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Environmental sustainability of oil palm cultivation in Papua New Guinea

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Paul N. Nelson, Michael J. Webb, Ian Orrell, Harm van Rees, Murom Banabas, Suzanne Berthelsen, Marcus Sheaves, Felix Bakani, Otto Pukam, Michael Hoare, William Griffiths, Graham King, Peter Carberry, Rachel Pipai, Ann McNeill, Petra Meekers, Simon Lord, James Butler, Tony Pattison, John Armour and Charles Dewhurst

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Cover: Hoskins (West New Britain) smallholders with harvested oil palm fruit (Photo: Richard Dellman)

Foreword

Papua New Guinea (PNG) is one of the most culturally and geographically diverse countries, and also one of the most rural. More than 80% of its 6.7 million people live outside urban centres and depend on subsistence agriculture for their livelihoods. Along with food crops, cash crops are a crucial part of the economy, generating virtually all of the country's non-mining income and supporting rural communities throughout the country. Of all the crops grown in PNG, oil palm is the most important in terms of export income; palm oil exports earned more than 1,000 million kina in 2008, considerably more than coffee, cocoa and all other agricultural exports.

The PNG oil palm industry is small by international standards (about 130,000 hectares and 1% of global production), but is very important for the country, underpinning the economies of the provinces where it is mostly grown: West New Britain, Oro, Milne Bay and New Ireland. More than 18,000 smallholder growers and two companies cultivate oil palm, which grows well in the coastal lowlands of PNG. Smallholder growers cultivate 45% of the area under oil palm and produce 32% of the fruit. The two plantation companies mill all the fruit, extracting palm oil and selling it, mostly to Europe. An estimated 200,000 people live in households that depend on oil palm as their principal source of income. It is vital for the future livelihoods of these people, and for others living in surrounding areas, that the crop is grown in a way that maintains the ecological integrity of the land and surrounding ecosystems.

As for any crop, poor management of oil palm can damage the environment. Both producers and consumers need to be confident that production is not causing environmental harm. To avoid environmental degradation, vulnerabilities and risks for the environment must be identified, and growers must work to minimise or eliminate those risks.

The Australian Centre for International Agricultural Research (ACIAR) supported a project aimed at identifying the main issues relating to environmental sustainability of oil palm cultivation in PNG, with particular reference to smallholder farms. The study resulted in recommendations for maintaining and improving environmental sustainability. The results of the study, including challenges that were identified for research and implementation, are presented in this report. It is hoped that the recommendations will lead to increased productivity and sustainability of this important tree crop.

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Abbreviations

ACIAR	Australian Centre for International Agricultural Research	$mmol_c$	millimoles of charge
CEC	cation exchange capacity	NAAR	net acid addition rate
EFB	empty fruit bunches	NBPOL	New Britain Palm Oil Limited
FFB	fresh fruit bunches	NGO	non-government organisation
ha	hectare	OPIC	Oil Palm Industry Corporation (of PNG)
HCVF	high conservation value forest	pHBC	pH buffering capacity
HOPL	Hargy Oil Palms Limited	PNG	Papua New Guinea
ISO	International Organization for Standardization	PNGOPRA	PNG Oil Palm Research Association
		RSPO	Roundtable on Sustainable Palm Oil
$kmol_c$	kilomoles of charge	t	tonne
kg	kilogram	WWF	World Wide Fund for Nature
m	metre		

Summary

Papua New Guinea's oil palm industry is the country's largest agricultural export earner. Oil palm is grown on about 130,000 hectares by more than 18,000 smallholder growers supporting an estimated 200,000 people, and by two companies. Environmental sustainability of the industry is increasingly coming under scrutiny by growers, palm oil purchasers and various interest groups in Papua New Guinea and worldwide. The oil palm industry and the high population associated with it both have an impact on the land used for oil palm, as well as on surrounding ecosystems.

This report focuses on the effects of oil palm cultivation on soil, water and the atmosphere. For nutrient balances to be sustainable, inputs and losses should be balanced and minimised. Nutrient cycling factors that are difficult to estimate include loss of nitrogen by leaching (the main factor of concern), gaseous losses of nitrogen and biological nitrogen fixation. The carbon balance is generally favourable, except for large losses of carbon dioxide during initial plantation establishment (where oil palm replaces forest) and probably also during replanting. Net soil erosion from fields appears to be generally small, except for bare connected areas on moderate slopes and some in-field roads. Health of soil is influenced by net acid addition rate (largely related to fertiliser use), return of organic residues and traffic. Health of aquatic ecosystems may be affected by nitrogen inputs leached from fields and poor riparian vegetation. There is limited availability of data that are specifically relevant to these environmental sustainability issues in Papua New Guinea.

The Papua New Guinean oil palm industry has committed itself to certification of environmental stewardship, particularly through the Roundtable on Sustainable Palm Oil. There is thus a need for practical and meaningful indicators of environmental sustainability that are based on a clear understanding of the oil palm agroecosystem, to underpin certification and to guide improvements in management.

Introduction

Background and aim

Oil palm (*Elaeis guineensis*) is an important crop in the global production of vegetable oil (contributing about 30% of vegetable oil) and in the economic development of tropical countries. Indonesia and Malaysia grow the vast majority of oil palm, but other tropical countries also have significant oil palm industries. In Papua New Guinea (PNG), the palm oil industry drives the cash economies of the four main provinces in which oil palm is grown and earns the greatest export income. Export earnings from palm oil overtook those from coffee in 2001, and were more than 1,000 million kina in 2008. Because oil palm is likely to remain an important crop for PNG, sustainability of its cultivation is imperative for ongoing productivity and income generation.

Expansion of the area under oil palm and other crops, along with associated logging, has been identified as a major driver of forest destruction in the tropics globally in recent times and into the future (Fitzherbert et al. 2008; Koh and Wilcove 2008; Butler and Laurence 2009). In many cases this expansion is into areas with high conservation values, rather than into heavily logged or otherwise degraded areas. There are still large areas of forest left in the tropics, but they are being lost at an unprecedented and alarmingly rapid rate. Deciding how much forest we want to retain, where it should be, and how the owners can be compensated if they wish to clear it are critical issues for PNG and throughout the tropics.

This review takes the position that agriculture is necessary and desirable in the tropics, but that the area, location and type of land devoted to agriculture and the management of that land are all important and negotiable factors. Furthermore, it is important for conservation (by reducing pressure to expand plantings), sustainability and rural livelihoods that the productivity of existing plantings, especially smallholder blocks, are maximised. There is active work in PNG to improve oil palm yields, and those of smallholder growers in particular. However, the important issues of planning, biodiversity conservation and intensification of oil palm production are beyond the scope of this report. This report concentrates on the sustainability of oil palm cultivation; its effects on soil, water and the atmosphere in-field and in the surrounding environment; and the ability of the land to sustain biological productivity into the future. The focus is on PNG, which differs from the main oil palm growing areas in Indonesia and Malaysia in several ways.

The aim of this report is to identify and describe the main issues relating to environmental sustainability of oil palm cultivation in PNG, with particular reference to smallholder farms. The content is mainly drawn from presentations and discussions in a workshop held at Walindi in West New Britain in February 2009.

The palm oil industry in Papua New Guinea

Overview

Palm oil, which is extracted from oil palm fruit, is produced in several forms. Oil palms produce fruitlets in bunches (fresh fruit bunches, FFB), which are cut from the palm when ripe and taken to a mill for extraction of the oil. Oil extracted from the mesocarp, termed crude palm oil, is the main product that is sold and traded. It makes up approximately 22% of the FFB mass. Oil extracted from the kernel, termed palm kernel oil, makes up approximately 5% of the FFB mass. Crude palm oil and palm kernel oil are further processed in refineries for use in various products. By-products of oil extraction include ‘palm kernel expeller’, which is sold for stock feed; fibre and kernel shell, which are used to fuel the mills; empty fruit bunches (EFB), which are applied back to the field directly or via compost; and palm oil mill effluent, which is applied back to the field or treated in effluent ponds.

Currently, about 130,000 hectares (ha) are under oil palm cultivation in PNG, mostly in West New

Britain province, followed by Oro province, Milne Bay province, New Ireland province and Morobe/ Madang provinces (Table 1). In PNG, all oil palm is grown either by the companies New Britain Palm Oil Limited (NBPOL) and Hargy Oil Palms Limited (HOPL), or by smallholders. NBPOL recently (April 2010) purchased CTP Holdings, which had operated several plantations and mills until then (Table 1). There are currently 12 palm oil mills in the country, all owned by NBPOL and HOPL. The smallholders, numbering 18,313 in December 2009, own oil palm blocks that are usually 2–6 ha in size. About 45% of the area under oil palm plantations is in smallholder blocks, but these produce only about 32% of PNG's palm oil. The total area under oil palm in PNG increased from approximately 112,000 ha in 2002 to about 130,000 ha in 2009, and the total FFB production increased from 1,597,498 tonne (t) in 2002 to 2,438,190 t in 2009.

It is worth noting that, in addition to the areas described above, there has recently been a rapid expansion in projects proposing oil palm developments using 'special agricultural and business leases' on large tracts of tropical forest throughout PNG. These projects are accompanied by applications for forest clearance authority that permit the commercial sale of the timber cleared for the proposed agricultural development. There is considerable concern among the country's actual palm oil producers that these developments are little more than a means of accessing saleable timber resources in the name of agricultural (oil palm) development. There is little evidence that these proposals will lead to viable palm oil production. Current indications are that there is in excess of one million ha under such leases. These projects are not discussed further in this report.

Most oil palm in PNG is planted on coastal plains with a lowland humid climate and annual mean rainfall between 2,200 mm and 3,500 mm. A high proportion (77%) is grown in West New Britain and Oro provinces on relatively coarse-textured, free-draining soils that are formed on ash, alluvium or colluvium of recent volcanic origin. These areas are highly suited to oil palm production and can produce some of the highest oil palm yields in the world.

Although the development of PNG's oil palm industry was initiated in areas of relatively low population, the subsequent economic development in these areas has led to a significant increase in population, and currently an estimated 200,000 people live in households that depend on oil palm as their principal source of income. The increased population pressure has significant impacts on the environment, particularly through conversion of forested areas to gardens, and increased fishing.

In 2008, Malaysia and Indonesia produced 87% of the world's palm oil; PNG ranks sixth in palm oil

Table 1. Oil palm area and production for Papua New Guinea, 2009

Province	Company[a]	Plantation[a]	Smallholder	Total
Area estimates (hectares)				
Milne Bay	Milne Bay Estates[b]	11,629	1,699	13,328
Morobe and Madang	Ramu Agri-industries[c]	7,668	260	7,928
New Ireland	Poliamba Estates[b]	5,689	2,613	8,302
Oro	Higaturu Oil Palms[b]	8,994	14,285	23,279
West New Britain	Hargy Oil Palms	9,906	13,163	23,069
West New Britain	New Britain Palm Oil	32,228	21,902	54,130
TOTAL		76,114	53,922	130,036
Fresh fruit bunch production estimates (tonnes)				
Milne Bay	Milne Bay Estates[b]	210,711	10,536	221,247
Morobe and Madang	Ramu Agri-industries[c]	56,072	124	56,196
New Ireland	Poliamba Estates[b]	108,440	16,203	124,643
Oro	Higaturu Oil Palms[b]	196,679	131,481	328,160
West New Britain	Hargy Oil Palms	211,416	200,699	412,115
West New Britain	New Britain Palm Oil	876,497	419,332	1,295,829
TOTAL		1,659,815	778,375	2,438,190

[a] Companies own the mills and 'plantation'
[b] Owned by CTP Holdings until April 2010, and thereafter by New Britain Palm Oil Limited
[c] Owned by New Britain Palm Oil Limited

production, representing about 1% of global production.

The first observational plantings of oil palm in PNG occurred in the 1920s. Commercial development did not begin until 1967, with the establishment of the Hoskins oil palm project in West New Britain province. This development was a joint venture between the private sector and government, and was set up using a nucleus estate and smallholder model. The company behind this initial development is now known as New Britain Palm Oil Limited. Further commercial oil palm developments followed in 1969 in Bialla (West New Britain province) and in 1976 in Popondetta (Oro province), both following the nucleus estate and smallholder model. All three developments included a land settlement program to initiate the smallholder production base. In the 1980s, the Commonwealth Development Corporation followed its Popondetta development with new projects in Milne Bay province (1985) and New Ireland province (1987). In 2006, Ramu Agri-Industries established new oil palm plantings in the Ramu Valley (Madang province) by converting some of its existing pastoral land.

Since the mid 1980s, the continuing growth of oil palm plantations in PNG has been through the expansion of existing projects, except for the Ramu Valley project. Much of the plantation expansion has been on customary-owned land and implemented using a lease/lease-back arrangement, whereby customary land owners form Incorporated Land Groups, register their land for development and lease the land to the government. The government in turn leases the land back to the oil palm company to develop and manage. The landowners and Incorporated Land Groups receive revenue from the development through rentals and royalties. The lease period is typically one or two crop cycles (20 or 40 years). At the end of the lease, the landowners can choose to either take back their land with all established infrastructure or renew the lease arrangement.

In 2008, exports of oil palm product exceeded 1,080 million kina. In contrast, PNG's next largest agricultural exports were coffee (520.2 million kina) and cocoa (345.6 million kina). The principal oil palm exports are crude palm oil and palm kernel oil. In 2004, NBPOL established a palm oil refinery in West New Britain that processes about a third of the company's crude palm oil into palm stearin and palm olein, which supply the domestic market as well as being exported.

When the company that is now NBPOL started its oil palm development activities in PNG in the late 1960s, it established seed gardens from genetic material brought into the country from its plant breeding program in Malaysia. This led to the development of NBPOL's plant breeding and seed production enterprise. NBPOL's oil palm seed production has a worldwide reputation for high quality and is a very successful export business.

PNG does not currently have a body that oversees the country's oil palm subsector. Instead, three national organisations, with different functions, represent stakeholders:

- The Oil Palm Industry Corporation (OPIC) is a statutory organisation formed under the *Oil Palm Industry Corporation Act 1992* to provide agricultural extension services to the country's oil palm smallholders.
- The Palm Oil Producers Association represents the interests of the country's palm oil milling companies.
- The PNG Oil Palm Research Association (PNGOPRA) is a non-government organisation responsible for providing research and development, and scientific technical services to all oil palm growers (smallholders and plantations) in PNG.

Smallholders have a close relationship with the plantation and milling company in their region; they sell all their fruit to the company, which then sells the oil. Smallholders also obtain credit and various agricultural supplies from the company. Importantly, their environmental accreditation is also driven by the companies. Therefore, although this report focuses on smallholders, company operations are also considered because they are integral to environmental sustainability on smallholder farms as well as on their own plantations.

Companies

NBPOL (until the purchase of CTP Holdings in April 2010) managed 35,000 ha of oil palm along the north coast of West New Britain. In addition, the company supports and buys fruit from more than 7,000 registered smallholders growing oil palm on a further 24,000 ha. It has five oil palm mills with a combined processing capacity, in March 2009, of 260 t of FFB/hour. In 2003, it commissioned a refinery in West New Britain with the capacity to refine 100,000 t/year of crude palm oil. Approxi-

mately 7,500 people are employed, including 134 PNG national executives and 42 expatriate executives.

NBPOL is the only PNG company involved in breeding and production of oil palm seed, which is a major business, at the Dami Oil Palm Research Station in West New Britain province. Another significant contributor to NBPOL's profitability is the Numundo Beef operation, currently carrying 4,000 cattle. In 2008, NBPOL purchased Ramu Agri-Industries, which grew primarily sugarcane, but also oil palm, on the mainland. In 2006, it purchased the abandoned Solomon Islands Plantation Ltd and re-established palm oil production in Solomon Islands under the company name Guadalcanal Plains Palm Oil Ltd. NBPOL is a public company listed on the Port Moresby and London stock exchanges.

HOPL is the other plantation and milling company operating on the north coast of West New Britain (Figure 1). It operates 9,906 ha of plantations and two mills with a combined capacity of 90 t/hour. Construction of an additional mill will begin in June 2010. The project is a nucleus estate project, with smallholders providing up to 50% of the crop. In 2009, there were 3,162 smallholders, with 13,200 ha planted. The smallholders produced 200,123 t of fruit in 2009, earning more than 33 million kina for the smallholder families. More than 17% of this income was paid directly to women through the 'loose fruit mama' scheme, whereby women collect loose fruit and sell it directly to the company. HOPL employs 3,500 people, including 12 expatriates. The company has embarked on a plantation expansion program, with an additional 10,000 ha to be planted by 2016.

HOPL is 100% owned by S.A. SIPEF N.V. Belgium Group, which is listed on the European Stock Exchange in Brussels. SIPEF was established in Antwerp, Belgium, in 1919 and has plantation interests in West Africa (oil palm), Indonesia (oil palm, rubber and tea) and PNG (oil palm and rubber). HOPL was established as a result of a decision by the then colonial administration to diversify the country's agricultural export base by introducing oil palm. The land along the north coast of West New Britain was recognised as having a high potential for oil palm because of its fertile volcanic ash soils and high rainfall.

CTP Holdings was a subsidiary of the privately owned companies Cargill and Temasek Holdings. CTP Holdings operated three milling/plantation operations: Higaturu Oil Palms in Oro province, Milne Bay Estates in Milne Bay province and Poliamba Estates in New Ireland province (Figure 1). These operations had previously been

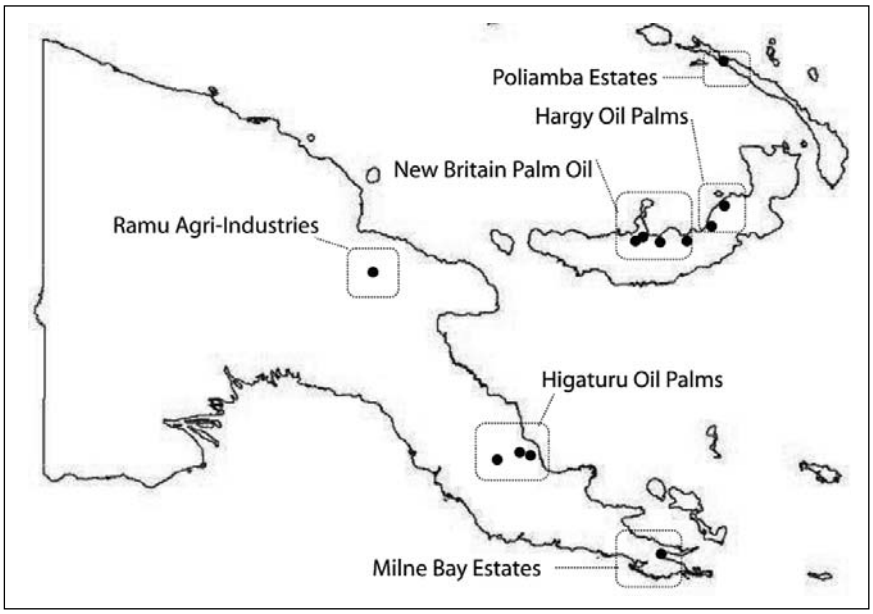

Figure 1. Location of palm oil mills in Papua New Guinea, showing company names

purchased from Pacific Rim Estates, formerly the Commonwealth Development Corporation. In April 2010, CTP Holdings was purchased by NBPOL.

Smallholders

Initially, the smallholder component of the nucleus estate and smallholder system in West New Britain and Oro provinces involved land settlement schemes, in which settlers were given 99-year leases on alienated land (land purchased by the government from customary landowners), typically 6 ha in size. No new smallholdings have been established under this scheme since the mid 1990s due to a shortage of available alienated land and also the resistance of customary landowners to such schemes. When the land settlement scheme blocks were planted to oil palm, a few hectares were set aside for gardens. However, nearly all of the blocks are now fully planted to oil palm, resulting in a shift of gardening to surrounding areas. The spread of gardening around oil palm blocks has been enhanced by increased populations on the blocks themselves (Koczberski and Curry 2005).

In addition to oil palm smallholdings under the land settlement scheme, village communities have been encouraged and assisted in setting up their own oil palm plantings. These village oil palm plantings usually comprise blocks of about 2 ha, and their establishment is based on a Clan Land Use Agreement. Currently in PNG, the ratio of plantings under the land settlement scheme to plantings under the village oil palm scheme is approximately 1:1.

In the older oil palm project areas (with higher population pressures), a third type of smallholding has emerged—Customary Rights Purchase Blocks. Papua New Guineans who do not have traditional access rights to a particular block of land can establish usage and access rights to establish an oil palm smallholding through the use of a Clan Land Use Agreement.

Oil palm is an attractive crop for PNG farmers for a variety of reasons. Profits are high relative to other crops, and income is earned regularly. The price smallholders receive for their fruit is set nationally and is linked directly to the world market price, unlike crops such as cocoa, copra and coffee, where middlemen have a large influence on the price received by the grower. The income from oil palm has led to considerable benefits for rural communities, but also problems, such as immigration of people to oil palm areas and resulting population pressure and social discord. Another feature of the crop is that it does not need a high level of management to achieve reasonable productivity, unlike crops such as cocoa, which require intensive management. An important advantage of this is that growers can attend to other activities, and when they return to harvesting their oil palm it is still producing.

Despite the attractiveness of the oil palm crop to smallholders, yields of smallholders are on average much lower than those of plantation companies. Low smallholder yields can be attributed primarily to incomplete harvesting and low fertiliser inputs. Reasons for low levels of management inputs include: competition for growers' time by non oil palm–related activities, high populations and associated social problems on land settlement scheme blocks, low availability of labour, and land disputes and tenure insecurity, which undermine grower commitment to productivity (Koczberski et al. 2001; Koczberski and Curry 2003, 2005). Various strategies are being employed to overcome these limitations (e.g. Koczberski 2007), but there is still much scope for improving smallholder productivity.

Agricultural extension services are provided to smallholders by OPIC in each of the 'project' areas. Coordination and management of OPIC extension activities revolves around a local planning committee established in each project area. The committee comprises smallholder representatives (through the growers' association) and representatives from PNGOPRA, the milling company, the provincial government and the National Development Bank.