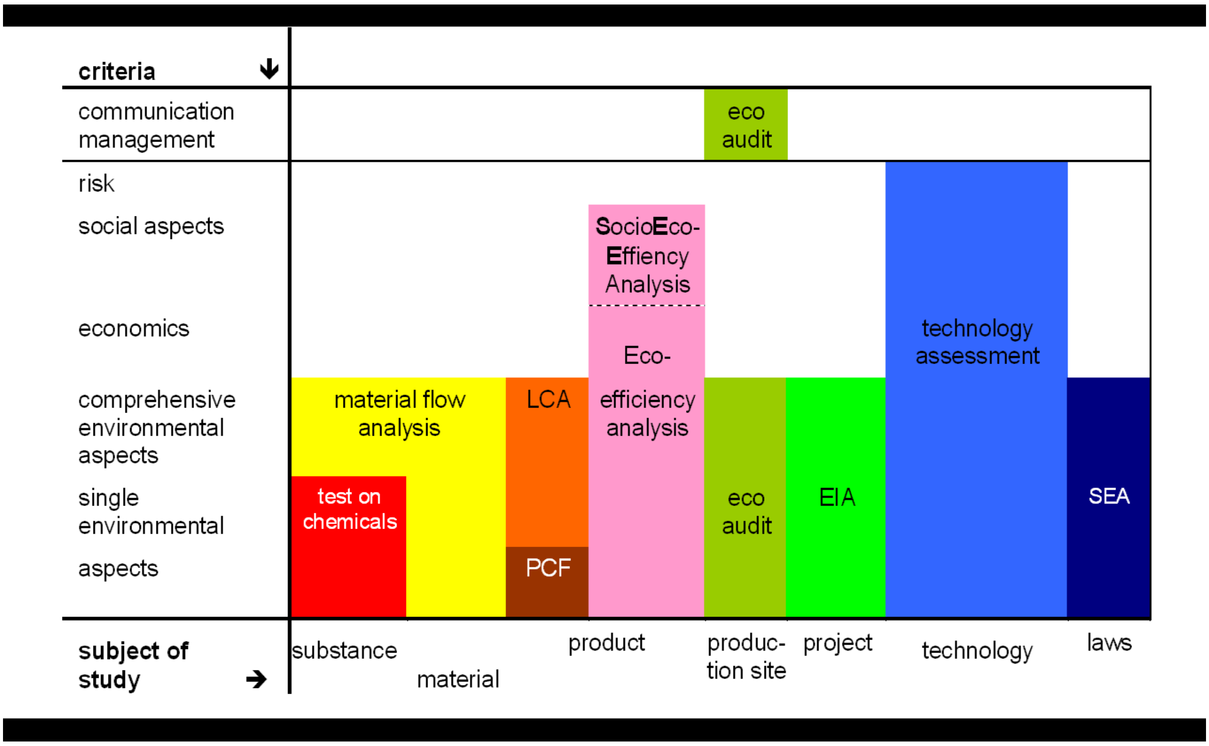


Figure 35: Environmental assessment techniques

The main areas of concern within the Global-Bio-Pact project are the use of land and related ecosystem impacts (biodiversity), the quality of soils, the availability and quality of water, and greenhouse gas emissions. While the latter can be quantified, others can only be described on a qualitative basis (e.g. biodiversity).

Consequently, the environmental assessment within the Global-Bio-Pact project combines elements of Life Cycle Assessment (LCA) with elements of Strategic Environmental Assessment (SEA) and / or Environmental Impact Assessment (EIA). LCA will be used for the quantification of greenhouse gas emissions (having a global impact), whereas SEA and / or EIA will be applied to the other three key environmental impacts (having a regional / local impact).

Elements of Environmental Impact Assessment (EIA) will be used to describe the local environmental impacts of biomass cultivation and conversion. **Error! Reference source not ound.** depicts the conventional procedure of an EIA.

As stated in the EIA Directive (85/337/EEC), an EIA shall identify, describe and assess in an appropriate manner, in the light of each individual case […], the direct and indirect effects of a project on the following factors:

- human beings, fauna and flora;
- soil, water, air, climate and the landscape;
- material assets and the cultural heritage;
- the interaction between the factors mentioned in the first, second and third indents.

Elements of the EIA were used to determine the impacts on biodiversity, water resources / quality and soil quality.

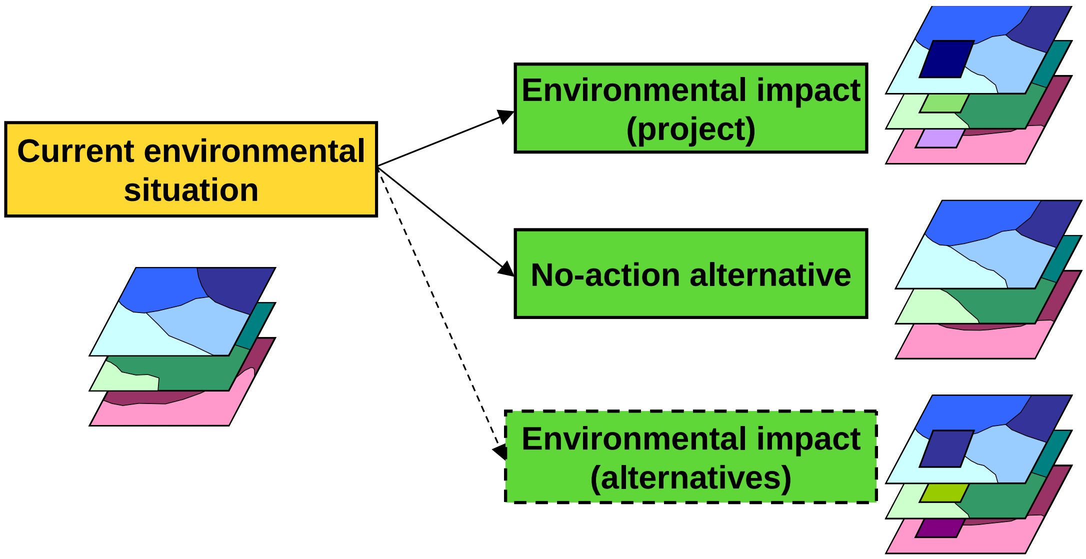


Figure 36: Conventional procedure of an EIA

For the quantification of greenhouse gas emissions, which are having a global impact, the life cycle assessment (LCA) methodology was used. The calculation rules laid down in Annex V of the Renewable Energy Directive (RED, 2009/28/EC) were taken into account.

5.1 Greenhouse gas emissions

5.1.1 Greenhouse gas emissions in the palm oil chain Aek Raso Plantation and Desa Asam Jawa

The following data is intended to support the calculation of greenhouse gas emissions from carbon stock changes in Aek Raso plantation and Desa Asam Jawa. These two case studies are considered together due to their close proximity.

Greenhouse gas emissions from carbon stock changes

The cut off date for land conversion specified in the Renewable Energy Directive is 01/01/2008. Land in both of these case study locations was converted well before this date; in the case of Aek Raso Plantation between 1983 and 1985, and in Desa Asam Jawa from 1986 onwards. In the case of the plantation, the land was previously forest, while in Asam Jawa, most of the land was rubber plantation of other agricultural uses.

Table 21: Data to support calculation of carbon stock changes (Aek Raso and Asam Jawa)

	01/01/2008	Today
Land use factor (F_{LU})[109]	F_{LU} – 1 (Perennial crop)	F_{LU} – 1 (Perennial crop)
Management factor (F_{MG})	F_{MG} – 1.22 (no tillage)	F_{MG} – 1.22 (no tillage)
Input factors (F_I)	F_I – 1.11 (High without manure)	F_I – 1.11 (High without manure)
Climate zone[110]	Tropical wet	
Soil type[111]	Dominant soil: Humic Gleysols; Associated soils and inclusions: Calcaric Fluvisols, Dystric Histosols, Thionic Fluvisols	
Vegetation type[112]	Perennial crops (C_{VEG}: 60)	
Ecological zone	Tropical rain forest	
Continent	Asia (insular)	

Greenhouse gas emissions from biomass cultivation and conversion

The following tables provide data to support the calculation of greenhouse gas emissions from palm oil cultivation on Aek Raso Plantation and in Desa Asam Jawa. Intermediate transportation of FFBs for Aek Raso mill is minimal as the mill is on the plantation site. Data on intermediate transportation of FFBs from Desa Asam Jawa is based on smallholder interviews. Data for greenhouse gas emissions for primary processing is based on Aek Raso Mill. As no biodiesel refinery was studied, no data was available for emissions from secondary conversion.

Table 22: Greenhouse gas emissions from biomass cultivation: Aek Raso Plantation (data for main plantation only, not plasma smallholders)

Yield per ha per year		
Yield (FFB)	**18,860**	kg per ha per year
Size of the cultivation area		
Size	**3053.5**	Ha
Fertilizer applied per ha per year (mature areas – doses differ for immature areas)		
NPK 15.12.22+TE	**508**	kg per ha per year

[109] http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2010:151:0019:0041:EN:PDF
[110] Defined based on the classification of IPCC (IPCC, 2006). See http://eusoils.jrc.ec.europa.eu/projects/RenewableEnergy/
[111] See http://eusoils.jrc.ec.europa.eu/projects/RenewableEnergy/ Soil types are classified according to the World Reference Base (WRB), translated into IPCC classes, which are applied to the Harmonized World Soil Database (HWSD) http://www.iiasa.ac.at/Research/LUC/luc07/External-World-soil-database/HTML/index.html
[112] See table 12: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2010:151:0019:0041:EN:PDF

PHE fertiliser [113]	**31.75**	kg per ha per year
Dolomite	**317.5**	kg per ha per year
Pesticides applied per ha per year - unstated		
Pesticides	**?**	kg active ingredient per ha per year
Diesel use per ha per year - unstated		
Diesel	**?**	L per ha per year

Table 23: Greenhouse gas emissions from biomass transport (Aek Raso Plantation to Aek Raso Mill)

Average distance from the energy crop plantation to the conversion facility		
	< 5	Km (mill on site)
Type of vehicle used to transport the biomass		
	truck	
Fuel used by this vehicle		
	Diesel	

Table 24: Greenhouse gas emissions from biomass conversion 1: Aek Raso Mill

Tons of feedstock processed per year		
	122,232	t feedstock/year (FFB)
CPO produced per year		
CPO	**28,116**	t/year
Amounts of by-products produced per year		
Shells	**7,945**	t/year
Palm fibre	**15,890**	t/year
entire palm kernels	**4,488**	t/year
Energy consumption of the oil mill per year - unstated		
Fuel oil	**?**	L per year
Natural gas	**?**	kWh per year

[113] Pupuk Hayati EMAS (Enhancing Microbial Activities in the Soil) is a biological fertiliser that enables farmers to reduce the dose of chemical fertilisers.

Electricity (external)	989,485	kWh per year
Electricity mix	Indonesia	
n-Hexane application per year		
n-Hexane	132	l/year
Methane capture from POME		
	1	yes (0), no (1)

Table 25: Greenhouse gas emissions from intermediate transport (to end conversion facility)

Average distance from the intermediate conversion facility to the end conversion facility		
	+/-300	Km
Type of vehicle used to transport the biomass		
	truck	
Fuel used by this vehicle		
	Diesel	

Table 26: Greenhouse gas emissions from biomass cultivation: Desa Asam Jawa[114]

Yield per ha per year		
Yield (FFB)	13584	kg per ha per year
Size of the cultivation area		
Size	2.5	Ha
Fertilizer applied per ha per year showed large variations between farmers, see Table 27 below		
Pesticides applied per ha per year – no pesticides used		
Pesticides	na	kg active ingredient per ha per year
Diesel use per ha per year - unstated		
Diesel	?	L per ha per year

[114] **All figures based on averages between 5 farmers. There is significant variation between farmers, see**

Table 27

Table 27: Fertiliser application in Desa Asam Jawa (kg/ha/year)

	urea	KCL	NPK	Dolomite	Organic	TSP	Mop
Farmer 1	300	112.5	150	375			
Farmer 2			600				
Farmer 3	400						
Farmer 4					300		
Farmer 5	335			335	335	335	335

Table 28: Greenhouse gas emissions from biomass transport (from Desa Asam Jawa to mill)

Average distance from the energy crop plantation to the conversion facility		
	7	Km
Type of vehicle used to transport the biomass		
	Truck	
Fuel used by this vehicle		
	Diesel	

5.1.2 Greenhouse gas emissions in the palm oil chain Harapan Makmur

Greenhouse gas emissions from carbon stock changes

Although land was converted more recently in this case study location, most planting still occurred before the cut of date. Prior to planting of oil palm, most village land was used for rice paddy.

Table 29: Data to support calculation of carbon stock changes (Harapan Makmur)

	01/01/2008	Today
Land use factor (F_{LU})[115]	F_{LU} – 1 (Perennial crop)	F_{LU} – 1 (Perennial crop)
Management factor (F_{MG})	F_{MG} – 1.22 (no tillage)	F_{MG} – 1.22 (no tillage)
Input factors (F_I)	F_I – 1.11 (High without manure)	F_I – 1.11 (High without manure)
Climate zone[116]	Tropical, wet	

[115] http://eur- lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2010:151:0019:0041:EN:PDF
[116] Defined based on the classification of IPCC (IPCC, 2006). See http://eusoils.jrc.ec.europa.eu/projects/RenewableEnergy/

Soil type[117]	Dominant soil: Calcaric Fluvisols; Associated soils and inclusions: Calcaric Fluvisols, Dystric Histosols, Thionic Fluvisols, Dystric Gleysols
Vegetation type[118]	Perennial crops (C_{VEG}: 60)
Ecological zone	Tropical rain forest
Continent	Asia (insular)

Table 30: Greenhouse gas emissions from biomass cultivation: Harapan Makmur

Yield per ha per year		
Yield (FFB)	**9600**	kg per ha per year
Size of the cultivation area		
Size	**2**	Ha
Fertilizer applied per ha per year[119]		
Urea	**280**	kg per ha per year
SP	**210**	kg per ha per year
KCL	**210**	kg per ha per year
Dolomite	**140**	kg per ha per year
Pesticides applied per ha per year - no pesticides used		
Pesticides	**na**	kg active ingredient per ha per year
Diesel use per ha per year - unstated		
Diesel	**?**	L per ha per year

[117] See http://eusoils.jrc.ec.europa.eu/projects/RenewableEnergy/ Soil types are classified according to the World Reference Base (WRB), translated into IPCC classes, which are applied to the Harmonized World Soil Database (HWSD) http://www.iiasa.ac.at/Research/LUC/luc07/External-World-soil-database/HTML/index.html
[118] See table 12: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2010:151:0019:0041:EN:PDF
[119] Again variations were seen between farmers, estimates of fertilizer use given are based on those provided by field workers

Table 31: Greenhouse gas emissions from biomass transport

Average distance from the energy crop plantation to the conversion facility		
	75	Km
Type of vehicle used to transport the biomass		
Initial transport – (estimated 5 km) by boat with diesel motor, then truck	**Boat + truck**	
Fuel used by this vehicle		
	Diesel	

5.2 Biodiversity

As mentioned in Article 17(3) of the Renewable Energy Directive (RED, 2009/28/EC), biomass shall not be obtained from land with high biodiversity value such as primary forests, protected areas (PA) and other biodiversity-relevant areas as well as highly biodiverse grassland.

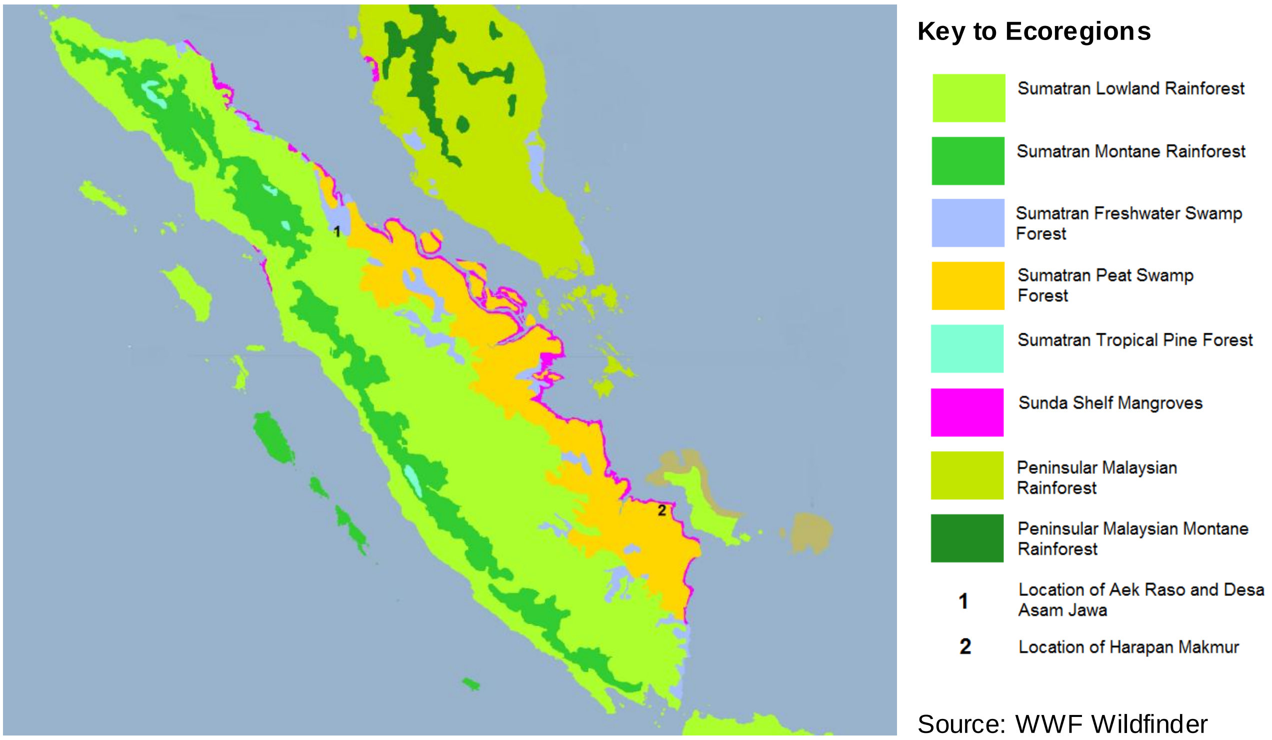
5.2.1 Ecoregions

According to the WWF's ecoregion classification[120], the two case studies in North Sumatra lie at the boundary of the Sumatran lowland rain forest and the Sumatran freshwater swamp forest (Figure 37). The Sumatran lowland rain forest ecoregion has one of the highest levels of biodiversity of any forest on earth and has a 'critical' conservation status. Both logging and agricultural expansion, including the development of palm oil plantations such as Aek Raso, have been the key factors resulting in a 60% reduction in these forests over the past 15 years (WWF_1). The Sumatran freshwater swamp forest is also severely threatened, with only around a fifth of the original natural habitat remaining. The fertile soils in this ecoregion have also made these areas attractive for agricultural development (WWF_2)

Harapan Makmur is situated within the Sumatran peat swamp forest ecoregion (Figure 37). This area is less threatened than fresh water swamp forests, as low nutrient levels limit the productivity of agricultural crops. Nevertheless, less than half of the peat swamp forest habitat remains. Large areas of peat swamp have been drained for development projects and transmigration schemes, including Harapan Makmur, making this a highly vulnerable ecoregion (WWF_3).

[120] Ecoregions are conservation planning units and are defined as a 'large area of land or water that contains a geographically distinct assemblage of natural communities'

Figure 37 Location of case studies in relation to ecoregions of Sumatra



Source: WWF Wildfinder

5.2.2 Protected areas

Indonesia had a total of 23,893,000 ha of protected areas[121] in 2003. However, 64% of these area are 'unclassified' protected areas that have no real biodiversity protection (WRI, 2007). Moreover, the level of protection afforded to areas with higher protection status' (IUCN I – V) is

questionable, and encroachment, illegal logging, and fires within protected areas remain widespread. Indonesia has a poor record of controlling deforestation within protected areas; this has included encroachment by palm oil and forestry concessionaires, as well as illegal logging by local people and outsiders. The government's transmigration program, which has moved people to less populated areas throughout the archipeligo, has also increased the opportunities for deforesation within protected areas (Bickford et al 2007). In addition, the Indonesian context, which includes high levels of corruption and regional governments' emphasis on 'development projects', is often at odds with conservation efforts.

There is no evidence to suggest that either of the case studies in North Sumatra have encroached upon protected areas. As Figure 38 indicates, there are no protected areas in the vicinity of either case study[122].

[121] All IUCN categories
[122] Note: as none of the case study locations appear on available maps and GPS coordinates are not available, in all cases locations are 'best guesses' based on available information.

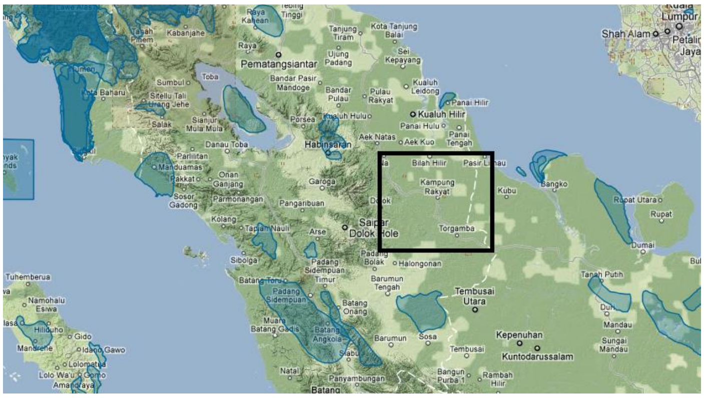


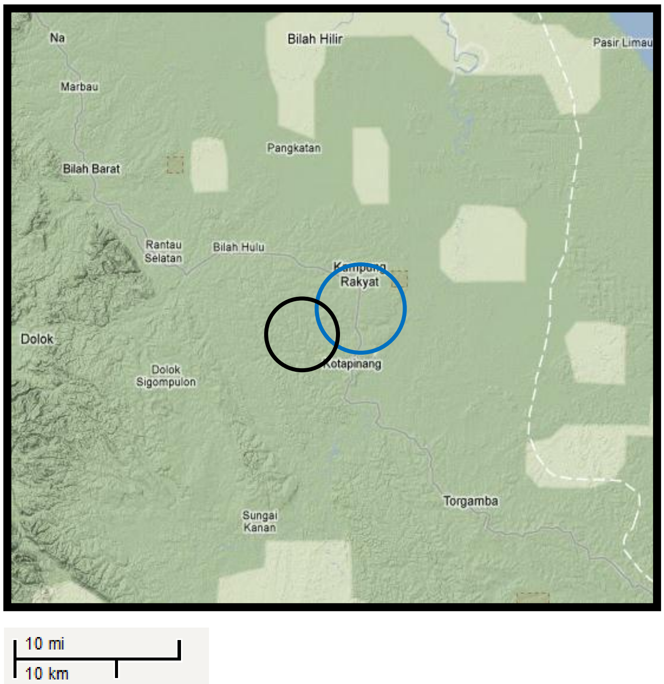
Figure 38: Location of protected areas in the vicinity of Aek Raso and Asam Jawa

Location of Desa Asam Jawa

Location of Aek Raso Plantation

Protected areas

Source: WDPA (2011)



Harapan Makmur, on the other hand, lies in close proximity to two protected areas along the coast of Jambi: Berbak National Park and Kelompok Hutan Bakau Pantai Timur. Berbak covers 162,700 ha and has been a protected area since 1935 under Dutch colonial law. It was made a National Park in 1992, and has been declared a wetland of international importance under the Ramsar Convention (WDPA, 2011).

Although there is no specific evidence to indicate that palm oil development in Harapan Makmur has encroached upon the national park, Berbak is under threat, and has been degraded since the 1990s. Major fires in 1994 and 1997 destroyed large areas, and it is estimated that at least 25% of the park has been affected by illegal logging and fires. Hunting and capturing of animals is a further threat within the park (WDPA, 2011).

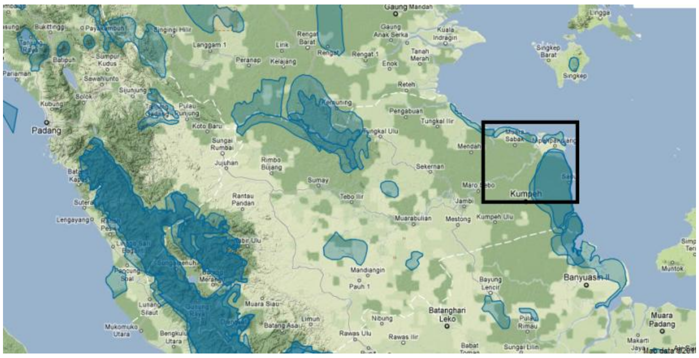
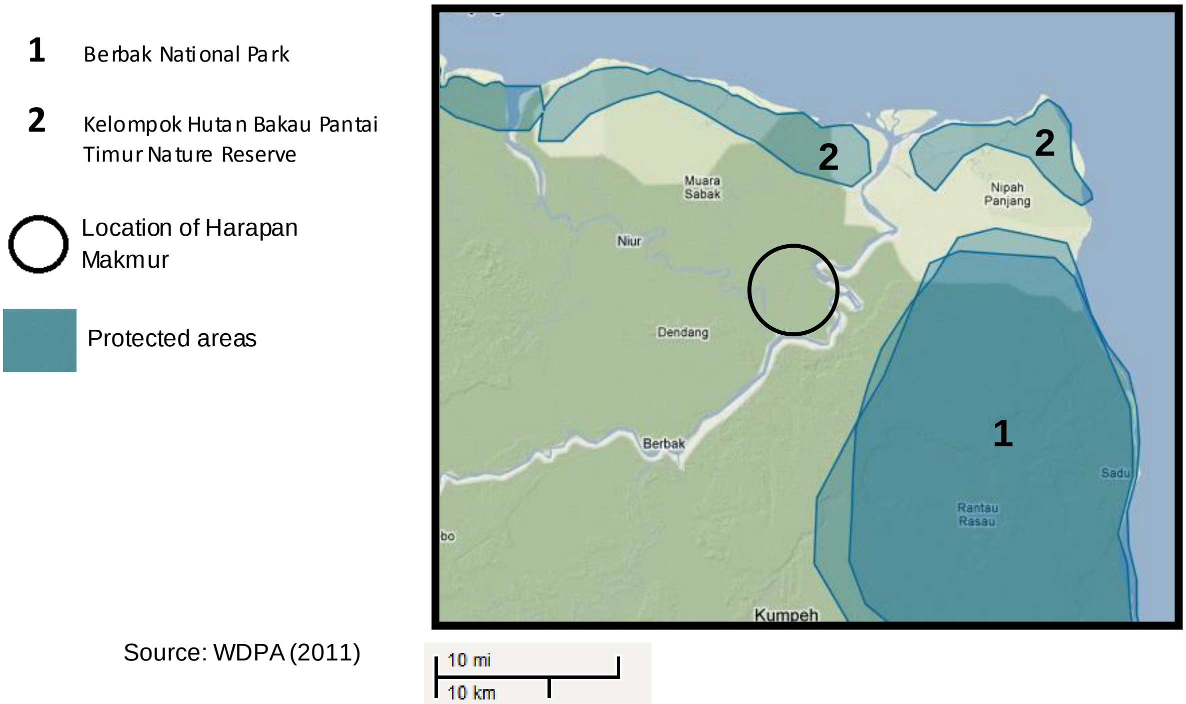


Figure 39: Location of protected areas in the vicinity of Harapan Makmur



Source: WDPA (2011)

5.2.3 Forests and peatlands

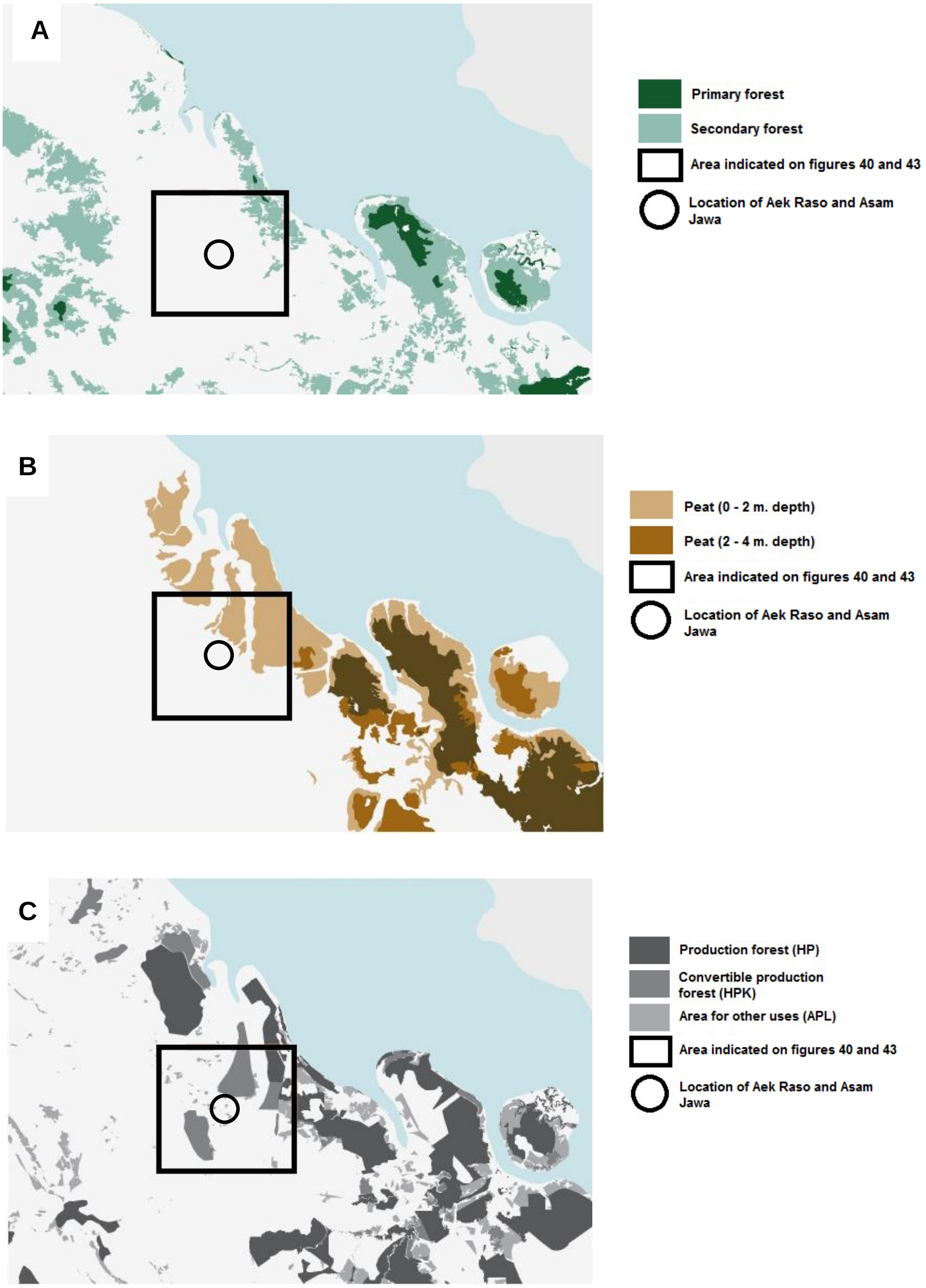
As noted in administrative designation and classification of 'forests' in Indonesia is not straightforward, and reality does not always align with land status. Land designated as 'forest area' is under the control of the government through the Ministry of Forestry. However, much of this area is not actually forested; in 2010, of 127,740,000 ha of designated forest land, only 87,491,000 ha were forested, whereas 6,942,000 ha of forested land were found outside the designated forest area[123] (FAO, 2010).

Forest land is classified according to its function: production, protection and conservation. In the context of biodiversity conservation, the latter two categories are of the most significance, as they are afforded protection from development. Nevertheless, the significance of these areas for biodiversity varies, and unfortunately some of the areas with the greatest value have also come under the greatest pressure from development (for example, the Sumatran lowland rainforest and the Sumatran freshwater swamp forest, described in Section 5.2.1). Despite its classification, protection forest in particular has been subject to degradation and loss (World Bank, 2006). A recent development, described in Section 3.1.9 is the signing of a presidential instruction implementing a two-year moratorium on issuing new forest permits, part of a $US

[123] It should be noted that data on forested are varies between sources

1billion REDD+ partnership between Indonesia and Norway. This covers between 64 and 72 million hectares of primary forest and peatland[124].

Figure 40: Location of Aek Raso and Asam Jawa in relation to: a. forests; b. peat; c. development areas

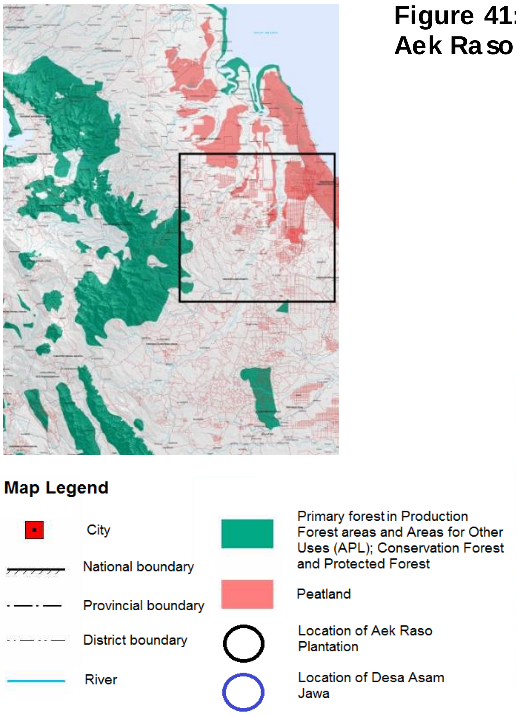


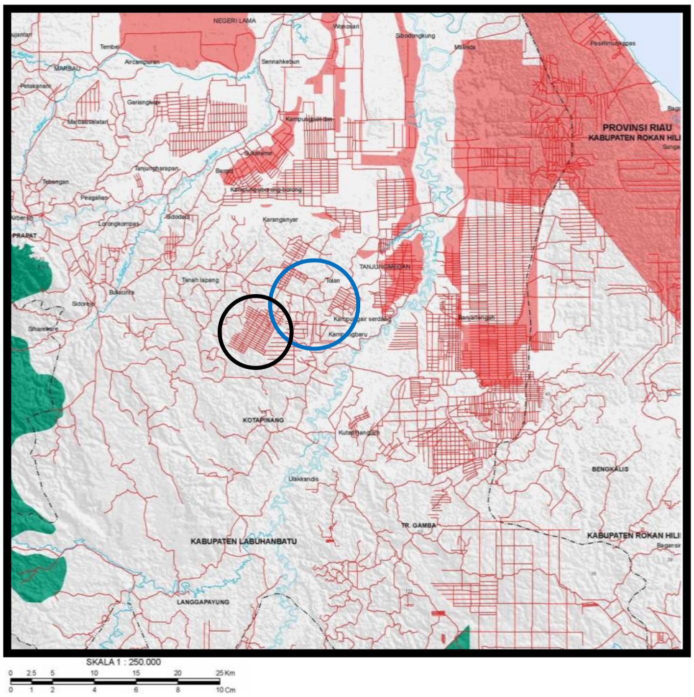
Source: Greenpeace (2010)[125]

[124] The maps which form part of the decree (see figures 43 and 45) have been criticised as insufficient information has been provided on the data and methods used. Digital maps and source data layers have yet to be made available (Gingold and Stowe, 2011)

As Figure 40 indicates, the area of the case studies in North Sumatra has little remaining forest. Although it appears that there are some peatlands to the east of the case study locations, it is understood that neither of the case studies themselves are on peat[126]. As a result, none of the areas indicated on the indicative moratorium map are in immediate proximity to the case studies (Figure 41).

Figure 41: Location of primary forests and peatlands in the vicinity of Aek Raso and Asam Jawa



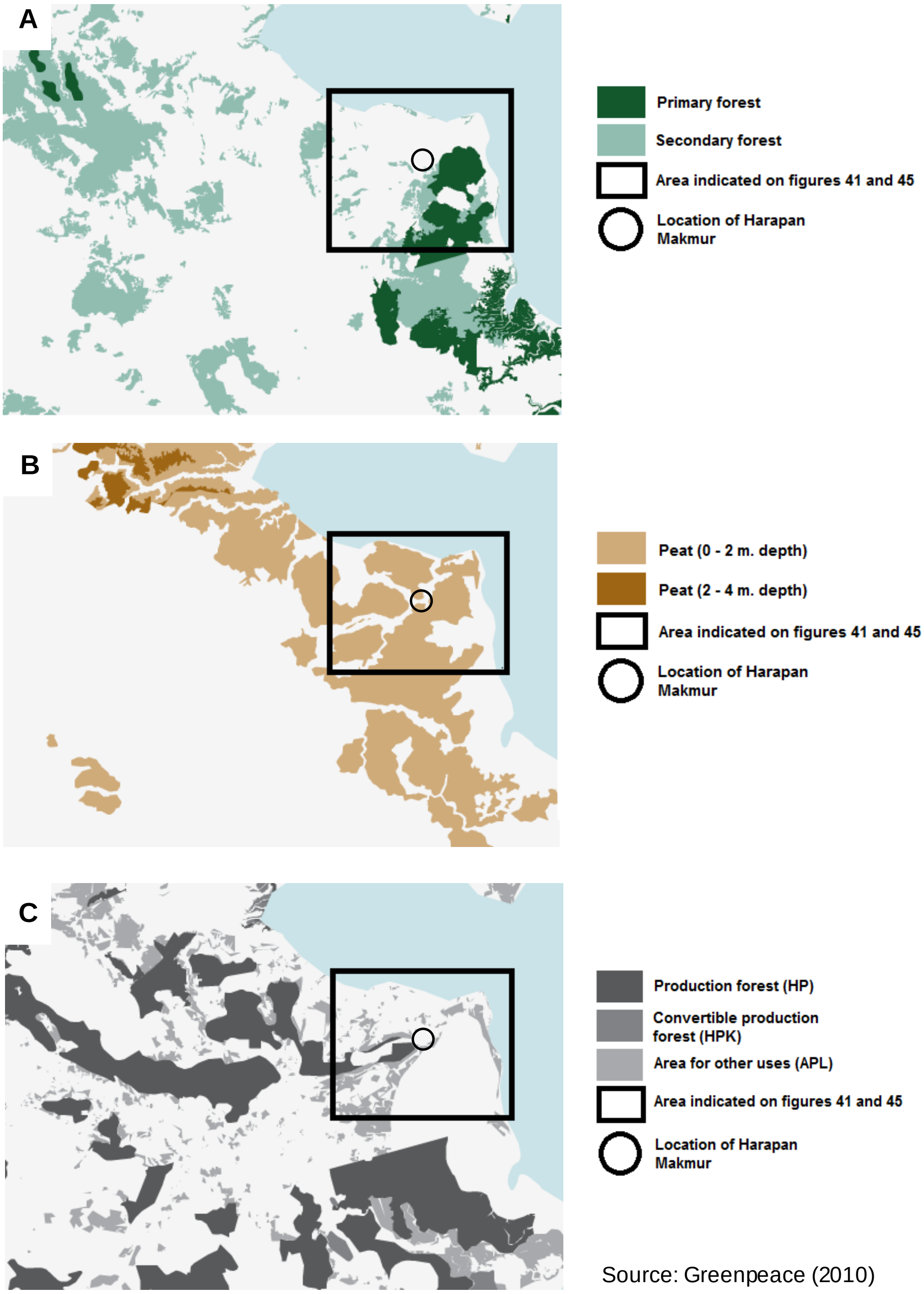


Source: Ministry of Forestry (2011)

Harapan Makmur, on the other hand, lies within an extensive area of peatland. Although not confirmed, this, and evidence observed during the data collection, suggests that the village may lie largely on peat. Nevertheless, this peat may be shallow, as the village does not lie within the peatland area indicated on the moratorium map (Figure 43). Both map evidence (Figure 43) and observations indicate that there is very little remaining forest in the immediate area of the case study; it was explained that forest was cleared prior to the migrants arrival in the 1970s. The remaining areas of primary forest in this area appear to be confined to Berbak National Park.

[125] Map developed based on sectoral and government data
[126] This w as understood from interviews, but was not confirmed.

Figure 42: Location of Harapan Makmur in relation to: a. forests; b. peat; c. development areas



Source: Greenpeace (2010)

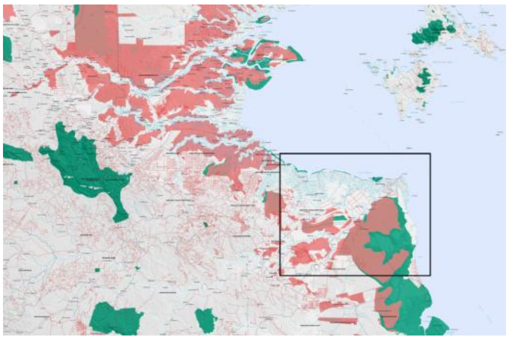
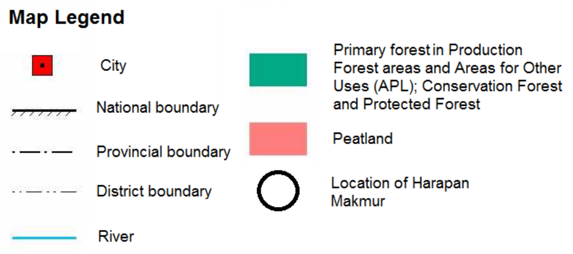
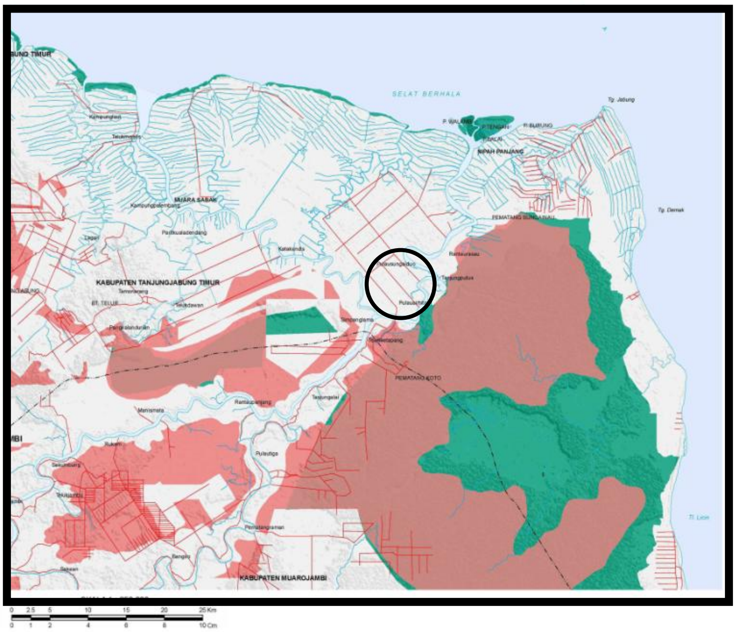


Figure 43: Location of primary forests and peatlands in the vicinity of Harapan Makmur





Source: Ministry of Forestry (2011)

5.2.4 Endangered species and HCV

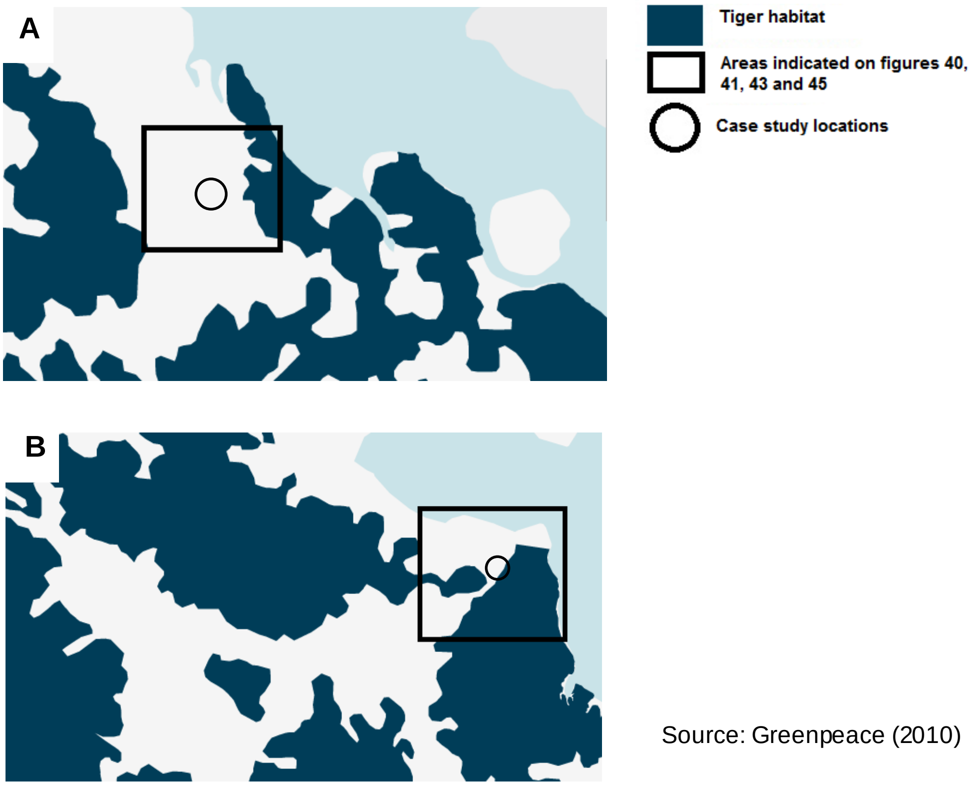
Key endangered species in Sumatra include the orang-utan, Sumatran tiger and elephant. According to data gathered by Greenpeace (2010), while orang-utan and elephant habitat are not found in the vicinity of any of the case studies, tiger habitat is found reasonably close to each of the case studies (Figure 44) and in the case of Harapan Makmur, immediately proximal.

Beyond the data presented here, no datasets were found to give a more detailed or high resolution picture of High Conservation Values (HCV). Although HCV assessments are an element of the RSPO principles and criteria, they are currently not mandatory prior to clearing land for palm oil plantations of other land uses in Indonesia[127]. Moreover, the terms associated with concession rights (HGU) are in some respects unsupportive of HCV conservation[128]. Information on HCV may therefore be available for some palm oil plantations on a site by site basis, but this is not the case for the case study locations.

[127] Although the concept of HCV is not recognised under Indonesian law, the introduction of the ISPO may require palm oil plantations to undertake HCV assessments.

[128] Although there are legal 'loopholes' which allow HCV areas to be set aside and conserved, the law in many ways discourages this. For example the recently passed 'PP No 11/2010 On the Control and Utilization of Neglected Land' is designed to encourage companies to develop idle lands to which they have been granted rights but which they are not actively developing.

Figure 44: Location of tiger habitats in the vicinity of a. Aek Raso and Asam Jawa and b. Harapan Makmur



Source: Greenpeace (2010)

5.3 Water resources and water quality

The only issue found in relation to water sources during the data collection was reported in Desa Asam Jawa. Villagers complained about a dispute they had had with the plantation company about POME contaminating local water sources (see Section 4.7.3) It appears that this issue has been resolved.

No reports or complaints were made about water contamination from agrochemicals in the case study locations, although discussions with community members in a village adjacent to Harapan Makmur reported that this had been a problem.

5.4 Soil

5.4.1 Land with high carbon stock

There is no official definition of high carbon stock land used in Indonesia. The key factors determining the carbon stock of land are forest cover and peat (if below ground carbon is to be considered), discussed in section 5.2.3.

5.4.2 Locally observed impacts on soil

Since starting to cultivate oil palm, smallholders (in particular in Asam Jawa and plasma smallholders in Aek Raso) noted a number of changes in the soil. Almost all farmers reported a decline in the soil's organic matter and fertility. This has resulted in them needing to increase fertiliser use to maintain yields. It was also noted that soil compaction has increased; farmers described having to 'loosen' the soil more often than before. Finally, soil moisture was reported to have declined, and the soil has become drier over time. No evidence of salinisation was reported.

6. Evaluation of the measurable units and indicators

6.1 Relevance of impacts

All impacts selected for consideration in this study were considered likely to be relevant to palm oil production and/or conversion at some scale; all had been highlighted in the literature as potential concerns or benefits. Figure 45 presents a representation of how relevant each category of impact was judged to be at each of the three spatial scales.

Figure 45: Relevance of impacts at different scales

	National	Regional[129]	Local
Economic impacts	High	High	High
Employment and poverty reduction	Moderate	High	High
Working conditions	Low	Low	High
Health impacts	Low	Low	Moderate
Impacts on food security	Low	Moderate	Moderate
Land use competition and conflicts	Low	Low	High
Gender related impacts	Low	Low	Moderate

Level of impact High Moderate Low

The general picture aside, the analysis in section 0 found varying levels of evidence of these impacts in the examples selected. As section 2.2 described, North Sumatra was selected as a regional level case study due to the significance of palm oil to the region, the extent of the palm oil chain located in the province and the diversity of practices found. The cumulative impacts of the sector at the regional scale, for example on job creation, are therefore likely to be greater than in regions where the sector is more recently established, and therefore have a greater relevancy. However, the nature of the sector in North Sumatra means that other impacts, highlighted in the literature as being issues of concern, have a lower relevance. The level of

[129129] Regional impacts will obviously differ depending the significance of palm oil production/conversion in the region (figure...). This representation assumes a region with a high level of palm oil production, such as North Sumatra.

social conflict associated with palm oil production in the region, for example, is much lower than in regions where land is currently being converted on a large scale.

Similarly, not all impacts considered at the local scale were found to have as high a level of relevancy as some literature might suggest. Plasma smallholders in Aek Raso, who were well established, and who had benefited from a previous government programme, reported few of the issues of debt burden and poor terms of trade highlighted elsewhere. For independent smallholders, the divergence between the established, reasonably successful and well located farmers in Asam Jawa, and the isolated smallholders in Harapan Makmur provides stark evidence of the variation, even within one category of producers. For the latter group, many of the impacts highlighted in section 4.9 (Risks for Smallholders) were highly relevant.

It would appear from the analysis, therefore, that impacts of the palm oil chain are characterised by both spatial and temporal variation. Differences in the relevance of impacts between provinces and districts depend on a number of factors, such as: the degree of infrastructure; level of local government capacity, and formal and informal policy objectives at the local level; level of competition between companies; the migrant – indigenous balance in the region and the nature of customary rules. Meanwhile, the relevance of impacts appears to change over time: during the early years of establishment, the process of land acquisition increases the risk of conflict, while low yields in the early years of production present challenges for smallholders. The evidence from North Sumatra suggests a tendency for these negative impacts to decline over time, while the income benefits increase[130]. These variations mean that it would be unwise to assume universal levels of relevance for the selected impacts on the basis of the narrow range of case studies analysed in this report.

6.2 Determination of thresholds

For some of the impacts and indicators identified, it is possible to recommend impact thresholds. These generally take the form of minimum standards, as defined by law or other bodies. While some thresholds (such as wages) are quantifiable, these are in the minority. The notion of thresholds has therefore been extended to include legal compliance, where there are laws in place which pertain to particular indicators. These are summarised in Table 32. It should be noted that given the limitations of some Indonesian legislation, with respect to some aspects of labour rights and land rights in particular, it may be judged that legal compliance is insufficient as a threshold. For indicators not listed in Table 32, there was insufficient evidence found to justify a specific threshold.

Table 32: Suggested thresholds for selected indicators

Indicator	Threshold	Details
Wage levels paid to workers, including casual workers	Wages meet legal minimum wages, as defined annually by Province Or Reasonable Cost of Living Index (KHL)	Regulation of the Minister of Manpower No.PER-01/MEN/1999 on Minimum Wages

[130] Incomes have also been lifted substantially by increases in FFB prices.

	Overtime hours, payment and terms are in accordance with the law	Decree of the Minister of Manpower No.102/MEN/VI/2004 on Working Time Overtime and Overtime Wage.
	Wages are paid in accordance with the law	Articles 90, 92 and 93 of Law No. 13 of 2003 on Manpower Government Regulation (PP) No 8 of 1981 on the Protection of Wages
Level of provision of OSH systems, training and protective equipment	Legal compliance with OSH regulations	Articles 86 and 87 of Law No. 13 of 2003 on Manpower Law No. 1 of 1970 on Occupational Safety
Extent to which legal requirements for social security payments and accident insurance are complied with	Legal compliance with social security and work accident regulations	Article 99 of Law No. 13 of 2003 on Manpower Law No. 3 of 1992 concerning Employees' Social Security Regulation of the Minister of Manpower No.PER.04/MEN/1993 about Warranty Work Accidents
Extent to which trade union rights are respected	Legal compliance	Article 104 of Law No. 13 of 2003 on Manpower Law No.21 of 2000 on Trade Unions / Labour
Extent to which industrial relations disputes are dealt with in accordance with the law	Legal compliance with industrial relations law	Article 136 of Law No. 13 of 2003 on Manpower Law 2 / 2004 concerning Industrial Relations Disputes Settlement
Extent to which child labour laws are complied with	Legal compliance with child labour laws	Articles 68 - 74 of Law No. 13 of 2003 on Manpower Decree of the Minister of Manpower No. 235/MEN 2003 About Types of Work Which harms Child Health, Safety or Morals Decree of the Minister of Manpower No. 115/MEN/VII/2004 About Protection Children who Perform Work To Develop Talent & Enthusiasm
The extent to which land acquisition followed the correct legal process	Legal compliance	1. Location permit obtained in accordance with Ministerial Regulation of the Agrarian Ministry / Head of National Land Agency (No. 2 of 1999) on Location Permit 2. Plantation Business Permit (IUP) obtained in accordance with Law no. 18, 2004 on Plantation; Regulation of the Minister of Agriculture. 26/Permentan /ar.140/2/2007 about Guidelines for Licensing of Plantations 3. HGU/HGB obtained in accordance with Articles 28 - 50 Law no. 5 of 1960, the Basic Agrarian Law ; Government Regulation 40/1996 about HGU, HGB and HP

Women's wages as a % of men's (doing work judged objectively to be similar)	100%	
The extent to which equal opportunities are extended to women and men in the workplace	Legal compliance with anti-discrimination law	Law 21/1999 on the Ratification of ILO Convention. 111 year 1958 regarding discrimination Employment and Occupation Articles 5 - 6 of Law No. 13 of 2003 on Manpower
The extent to which women's reproductive rights are respected	Legal compliance	Article 76 paragraph 2 and Articles 81 - 83 of Law No. 13 of 2003 on Manpower

6.3 Impact mitigation options

The question of how the identified impacts should be addressed involves, as a first step, identifying the actor which bears the responsibility or possesses the influence over the impact in question, and secondly specifying actions required in order to address the impact. In most cases, in the case of palm oil production or conversion, the actor concerned is the plantation company, mill or group of producers. This is this standard model for certification schemes, in which fulfilment of actions is rewarded with certification or market access. With respect to most of the impacts discussed in this report, this model is appropriate, particularly at the local scale. In these cases most desirable 'actions' are already specified in existing certification schemes (section 6.4). Exceptions to this model are impacts over which influence lies with bodies other than the producers themselves. Examples of such impacts are some of the risks for smallholders, discussed in sections 4.9 and 4.10.10.

Actions to address impacts will also differ depending on whether the intention is to minimise a negative impact or to maximise a benefit. Both are relevant in the context of this report, although actions specified in existing certification schemes tend to focus on the former (section 6.4). Identifying opportunities to maximise positive impacts requires moving beyond thresholds and considering theories of change from other schools of thought, including development studies

6.4 Impacts and biomass certification

The palm oil industry in general, and in Indonesia in particular, has come under increasing pressure in recent years from NGOs and consumer groups to improve sustainability standards. The result of this pressure was the formation of the Roundtable on Sustainable Palm Oil (RSPO) in 2004. As described in section 3.2.8, this is voluntary, multi-stakeholder association. The RSPO has by far the most extensive coverage of any certification scheme (994,505 ha of palm oil production area certified worldwide). Most of the large palm oil companies are members of the RSPO, although only a minority are currently certified (a total of 16 companies in Indonesia). Evidence suggests that the RSPO has a sufficiently high profile that many palm oil companies experience reputational damage by exclusion[131]. A concern about the RSPO has been that its principles and criteria have primarily focused on large palm oil plantations. The Indonesian national interpretation of the RSPO principles and criteria has been extended to

[131] A recent example was the suspension of Golden Agri Resources on the grounds of non-compliance with RSPO rules. The publicity generated by this decision prompted the adoption of a stringent new policy on forest conservation by the company (Butler, 2011)

include guidelines for scheme (plasma) smallholders, although independent smallholders have yet to be covered[132]. Even when these guidelines do become available, many are concerned that the even using the group certification model, the requirements will deter all but the most progressive farmers, and reduce market access for others.

A second scheme which is likely to have a significant impact on the Indonesian palm oil industry over the coming years is the Indonesian Sustainable Palm Oil (ISPO). As section 3.2.8 described, the crucial difference between this and the RSPO is that the ISPO is mandatory. The scheme is still in the process of development, but indications so far indicate that most criteria will concern legal compliance, with some additional requirements such as protection of High Conservation Value areas. The impacts of this scheme will remain to be seen. While the standards appear to be less stringent than those of the RSPO, they do have the advantage of being mandatory. Nevertheless, the need for such a scheme is evidence of the low levels of legal compliance in some areas, and weaknesses in current enforcement. The capacity to enforce and monitor a scheme on an industry-wide scale is therefore being questioned by many (Greenpeace, pers. comm.).

Other certification schemes which are designed to cover palm oil include the Roundtable on Sustainable Biofuels (RSB) Standard and the Sustainable Agriculture Network (SAN) developed by Rainforest Alliance. Neither of these schemes has yet become established as a certification option for palm oil. The RSB only began operating in March 2011 and involves independent 3rd party certification bodies. The Standard has been developed to cover a range of biofuel feedstocks, and aims to aims to support compliance with various regulations, including those of the European Union[133]. In contrast, the SAN is an established voluntary certification scheme, which has built its reputation in commodities such as coffee and cocoa. It has recently extended its standard to include palm oil specifically, although no plantations have yet to be certified.

[132] The Malaysian national interpretation already includes guidelines for independent smallholders and these are under development in Indonesia.

[133] The RSB's standards and certification system was recognised by the EU in July 2011 as a way to demonstrate and document compliance with the EU biofuels mandate (RSB website)

Table 33: Summary of socio-economic coverage of existing certification standards

	RSPO	RSB	SAN	ISPO
Status	Established	Developed but yet to certify any palm oil producers	Developed but yet to certify any palm oil producers	Still in pilot phase
Coverage				
Economic	✓	✓	✓	✓
Employment and poverty reduction	✓	✓✓	✓✓	✓
Working conditions	✓✓	✓✓	✓✓	✓✓
Health[134]	✓	✓✓	✓✓	
Food security		✓✓		
Land use competition and conflict	✓✓	✓✓	✓	✓
Gender impacts	✓✓[135]	✓✓	✓	✓
Risks for smallholders	✓	✓		✓

✓ Limited coverage ✓✓ Significant or extensive coverage

Table 33 indicates that most impacts addressed in this report are already covered by existing certification schemes, although level of coverage does vary between the standards. The RSB, for example, is the only one to address impacts on food security specifically (Principle 6). The RSB Standard includes guidelines for a food security assessment and emphasises the context specific nature of food security issues. This standard also goes the furthest in requiring producers to maximise socio-economic benefits and contribute to local development (Principle 5).

While the extended coverage of the RSB standard should be welcomed, the reality is that the RSPO is likely to remain the most influential and widely recognised standard amongst palm oil producers for the foreseeable future. As Table 33 indicates, the RSPO standard does provide some coverage of most of the impacts discussed in this report (with the exception of food security), and some issues, such as land acquisition and principles of FPIC are well covered. However, there are limitations of the RSPO, especially when compared to other standards. Perhaps most significantly, the RSPO focuses on limiting harmful socio-economic impacts of

[134] Coverage is acknowledged if the standard goes beyond references to OSH
[135] Well covered in guidance notes (advice on forming a gender committee) although indicators are more minimal

palm oil development on communities are workers and lacks any meaningful requirement to maximise benefits[136].

The ISPO provides less coverage than the other standards, as might be expected. As it is largely a list of relevant laws, the inherent weaknesses of these regulations, discussed elsewhere, apply to this standard. Where the criteria extend beyond current legal requirements, indicators appear quite superficial (Principle 5 on 'Social and Community Responsibility' for example, is very broadly defined). Nevertheless, the standard does include a principle on economic empowerment of local communities. Moreover, if the ISPO is successfully implemented, the cumulative impacts across the industry as a whole could be significant. The standards also differ in their requirements for assessing socio-economic impacts of operations. The ISPO, for example, only requires compliance with the legal requirement to undertake an AMDAL. As noted in section 4.10.2, this is judged here to be insufficient for the purposes of sufficient collecting baseline data, for establishing a context-specific understanding of socio-economic issues and for identifying specific risks and opportunities. The RSPO requires that assessment of social impacts goes beyond the AMDAL (criteria 6.1 and 7.1) and gives guidance on what should be assessed and how. The SAN Standard also requires a social impact assessment as a prerequisite for establishing a social and environmental management system (Principle 1). In the RSB Standard, a Social Impact Assessment is a key requirement upon which other criteria are based, and accompanying guidelines are provided (see RSB 2011_1).

7. Conclusion

This report comprises one of the case studies for the Global-Bio-Pact project, and has presented the results of an investigation into the socio-economic impacts of palm oil production and conversion in Indonesia.

The study found evidence of socio-economic impacts of the palm oil chain at all of the three scales analysed: national, regional and local. At the national scale, the cumulative economic impacts of the sector are significant. Although the dynamics of these macro-economic impacts were not analysed in detail, it can be observed that the contribution of the palm oil sector to Indonesia's exports is significant; expanding output in the context of high CPO prices means that the value of the sector is increasing. The palm oil chain in Indonesia is, however, skewed towards production of CPO; the downstream processing industries are still relatively undeveloped, especially in comparison to neighbouring Malaysia. The biodiesel sector in particular is still in its infancy, and will require sustained political support and changed incentives if its development is to gain traction.

The palm oil chain is concentrated in a relatively small number of regions (Figure 8). it is in these provinces, including North Sumatra, where the cumulative impacts of the sector are most significant at a regional scale. In regions with high levels of palm oil production, and in particular those which have downstream processing facilities, the economic impacts appear to be significant (again regional major-economic impacts were not fully analysed). The impact of the sector on employment, although again difficult to quantify, is likely to be significant in higher producing regions. Impacts on food security were also found to be potentially significant at a regional scale in regions with high levels of palm oil production and rapid rates of land

[136] The exception to this is Criterion 6.1: Growers and millers contribute to local sustainable development wherever possible.

conversion. As discussed in sections 3.1.7 and 4.6, however, these impacts are not straightforward and require further analysis.

The majority of the socio-economic impacts discussed in this report are most relevant at a local scale. The local impacts for which most evidence was found in this report included those associated with employment creation, working conditions and risks for smallholders. However, as has been emphasised throughout the report, the palm oil chain, and its associated impacts, exhibit considerable variations, both spatially and temporally. Impacts in terms of regions with established palm oil plantations (such as North Sumatra) are likely to differ substantially from regions where plantations are currently expanding (for example, in terms of employment intensity and social conflict). The examples analysed in this study also suggest that the potential for smallholders to benefit from palm oil production varies regionally; in this case, smallholders in North Sumatra experienced greater benefits than those in Jambi. The key conclusion from these findings is that any generalisations about the socio-economic impacts of palm oil, and any examples claiming to be ‘representative’ should be treated with caution.

Both positive and negative socio-economic impacts are, for the most part, a function of company practices, in combination with the regulatory and institutional context. In many cases, the legal instruments exist in Indonesia at least to minimise negative impacts (for example on working conditions and labour rights), but poor enforcement and corruption present challenges. Sustainability standards and certification schemes, therefore, both voluntary and mandatory, have an important role to play in improving the socio-economic sustainability of the palm oil sector in the future.

8. References

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