



The local impacts of oil palm expansion in Malaysia

An assessment based on a case study in Sabah State

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Palm oil fruit harvest, Malaysia

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1. Introduction

This study is part of a broader research process assessing the local economic, social and environmental impacts from feedstock expansion for the growing biofuel sector (see German *et al.* 2011). Nonetheless, in the Malaysian context, biofuel production volumes are negligible despite government interest in promoting sector expansion. Since Malaysia is the second largest palm oil producer in the world, palm oil is slated to become the primary feedstock for biofuel production in the country. Since palm oil consistently outperforms all other substitute vegetable oils on price, it is also becoming an important feedstock globally. While a rapidly growing global biofuel sector could develop into an important new market outlet for Malaysia, it does carry a number of risks. This paper aims to reflect on these risks by exploring the local social and land-use impacts of oil palm in the Beluran District of Sabah State. This is based on household surveys to discover the perception of impacts among relevant local stakeholder groups, and remote-sensing analysis. While the impacts of oil palm in the study site cannot be attributed to the biodiesel industry *per se*, lessons learnt will be directly applicable to the biodiesel sector in Malaysia, and relevant for the whole Southeast Asia region.

The following section offers a general survey of the social and environmental impacts associated with oil palm development, with emphasis on the state of Sabah. This is followed by a brief overview of the case study site and the research methodology adopted for data collection. The next section presents findings from the field research. The paper concludes with a reflection on the findings and implications for the governance of oil palm development in Malaysia.

2. Social and environmental impacts of oil palm plantations in Malaysia

The production of palm oil has long been associated with reports of tropical deforestation, biodiversity loss, water pollution, and violation of customary land rights (Anon. 2004, 2009; Koh and Wilcove 2008; Then 2009). In the past, Malaysia was among 14 countries with annual deforestation rates in excess of 250 000 ha per year (Wood 1990). Most of this

is attributable to the country's large timber industry and the growing oil palm plantation sector. An analysis by Koh and Wilcove (2008) suggests that during the period 1990–2005, close to 60% of the oil palm expansion in Malaysia was at the expense of forest conversion, with the remainder coming from existing cropland (e.g., rubber, cacao). Toh and Grace (2006) argue that the substantial loss of forests in Sabah was due primarily to over-harvesting, poor logging practices, short logging cycles and the absence of rehabilitation following harvesting. These activities resulted in a massive reduction of primary forest cover between 1975 and 1995, from 2.8 million ha to 300 000 ha, and a corresponding increase in degraded forest, which reached 2.5 million ha (Mannan and Yahya 1997, cited in Toh and Grace 2006).

Sabah then transitioned towards the development of a cash-crop estate economy, in which powerful state associations (Yayasan Sabah) were granted powers to allocate the land and control the trade in key products such as timber and palm oil. Forests on state lands not identified as forest reserves were unprotected. The state had the right to alienate¹ such lands for development; and they were usually logged and cleared for agriculture (Toh and Grace 2006). In the 1980s, huge areas of degraded forests in Sabah were degazetted and cleared for oil palm cultivation (Jomo *et al.* 2004). From 1973 to 1992, Sabah's forest cover outside protected areas declined from 51% to 15% (Tanner and Kirk 2008). By 2003, some 87% of the total land cultivated in Sabah was under oil palm (Toh and Grace 2006). By the end of the first decade of the 2000s, oil palm covered about 1.36 million ha in Sabah (Wahid 2010). The state is the biggest palm oil producer in Malaysia, accounting for approximately 31% of the total national output (POIC 2010).

Deforestation followed by plantation establishment has a significant effect on carbon stocks and greenhouse gas emissions. Henson (2005) estimated that the expansion of agricultural plantations from 1981 to 2000 led to an overall decline in biomass carbon stocks in forests and tree crops in Malaysia.

¹ According to the Sabah Land Ordinance 'alienate' means 'to lease, or otherwise dispose of State land on behalf of the Government in consideration of the payment of such rent and of such premium, if any, as may be required'.

The emissions from land-use change associated with plantation expansion may be significant. Using land with low carbon stocks, such as grassland, for oil palm plantations, would result in a carbon gain, whereas the use of areas such as forests with higher carbon stocks would result in net emissions (Henson 2005). A new oil palm plantation may register higher growth rates and therefore sequester carbon at a faster annual rate compared to a naturally regenerating forest, but in the end the oil palm plantation will store 50–90% less carbon (estimated over 20 years) than the original forest cover (Ch'ng *et al.* 2009).

The situation is further complicated by the prevalence of extensive peatlands in Indonesia and Malaysia that contain globally significant levels of carbon below ground. Through tree growth and peat accumulation, a natural peat swamp forest acts as a carbon sink, absorbing at least 2.6 tonnes of CO₂ per hectare per year (Mongabay.com 2007; Science Daily 2007). Planting oil palm on drained peatland can lead to high emissions of CO₂ to the atmosphere due to the oxidation of most of the peat carbon above the drainage level. According to Fargione *et al.* (2008), it would require 423 years before the CO₂ released by converting peatland to oil palm would be repaid – more than any other type of common land-use change. About 12% of oil palm plantations in Malaysia are planted on peatland (Wetlands International 2010), though the areas in Sabah are small compared to those in Sarawak and the Peninsula.

The clearing of forest for oil palm also has significant consequences for biodiversity (Koh 2007; Koh and Wilcove 2008; Brühl and Eltz 2010). Fitzherbert *et al.* (2008) conducted a literature review on the effect of oil palm on biodiversity and found that most studies show large differences in faunal species composition between forests and oil palm plantations. Species found in plantations tend to be generalists, non-forest species (including invasives) and pests, while specialists and those of highest conservation concern are generally absent.

On the positive side, oil palm cultivation is said to have played a significant role in poverty alleviation among smallholders and the rural population in Malaysia (Arif and Tengku Mohd Ariff 2001). According to these authors, the incidence of poverty in the entire agricultural sector decreased significantly

from 1970 to 1997 (from 68.3% to 11.8%), while the incidence of poverty among oil palm smallholders was the lowest of all agricultural sub-sectors. This was attributed to the higher returns from oil palm compared to other agricultural products, and aggressive government land-expansion schemes (such as Federal Land Development Agency (FELDA)) for organised oil palm smallholders, mainly in Peninsular Malaysia (Arif and Tengku Mohd Ariff 2001; Dompok 2010).

However, independent smallholders, who represented about 13% of the area under oil palm in 2010 (confined largely to the states of Johor, Perak, Sabah and Selangor), are perceived to be inefficient and unproductive (Rahman *et al.* 2008; MPOB 2010), 'producing barely half the national average' yield (Dompok 2010). Nonetheless, fieldwork in the middle Kinabatangan in November 2005 discovered very different outcomes for smallholders in the main town of Bukit Garam, where several households with access to up to 15 ha of oil palm were reasonably well off and hired Indonesian workers, compared with those in a less accessible village (Sungai Lokan), which was suffering from a shortage of land and encroachment from a nearby estate. Some villagers in Sungai Lokan were earning only the equivalent of a plantation labourer's wage and they were heavily reliant on remittances from family members working elsewhere (Potter 2010). It is assumed that smallholders growing oil palm are more vulnerable to variations in oil palm prices. Yet, when palm oil and rubber dropped to low levels during the world financial crisis of 2008–2009, smallholders received direct government help to compensate for the decrease in their incomes.²

Sabah State has a population of 3.4 million people, of whom 37% are indigenous (Colchester 2010). The majority of the 39 indigenous groups occupy rural areas and depend on subsistence farming and cultivation of cash crops (PACOS 2008). Despite

2 In Sabah, they were offered a cash payment per tonne of CPO produced during the most difficult 3 months of October to December 2008 as part of the Malaysian Economic Stimulus Package 2009–10 (speech by Dato' Sri Mohd Tun Abdul Razak: Supplementary Supply Bill 2009 in the Dewan Rakyat 10 March 2009, *Daily Express*, 13 November 2009). The Minister of Plantation Industries and Commodities in the Federal Government acknowledged that the small landholders, 'living on the fringe of the big boys...do not have the means to go for good agricultural practice and...do not have the money to buy fertiliser' (Dompok 2010).

the increased incomes of some indigenous oil palm smallholders, the Sabah government's policies on oil palm development have resulted in many concerns about land rights. This is due in large part to the wide gap between traditional rights as perceived by the indigenous groups and the concept of 'Native Customary Rights' (NCR) as interpreted by the government.

Protection of NCR is provided through the Sabah Land Ordinance. However, these provisions are weak and at times not complied with (PACOS nd). The Land Ordinance recognises customary land after more than 3 years of occupation, even in the absence of title. Communities, including households and individuals, can make requests for native title. However, in settlement areas, customary owners must register their claims and acquire native title to avoid expropriation (Colchester and Fay 2007). When lands are gazetted as forests, native communities must declare their interests to preserve their usufructuary rights (Colchester and Fay 2007). Sabah's Land Code favours agriculture over other uses and the conversion of forest to permanent cash crops. At least one-third of alienated land must be cultivated within 3 years to prevent it from being reclaimed by the state. Fallow land cannot be claimed as NCR, making it impossible for communities who still practise shifting cultivation to claim customary land (PACOS nd). Despite extensive oil palm expansion in Sabah, indigenous communities remain marginalised (PACOS 2008; Thien 2008). The poverty rate in Sabah is the highest in the country, with 23% of households living below the poverty line (Leete 2008). Poverty occurs mainly in rural areas and has been generally attributed to poor infrastructure and facilities, low education levels, difficult access to markets and services, lack of employment opportunities, geographical barriers and poor resource endowments (IDS Sabah 2009).

3. Background to the case study

The case study was conducted in the Beluran District of the Sandakan Division in Sabah (Figure 1). In 1980, around the time that oil palm was first introduced as an industrial crop in the area, the district had a population of 30 066 (Department of Statistics Malaysia 2010). By 2008, the population had more than tripled to 96 900 (Beluran District

Office 2010). The main ethnic groups in Beluran District are the Kadazandusun, Sungai and Tidong. According to figures from the Department of Agriculture, the area planted with oil palm in the district amounted to 217 949 ha in 2007, equivalent to approximately 28% of the district's land area. The majority of the district's population comprises oil palm smallholders (others are fishers, small-scale traders, plantation workers and civil servants). Oil palm is the main cash crop, followed by rubber, rice and coffee (Beluran District Office 2010).

The plantations that were the object of this research were owned by the Malaysian company PPB (Perlis Plantation Berhad), which was founded as a sugarcane company in 1968 in Perlis (Peninsular Malaysia). The company became involved in oil palm cultivation in 1986, with the establishment of its first plantation in Sarawak. The following year, PPB acquired an interest in Sapi Plantations Sdn Bhd to develop oil palm on 14 200 ha of land near Sandakan, Sabah. Ten years later, the two plantations in Sabah and Sarawak were combined under its subsidiary, PPB Oil Palms (PPB OP) Berhad. In 2007, PPB merged its oil palm plantations and edible oils refining and trading businesses with Wilmar International Limited, one of Asia's largest integrated agribusiness groups and the world's largest biodiesel manufacturer, giving PPB Group an 18.3% equity interest in Wilmar (PBB Group Berhad 2008). As of 31 December 2008, PBB OP Berhad had access to a total of 78 395 ha of land in Sabah and Sarawak, of which 80% was planted with oil palm.³

Situated 105 km from Sandakan town, estates Sapi 1 and Sapi 2, around which the study was conducted, are part of a bigger cluster of contiguous estates (Terusan 1, Terusan 2 and Reka Halus) owned by PPB OP Berhad (Figure 2). Together they comprise slightly more than 20 000 ha, with the two Sapi estates, first established in the mid-1980s, being the oldest of the five. Land titles are for a duration of 99 years, with the majority of titles expiring between 2086 and 2088 (PPB OP 2000). Sapi 1 and Sapi 2 cover 6861 ha, of which 6244 ha are planted with oil palm.⁴ Sapi 1 has already undergone one planting

³ Information about the estate, its history and workings, was provided by the General Manager, Mr Seng Heng Tee, in interviews on 6 and 8 April 2010. This information was complemented with an interview with Ho, R&D Manager, PPB OP Berhad.

⁴ Information from the visitor centre in PBB OP Berhad's office in Sandakan.

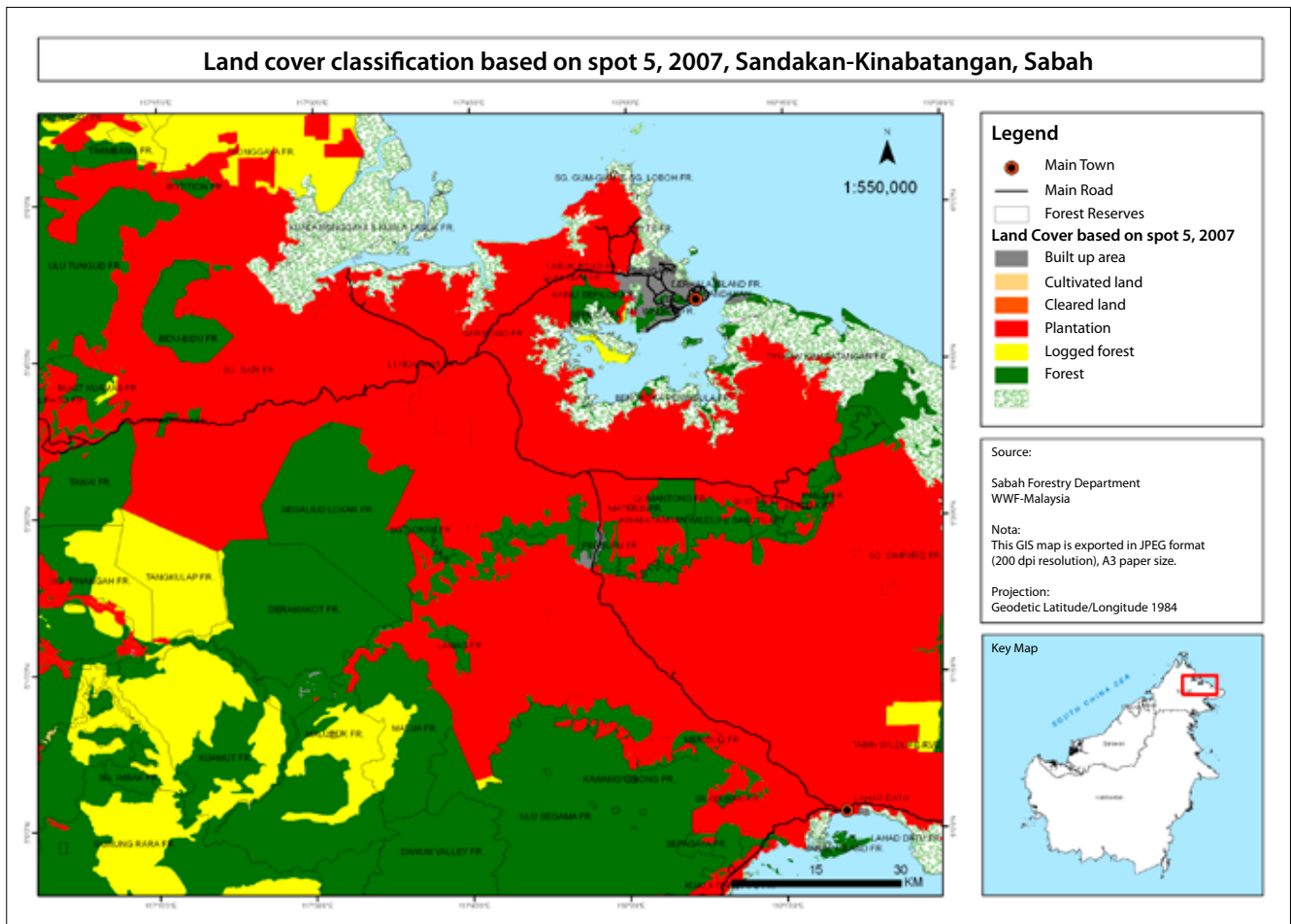


Figure 1. Land-use map of the study area and its surroundings in 2007 (based on information from Sabah Forestry Department, Sabah Land and Survey Department and WWF-Malaysia)

cycle and replanting was completed in 2007. At the time of our survey, parts of Sapi 2 were undergoing replanting. In 2008, the Sapi and Reka Halus estates and mills were awarded certification from the Roundtable on Sustainable Palm Oil (RSPO 2008).

The fresh fruit bunches (FFB) from Sapi 1 and 2 are processed by the Sapi mill, which has a daily capacity to produce 60 tonnes of crude palm oil (CPO).⁵ Over 20% of the FFB that is processed by the Sapi mill comes from independent smallholders in the surrounding area.⁶ This equates to 200–250 smallholders (calculated from data presented in Rahman *et al.* 2008; MPOB 2010). The FFB sold by the smallholders are graded at the mill; the price is based on the advised market price published by

5 The Reka Halus and Terusan estates have their own mills.
 6 Interview with Seng Heng Tee, General Manager Plantation – Sabah, PPB OP Berhad, 6 and 8 April 2010.

the Malaysian Palm Oil Board (MPOB). Although mills are not obliged to adopt this price, it has served to increase market transparency and created uniformity in prices. Smallholders are not bound by any contractual agreement to sell their FFB to any particular mill, but they use the PPB mill because it is the closest to their estates. In 2009, smallholders accounted for 11% of the total area planted with oil palm in Sabah, slightly below the national average of 13% (MPOB 2010). Although a larger area (16%) is cultivated by organised smallholders (through various state and federal schemes), smallholders supplying Sapi are largely unorganised and independent. Although Sapi, therefore, has no contractual commitment to providing inputs, smallholders can at times buy excess oil palm seedlings at a discounted rate from Sapi and compost may be provided free. Nevertheless, seedlings, training and technical assistance are typically obtained from MPOB.

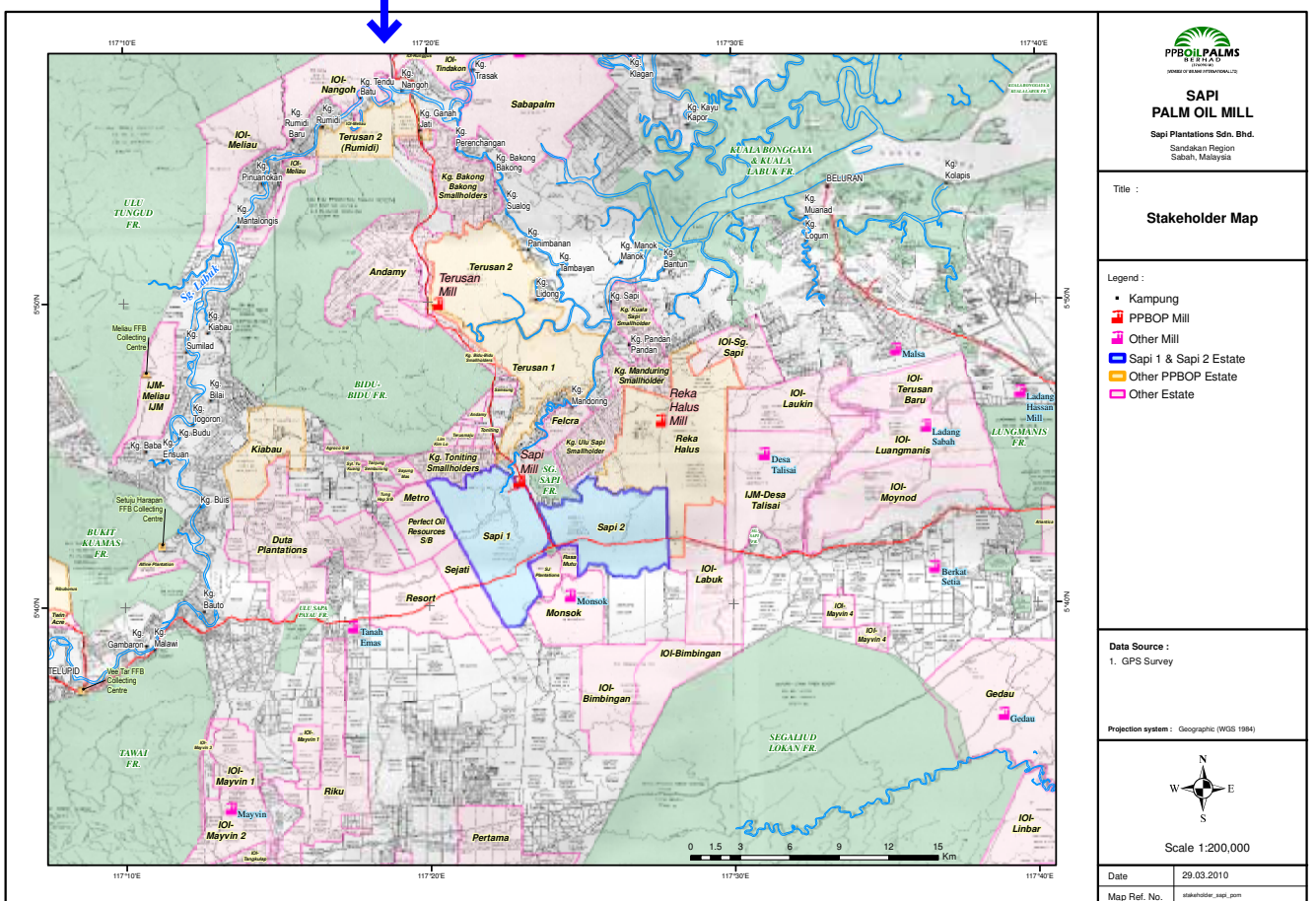
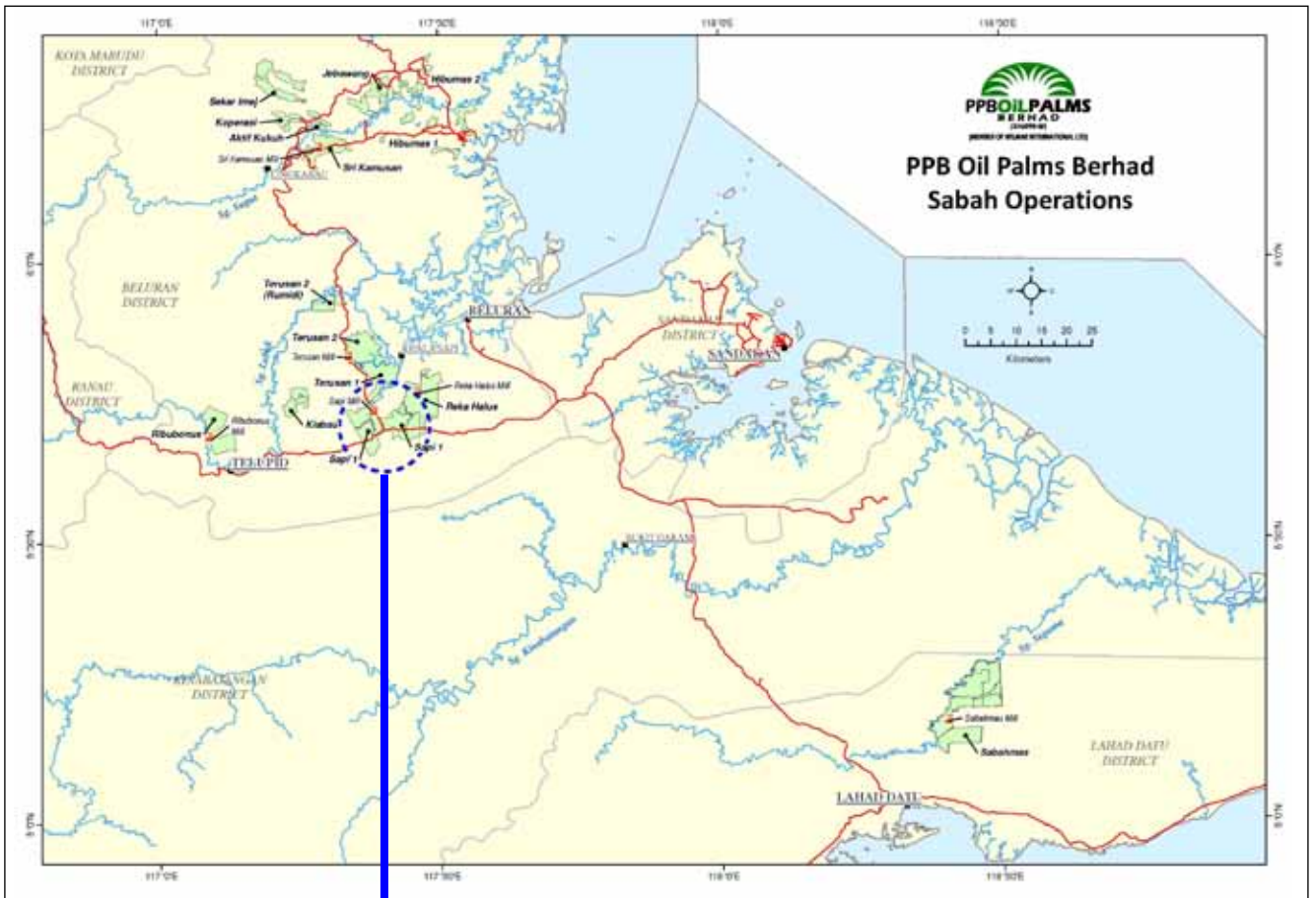


Figure 2. Map of the study site at PPB OP Berhad

4. Methodology

The methodology used for data collection consisted of three basic components: (i) key-informant interviews⁷ with management staff of PPB OP Berhad, relevant local authorities and village heads; (ii) household surveys using structured questionnaires with respondents from identified stakeholder groups, to gather information on impacts, which are largely based on local perceptions; (iii) small focus-group discussions (FGDs) with selected respondents for each stakeholder group; and (iv) remote-sensing analysis to understand the land-cover changes in the concession area. Household surveys were conducted in four villages neighbouring the estates and falling within *Mukim*⁸ Sapi, namely Toniting, Bintang Mas, Ulu Sapi and Lidong. The purpose of the FGDs was to clarify certain issues that were brought up during the interviews, and to complement information obtained through formal questionnaires.

Three stakeholder groups were identified in this study: unskilled workers or employees, independent growers, and affected neighbours. Thirty household surveys were conducted on each group, with questionnaires customised to each of them. Households were selected with help from relevant authorities (e.g., employers and village heads). Respondents from the employee group were unskilled workers from Sapi 1 and Sapi 2 estates who were of Malaysian descent but not customary residents of villages in *Mukim* Sapi. These employees originate mostly from the neighbouring districts and form the bulk of the Malaysian workforce. While more than 80% of the unskilled workforce at Sapi were foreigners (mainly from Indonesia), we focused on Malaysians in order to capture how *local* stakeholders were uniquely affected. All of the workers interviewed lived in the workers' quarters provided by the company.

7 Individuals interviewed: (a) Tee Seng Heng, General Manager Plantation – Sabah, PPB OP Berhad, 6 and 8 April 2010; (b) Henry Dusmin, Manager, IPAS training school, PPB OP Berhad, 6 and 7 April 2010; (c) Philip Ho, R&D Manager, PPB OP Berhad, 8 April 2010; (d) Encik Sampin, Ketua Anak Negeri (Mukim Sapi), Mahkamah Anak Negeri, 8 April 2010; (e) Ensime Mail, Ketua Kampung Toniting, 5 April 2010; (f) Libon Loqun Lokunsing, Pengerusi JKKK (Kg. Ulu Sapi, Kg. Toniting, Kg. Bintang Mas), 5 April 2010; (g) Masli Saratin, Ketua Kampung Lidong, 6 April 2010; (h) Utah Lumah, Pengerusi JKKK (Kg. Lidong), 6 April 2010; and (i) Dr Bilson Kurus, Head of R&D, Palm Oil Industrial Cluster, Sabah, 29 June 2010.

8 A *Mukim* is a cluster of villages.

Respondents from the independent smallholder group that sell their FFB to the Sapi mill are native to the villages of Toniting, Bintang Mas and Ulu Sapi. Respondents from the so-called 'neighbours' group are mainly from Lidong. Being situated along a river, the main economic activity in Lidong has traditionally been, and continues to be, fishing. Although some residents participate in the oil palm sector through employment, this group distinguishes itself from the preceding groups by its continued dependence on predominantly traditional livelihood activities, with employment being a secondary, rather than primary, source of income.

Land-use change analysis was based on Landsat imagery. Three periods were selected, representing: the period prior to oil palm establishment (Landsat 2MSS 1979), the mid-point (Landsat 5TM 1991), and the most recent available data (Landsat 5TM 2005). Landsat data were downloaded from the United States Geological Survey's website (USGS 2011). Excessive cloud cover limited the number of images available for the analysis. The images for 1979 were the first available with low cloud cover before plantation establishment in 1986 (i.e., images for 1980–1985 were too cloud-obscured). Unsupervised classification⁹ combined with visual interpretation was used for land-use classification. The identification of classified land uses was based on available land-use and land-cover maps. Published land-cover maps were used to validate the classification. A land-use map dated 1970¹⁰ was used to interpret the 1979 Landsat data, and a land-use map of 2007 (Figure 1) was used to interpret the 2005 data. Four land-use classes have been identified in the analysis: scrub forests, forests, oil palm and clouds. The next section present the outcomes obtained with land-use change analysis using remote sensing.

This study has some limitations. The first has to do with site and respondent sampling. An analysis based on only one company and 30 respondents for each stakeholder group may not provide comprehensive representation of the current scenario of oil palm development in Sabah. A potential bias existed in

9 Categorization of digital image data by computer processing based solely on the image statistics without availability of training samples or a-priori knowledge of the area (http://www.nrcan.gc.ca/earth-sciences/glossary/index_e.php?id=650).

10 Cf. Land Use Map 1970, Land Use Survey Division, Department of Agriculture, Ministry of Agriculture and Fisheries Malaysia.

the selection of respondents, which ideally should have been random. However, the study team had to rely on the plantation manager to identify and locate some estate workers, and on the village head to access villagers under his charge. Furthermore, due to time and budgetary constraints, questionnaires could not cover all the researchers' information needs (e.g., comprehensive economic data). Thus, while the study successfully identified some of the significant social, economic and environmental impacts of oil palm development in Sabah, it may have missed more complex, sensitive issues, such as the local political climate and its impact on land disbursement, social relations and land conflicts.

5. Findings

5.1 Environmental impacts

Before the land where the Sapi estates are located was converted to oil palm, it consisted predominantly of forest cover. Local stakeholders suggested that much of the area has been logged as a result of commercial logging pressures since the 1950s, yet those impacts are not possible to detect in the satellite imagery. In 1970, most of the area was still covered by forests,

with only small sections converted to oil palm. McMorrow and Mustapa (2001) indicate that the decline of forest cover in Sabah occurred mostly in the 1970s and early 1980s, when forests began to be converted to permanent crops, such as oil palm, rubber, cacao and coconut. It is assumed that the same conversion pattern also occurred in our study area.

The remote-sensing analysis indicated that in 1979 a portion of the plantation area was still under forest, that most of the area was converted to oil palm by 1991, and that the concession area was entirely covered by oil palm in 2005 (Figure 3, Table 1).

It is noteworthy that there are two forest reserves in close proximity to the Sapi plantations and the surrounding villages: the Bidu-Bidu Protection Forest Reserve (FR) (16 094 ha) and the Sapi Virgin Jungle Reserve (VJR) (625 ha) (SFD 2005). Sapi VJR was first gazetted in 1958, but in 1978 a very large proportion of the original forest reserve (35 447 ha) was excised for agriculture, mainly oil palm cultivation (SFD 2005). Now completely surrounded by oil palm plantations, Sapi VJR is a refuge for wildfowl and small mammals like wild boar and monkeys, but is too small to harbour larger

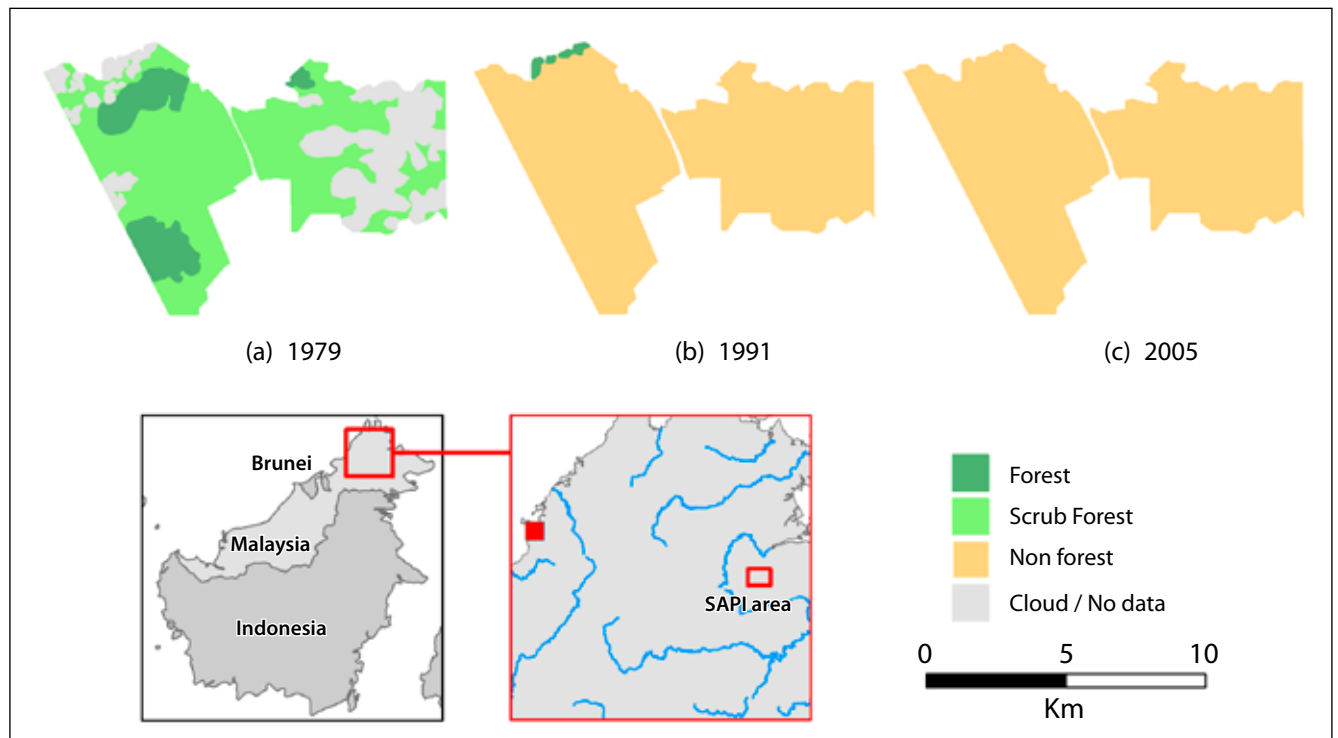


Figure 3. Land-cover analysis using Landsat prior to oil palm plantation development (a), near the mid-point (b), and in the most recently available image (c)

Table 1. Land cover change (in hectares)

Land cover type	1979	1991	2005
Scrub forest	4537.24	n/a	0
Forest	791.78	48.81	0
Oil palm	0	6495.82	6861.00
Cloud	1531.98	316.37	0
Total	6861.00	6861.00	6861.00

Source: Authors' estimates from remote-sensing analysis

mammals (SFD 2005). The forests in the Sapi VJR are now partially degraded and show signs of human disturbance and encroachment due to improved road access (e.g., small-scale tree cutting, illegal hunting for wild boar) (SFD 2005). The forests at Bidu-Bidu FR, in contrast to Sapi VJR, are relatively intact, with sightings of orangutan, sun bear, wild boar, mouse deer and barking deer (SFD 2005). However, the FR has also shown signs of encroachment around its boundaries, which include land clearing for agriculture, illegal logging, and hunting (snares, traps and spent shotgun shells were observed during SFD field surveys) (SFD 2005). During the drought in late 1997 and early 1998, between 10 and 20% of the reserve was damaged by fire, especially along the boundary adjacent to private land and large oil palm plantations (SFD 2005). An aerial survey conducted between 2002 and 2003 showed a 90% decline in orangutan numbers in the reserve over population estimates of the 1980s (based on nest counts). The decline may be due to the conversion of lowland forests surrounding the reserve to oil palm, as well hunting pressure (SFD 2005).

According to respondents, it is clear that the perceived environmental impacts of oil palm vary according to the location and level of dependency on natural resources by the different stakeholder groups (Table 2). For example, a larger percentage of unskilled workers and independent growers identified air pollution as a problem, which may be attributed to their close proximity to the Sapi mill. Respondents from Lidong (affected neighbours) were more cognizant of water quality changes due to their dependence on the river and aquatic resources for their livelihoods and domestic water consumption. Larger numbers of unskilled workers and independent growers' households have access to piped water, which is likely to account for

their lower concern about water quality. Despite this, independent growers did provide a host of observations about negative changes in water quantity and quality. These included loss of potability of the river water due to pollution (illustrated by the water turning blackish as a result of effluent discharge from the various mills in the area), and erosion of the river banks, resulting in decreasing water depth. Others stated that the river surface looked oily and cited dead fish floating in the river. Some respondents noted that logging in upstream areas could also have contributed to worsening water quality.

While significant numbers of respondents in all groups identified deforestation as an issue of concern, a larger number of respondents from the affected neighbours group identified this as a change, reflecting their high dependency on forest resources. Long-term residents remarked that, in the past, the landscape was mainly made up of rice and thick forest. However, everything now has been converted to oil palm except for areas set aside as forest reserves. As a result, respondents noted that they can no longer hunt or collect wild fruits, and are forced to encroach on surrounding forest reserves, confirming observations from the SFD survey and illustrating drivers of indirect land-use change from oil palm cultivation.

5.2 Socio-economic impacts

Unskilled employees

Employee respondents were aged 18 to 48 years, with 80% of households having two or more working adults. The majority of respondents (53.3%) had no formal education, and many were relatively new to the area, with 67% having been with the company for five or fewer years. New opportunities for formal employment attracted these migrants to the area, most of whom originated from other districts in Sandakan Division. Of the interviewed employees, 53% were subsistence farmers prior to their employment at the plantation; the remainder were typically unskilled waged labourers or housewives. In 83.3% of these households, these activities ceased when they entered employment at the plantation. With most Malaysians observed to be reluctant to work in oil palm plantations due to tough working conditions and poor wages, those that do actively seek employment generally originate from

Table 2. Perceived environmental impacts of oil palm plantations among local stakeholders

Environmental impact	Employees (n=30)			Independent growers (n=30)			Affected neighbours (n=30)		
	No change (%)	Moderate change (%)	Significant change (%)	No change (%)	Moderate change (%)	Significant change (%)	No change (%)	Moderate change (%)	Significant change (%)
Decreased water quality	53.3	26.7	20.0	10.0	26.7	63.3	0	16.7	83.3
Decreased water quantity	73.4	23.3	3.3	20.0	40.0	40.0	46.7	40.0	13.3
Decreased forest cover	50.0	13.3	36.7	26.6	46.7	26.7	16.7	53.3	30.0
Increase in crop pests	50.0	26.7	23.3	63.4	33.3	3.3	63.4	33.3	3.3
Air pollution	30.0	53.3	16.7	20.0	30.0	50.0	86.7	13.3	0
Soil erosion	80.0	10.0	10.0	73.4	23.3	3.3	30.0	60.0	10.0
Soil stabilisation	76.7	20.0	3.3	93.3	6.7	0	66.7	33.3	0
Increase in human disease	90.0	6.7	3.3	43.3	36.7	20.0	70.0	30.0	0
Increase in human-wildlife conflict	93.4	3.3	3.3	80.0	16.7	3.3	96.7	3.3	0
Increase in temperature	83.3	0	16.7	96.7	0	3.3	0	16.7	83.3

comparatively poor and remote areas where there are few opportunities for formal employment.

The Sapi plantation has its own in-house training centre for recent graduates and school leavers. Trainees are given classes and on-the-job training to equip them with the relevant skills and to familiarise them with all aspects of plantation work. In addition to free food and accommodation, Executive Trainees, typically university graduates taking on managerial duties, are given a monthly allowance of RM 1000 (USD 307.70) and Non-Executive Trainees, typically unskilled manual labourers, a monthly allowance of RM 500 (USD 153.85). Successful trainees are offered jobs at plantations owned by PPB OP. Unskilled workers (fruit pickers, harvesters, pesticide sprayers, etc.) are generally paid a base daily rate of RM 14 (USD 4.31). Their final salary, which averages about RM 500 per month (USD 153.85), also includes a performance-based pay component. For example, for a fruit picker this component is based on the weight of fruit collected per day, whereas for a pesticide sprayer this is based on area sprayed. In order to encourage high work attendance, a bonus of RM 34 (USD 10.46) is given to those who have worked at least 22 days in a month.¹¹

As part of efforts to improve the social welfare of workers and their families, Wilmar approached the Borneo Child Aid Society¹² in 2006 to set up a school (known as Humana schools) in one of Wilmar's plantations in Sabah as a pilot (Wilmar 2009). Wilmar started its first Humana school in 2007.¹³ It met with such success that by 2010, the group planned to operate 15 schools capable of educating more than 1200 children throughout their plantations in east Malaysia. Wilmar pays for all the costs associated with the running of the schools (Wilmar 2009). PPB OP has one school located at the Terusan estates, which children of the Sapi estate workers attend.

¹¹ Interview with Henry Dusmin, Manager, IPAS training school, PPB OP Berhad, 6 and 7 April 2010.

¹² The Borneo Child Aid Society (also known as Humana) is a social NGO that was set up in 1991 to provide basic education to plantation children of Indonesian or Filipino descent in the remote parts of Borneo. Humana schools normally cater for children aged from 5 to 12 years.

¹³ During the site visit, the survey team visited the Humana school at the Terusan Estate.

The main livelihood impacts for the surveyed employees were predominantly related to increased income and improved living conditions (Table 3). All employees are provided with free housing, treated water supply, electricity, medical and personal accident insurance, and basic amenities within the plantation complex, with the type of housing depending on the grade of the employee. A clinic at the estate provides basic healthcare, while more serious medical cases are referred to a local hospital and paid for by company insurance.¹⁴ With education provided to the children of Malaysian employees, improved access to schooling was also considered to have contributed to improving livelihood quality. As a result of these perceived benefits, 76.7% of respondents felt that their employment with the company had brought about an overall positive change to their livelihoods.

Working in the plantation has also brought about negative impacts: with more adults working full-time at plantations, 30% of respondents felt the burden of household chores had increased significantly, falling on those who remain at home, typically women and children. Some of these chores included cooking, taking care of children, cleaning, and managing the household. Another such impact, cited by 17% of respondents, was the increase in daily expenses due to the decline in farm produce that once used to provide their daily food needs, decreasing their food security. Increased incomes have also generated demand for more material goods, influencing spending patterns. Despite these drawbacks, only one respondent considered employment to have had a net negative livelihood impact.

Participants in FGDs did not feel that there were social tensions between the different ethnic groups working in the plantations, but remarked on some tension between workers and supervisors on work-related matters (e.g., the scheduling of work hours). Although the workforce is comprised largely of Indonesians, there was no evidence of conflict or competition with Malaysian employees.

Independent growers (smallholders)

The largest numbers of smallholder oil palm farmers supplying the Sapi mill are resident in Toniting, Bintang Mas and Ulu Sapi. These villages are

¹⁴ Interview with Henry Dusmin, Manager, IPAS training school, PPB OP Berhad, 6 and 7 April 2010.

Table 3. Reasons for perceived livelihood impacts among employees

Rank	Indicator	Percentage of respondents mentioning the impact (n=30)
Positive impacts		
1	Increased income	90.0
2	More steady or reliable income	40.0
3	Education	33.3
4	Better access to transport services	26.7
5	Health facilities	23.3
6	Accommodation	20.0
Negative impacts		
1	Increased labour burden on unemployed household members	30.0
2	Insecure income flows due to lower wages than initially expected	20.0
3	Increase in food insecurity relative to position before employment	16.7
4	Increase in daily expenditure	16.7

comparatively new, having been established when commercial logging activities commenced in the area in the 1950s. Villages and their farms were at that time typically established in areas that were cleared by the logging companies. Although traditional land uses (e.g., forestry) were displaced when much of the area was formally excised for agriculture, sufficient land remained accessible to continue with agricultural livelihood activities and transition to oil palm cultivation when mills were established in the area. Households in these villages were quick to recognise the economic potential of oil palm cultivation, with the majority of households in these villages now cultivating oil palm and supplying FFB to the Sapi mill.

The average age of the respondents' oil palm plantations was 20 years, with the majority of respondents (53.3%) having cultivated oil palm before 1991. The oldest planting dates back to 1980 and the most recent to 1999. The average plantation size is 3.59 ha, with the total area under oil palm cultivation ranging from 1 to 11 ha per household. This average is lower than the typical size of smallholder oil palm plantations in Sabah, which, according to MPOB data, averaged 6.77 ha in 2007 (cited in Rahman *et al.* 2008).

Eighty per cent of the plots under oil palm cultivation were titled in the name of the cultivator. Without this security of tenure, few smallholders

would take the risk of shifting from subsistence agriculture to high-input perennial crop cultivation such as oil palm. About 33.3% of the respondents cultivate oil palm within village boundaries, with the rest planting it on land in neighbouring villages. Land from other villages was typically awarded to land applicants provided that it was available and there were no other claims or applications. At times, plots in neighbouring villages are also inherited (e.g., from the spouse's family) or applied for under the names of siblings. Some respondents considered plots under the names of family members or in-laws as their land, as they were the ones managing them.

For all the respondents, the primary source of income was oil palm cultivation, with a small group also involved in other activities such as watermelon cultivation (Table 4). Most traditional livelihood

Table 4. Types of income stream among independent growers

Rank	Income stream	Percentage of respondents involved (n=30)
1	Palm oil	66.7
2	Palm oil and watermelon	26.7
3	Palm oil and other fruits	3.3
4	Palm oil and livestock	3.3

activities for the oil palm smallholders – primarily rice cultivation and fishing – have ceased since the adoption of oil palm, with 66.7% of the respondents claiming that oil palm is now their only notable source of income. According to respondents, the primary reasons for shifting from traditional livelihood activities to oil palm cultivation were higher returns for oil palm due to perceived high prices (43.3%) and perceived ease of managing oil palm plantations (30%).

The main livelihood impacts for small-scale growers were related to higher incomes from oil palm *vis-à-vis* traditional revenue streams. On the basis of production costs and average yield data for independent smallholders in Malaysia (from Rahman *et al.* 2008) and a typical FFB price range in 2011 of RM 600 to 800 per tonne (from MPOB 2011), the average respondent supplying the Sapi mill in 2011 was likely to be making a profit in the order of USD 9700 to 14 100.¹⁵ In 2011, average smallholder income was likely to be at least 50% more than the average GDP per capita in Malaysia in 2009 (which was USD 7350; World Bank 2011). However, with the CPO market being highly volatile, FFB prices are unstable. At the time of writing, FFB prices were comparatively high, so these figures are not illustrative of long-term financial gains. In 2006, for example, average FFB prices were approximately RM 260 per tonne. Such FFB prices would have translated into a net annual profit for the average respondent in 2006 of approximately USD 1090. This high variability in income illustrates that, in addition to the high potential profitability of oil palm cultivation, it can also create high instability.

From the FGDs, respondents remarked that males now have more time on their hands, as the time spent tending to their oil palm estates is flexible. This is because the more established growers can afford to hire foreign workers to carry out plantation work, leaving them and their household members with more time to venture into other small business activities such as catering and selling basic foodstuffs. In comparison, when they were involved in rice planting and fishing, they had to carry out these activities on their own because those were largely

small-scale subsistence activities, and did not generate enough income to hire external labour. The respondents were also no longer bound to work at specific times of the year compared to when they used to fish or farm rice. While high dependency on a single source of income could create high exposure to shocks (as illustrated above), there was little evidence that this high dependency had negative impacts on the household, illustrating perhaps the prudent use of income and savings to protect against the impact of poor market conditions. While all respondents are supplying their FFB to a single mill, there was little evidence that high dependency on a single marketing channel and the absence of a contractual relationship had subjected the smallholders to exploitation. Presumably, since numerous mills operate in the area, mills tend towards standardised market prices (e.g., the MPOB FFB reference price). All in all, few negative impacts of shifting to oil palm cultivation were observed in this case study.

Affected neighbours

The village of Lidong was established in the area long before the introduction of commercial logging. It used to be a remote fishing community, practising traditional subsistence activities such as fishing, hunting and gathering, and small-scale cultivation of predominantly rice for household consumption. Fishing in particular used to be and continues to be the most important livelihood activity, and the primary source of cash income for a portion of the community. However, as land was gradually converted to oil palm, most of the land-based resources that also formed an integral component of village livelihoods were lost. The village is now sandwiched between the main river and the Terusan 2 estate (Figure 1).

Seventy-seven per cent of respondents said that their families were not consulted ahead of time about the establishment of the plantation in their area. Those who were consulted (in fact, only 'notified') said that they were given letters of notice from the village head. Respondents who were not notified indicated that they had no land titles despite their customary use of the land, and claimed that the oil palm was planted without their prior knowledge. This is not unusual, as all land belongs to the state, unless privately owned or formally recognised as native customary land. Without formal land titles, native claims are not legally recognised.

¹⁵ According to Rahman *et al.* (2008), the average cost of production for independent smallholders in Malaysia amounts to RM 165 per tonne of FFB produced. The average yield from independent smallholders is estimated by the same authors at 18.8 t/ha per year.

The main negative impacts from the introduction of commercial oil palm cultivation in the area over the last 25 years relate primarily, in order of significance, to a drop in fish stocks, loss of access to forest resources, and loss of cropland (Table 5). Since for most respondents fishing continues to be the key component of their livelihood portfolio, reduction in fish stocks over recent decades has led to substantial economic losses. River pollution (as mentioned under 'Environmental impacts' above) was said to have been the primary factor affecting fish populations and reducing their catch rate. Some households indicated that they have to venture further afield to coastal areas to fish, increasing the labour burden. Furthermore, the loss of forest cover has led to a decrease in hunting activities among villagers, as they now have to travel further and deeper into the forests to find game such as wild boar and deer. Deforestation has also impacted on the availability of non-timber forest products, such as wild fruits, rattan and traditional herbs. As they no longer own land for agricultural use, households have become more reliant on natural-resource-based activities (e.g., hunting, collecting and fishing), making deforestation and declines in water quality more keenly felt by this group. Reduced access to and availability of these natural resources has, according

to respondents, changed their traditional food consumption patterns – they now purchase more food items than in the past.

From the FBDs, it was also noted that the burden of household chores had increased for women, particularly the task of collecting water. Since the river has become more polluted and less suitable for drinking, women have to rely on the availability of rainwater to perform their household chores. While in the past, villagers could bathe and wash by the river, they now have to collect the rainwater in tanks and ration supply. This is more time consuming and tedious, especially for women. Men have less time to help around the house due to the increase in labour burden. Loss of readily available natural resources has also created a situation in some households where women go out to work as well as perform most of the household chores.

Despite these negative impacts, respondents in this group also noted a number of positive impacts from the establishment and expansion of oil palm plantations in the area. These relate in particular to improved road access and increased job opportunities. Now, at least 30% of the respondents have household members, particularly the young adults, working as unskilled labourers on the plantations. For these households, employment, while not forming the basis of their livelihoods, has in part compensated for losses in access to traditional livelihood resources. With new roads in the area, villagers no longer need to depend on the river as the main access route. This has enabled them to market their fish and crops in nearby towns and has improved social networks with neighbouring villages. The village children are also able to travel by road to the nearby school, thus eliminating the need for them to attend boarding school or travel many hours by boat.

Although larger proportions of the village could in theory obtain plantation employment, it was observed that many households were resistant to formal employment. It was argued that employment would reduce their 'independence' and consume too much time, which would require them to significantly reduce or abandon traditional livelihood activities altogether. This reluctance, however, did not appear to translate to oil palm cultivation. As they have witnessed the substantial economic benefits

Table 5. Most common factors impacting on livelihoods of respondent affected neighbours

Rank	Livelihood indicator	Percentage of respondents (n=30)
1	Reduced fish stocks due to water pollution	96.7
2	Reduced access to forest resources	83.3
3	Improvement in road infrastructure	66.7
4	Increased opportunities for formal employment	56.7
5	Loss of primary crop land	53.3
6	Increased incidence of human or crop pests and diseases	30.0
7	Improvement in household income	30.0
8	Loss of customary access to water resources	20.0
9	Increase in social conflict	3.3

accruing to neighbouring villages involved in the industry, they have been increasingly interested in cultivating oil palm. However, land constraints have undermined their capacity to diversify into oil palm cultivation. Nevertheless, a number of respondents indicated that they had made applications for land titles in other villages, though it was unclear how many of these applications had actually been approved. The land title application can be a long process and the outcome is often influenced by local politics.

6. Discussion

Oil palm development has brought significant impacts, according to respondents, to different stakeholder groups. The impacts felt by the respondents depend on the location of their villages and the extent to which they are dependent on natural resources. Generally, oil palm has brought positive impacts, such as increased income, secure employment, and improved access to social services. However, involvement in oil palm has also caused many local communities to move away from traditional practices.

The independent growers in particular have been willing to forgo their traditional way of life, including dependence on ecosystem services such as river water quality and natural forest products, in return for substantial economic returns from oil palm cultivation. Before the advent of oil palm, living conditions were very poor and this was another motivation for venturing into oil palm. Nevertheless, long-established communities have shown greater resistance to foregoing traditional practices (and thereby their culture) for stable income from employment. While these communities are receptive to oil palm cultivation, their capacity to embrace these opportunities is limited by land constraints arising from land-use change and lack of tenure security.

In incidences where respondents lost access to primary crop land and forests due to land alienation and oil palm plantation establishment, they appeared resigned to the fact that they had no formal claims to these lands in the first place despite the far-reaching consequences of land loss to their livelihoods. This could explain why the respondents interviewed did not show any resentment when they were not

consulted over the allocation of land by the state to plantation companies.

Although the study does show the negative impact of oil palm cultivation on the environment and the consequent negative impact on natural-resources-dependent (especially indigenous) communities, it also reinforces some of the existing literature that oil palm development plays a significant role in alleviating poverty and providing a better standard of living to many rural communities. However, it appears that processes of inclusion and exclusion from this development depend first and foremost on the extent of community land loss and, therefore, their ability to adopt oil palm cultivation as a new livelihood strategy. There do not appear to be many viable alternative livelihood pathways besides the oil palm sector for these impacted communities.

While some of the negative impacts of oil palm that have been reported elsewhere in the literature were not observed in this study – such as conflicts between local and migrant workers and disputes over the loss of customary lands (e.g., Wakker 2005; SUHAKAM 2006; Tan 2008) – it cannot be concluded that they do not exist. There are local NGOs that assist communities in fighting for their rights over ownership of their traditional lands. It is noteworthy that an increasing number of cases have been brought to court by local communities to seek legal recourse on lands that have been unfairly and illegally taken from them (IWGIA 2002; Thien 2008; Then 2009; Anon. 2010). Despite land conflicts being a long-standing problem and land tenure laws being criticised for being opaque and unclear, the issues have not yet been resolved (Toh and Grace 2006).

7. Conclusion

This paper assesses the social, economic and environmental impacts arising from oil palm cultivation in Malaysia in order to draw lessons for an incipient biofuel sector. Key-informant interviews, household surveys and focus-group discussions with various local stakeholders point to largely positive impacts from oil palm on local livelihoods, particularly independent oil palm growers and migrant employees. Despite this perceived positive outlook, adverse impacts on the environment, such as deforestation and river pollution, were shown to be a concern among those who continue to

rely on traditional land-use activities or depend on the river for household uses – illustrating high variability of impacts among stakeholder groups. The findings of this study are limited to the land-use history, governance context and socioeconomic characteristic of the research site and may not reflect socioeconomic impacts occurring elsewhere in Sabah, and in other parts of Malaysia. This study is also limited in scope and depth with regards to issues relating to land tenure and ownership, as well as quantitative socioeconomic comparisons before and after oil palm cultivation. Nevertheless, the preliminary findings highlight some room for improvement in both social and environmental practices of large-scale oil palm estates in particular.

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This paper seeks to deepen our understanding of the potential future local impacts of expanding oil palm production for biodiesel production by drawing lessons from Malaysia's experience. This analysis is based on a case study exploring local perceptions of impacts of oil palm development on the environment and local livelihoods in the Beluran District of Sabah State. Findings suggest that smallholder cultivation of oil palm constitutes an important alternative to customary livelihood activities and that plantation employment offers new livelihood opportunities to disadvantaged groups. However, this does come at the expense of environmental degradation and loss of traditional subsistence activities such as fishing and rice farming.

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