The Economic Benefits of Palm Oil in Papua New Guinea

March 2011

ITS GLOBAL

International Trade Strategies Pty Ltd, trading as ITS Global
Level 1, 34 Queen Street, Melbourne, 3000
Tel: (61) 3 9654 8323
Fax: (61) 3 9654 4922
http://www.itsglobal.net

Contents

Executive Summary

The palm oil industry has the potential to generate significant economic growth in Papua New Guinea (PNG). Palm oil is PNG's most successful agricultural crop, accounting for around 39% of agricultural export earnings over the last decade while directly providing income for over 160,000 people living in rural households.

However PNG requires expanded economic development. Development indicators compiled by the Asia Development Bank show approximately 40% of the population live below the national poverty line, with high levels of child mortality, illiteracy, unemployment and population growth.

A vibrant palm oil industry is both economically and environmentally viable in PNG and has the potential to foster economic growth and raise the living standards of PNG's poorest communities. PNG soils offer the prospect of highest output per hectare from palm oil of any economy. Furthermore the industry provides a net climate benefit to PNG despite a politicised "environmental" campaign pursuing an anti-development agenda.

The contribution of agriculture to PNG's economy

PNG relies heavily on the agricultural sector's economic contribution. The industry accounts for approximately one-third of GDP. However there exists in PNG both the necessity and opportunity to expand agricultural activities.

- Agriculture in Papua New Guinea is performing below its potential. Although the sector constituted 34% of GDP in 2008, there is an imperative for the agricultural sector to expand in order to accommodate PNG's rapid population growth rate of 2.7%.
- High population growth is a significant issue for PNG's long term economic development and compounds already existing problems such as food security and nutritional dietary deficits. The growth of the agricultural sector would act negate these effects by securing a needed supply of food produce.
- The agriculture sector is one of the major sources of infrastructure development in PNG's rural economy. Rural communities rely on infrastructure such as roads, ports, healthcare, law enforcement and construction projects funded by agricultural and resource industry investment.
- PNG is heavily reliant on its resource sector. In 2008 minerals accounted for 77% of total value of exports. PNG faces the very serious risk of 'Dutch Disease'. Growth in the agricultural sector would serve to diversify the economy and reduce resource reliance and symptoms of Dutch Disease.

Viability of palm oil in PNG

Palm oil is PNG's most viable option for growth in the agricultural sector. Global palm oil consumption and demand is rising. Meanwhile traditional palm oil producing countries are slowing down production due to land use restrictions and productivity concerns. PNG is in a prime position to fill future supply shortages.

- Over the next ten years, global demand for palm oil is expected to increase by 30%. This reflects growing consumption for palm oil as both a food product and as a feedstock for biofuel.
- The world's current dominant producers face obstacles in meeting this demand. Malaysia and Indonesia together make up over 80% of global palm oil production and both producers face land use restrictions and productivity concerns.
- PNG stands in a good position to take advantage of a potential supply shortage. PNG is endowed with suitable soils and climate, adequate rainfall and available land to take advantage of growing global palm oil demand.
- PNG palm oil industry is already internationally competitive – oil yields reached 4 tons per hectare in 2007, outperforming top international producers such as Malaysia.

The role of palm oil in PNG's economic development

PNG has a record of economic instability. This has an adverse effect on attempts to alleviate growing rates of poverty. But detailed analysis demonstrates that palm oil crops act as an effective mechanism to achieve economic development.

80% of PNG's population is located in rural areas known to suffer from high levels of poverty. Within the rural population, 40% live below the poverty line. The palm oil industry has the potential to provide necessary economic benefits to PNG. PNG's palm oil industry already contributes significantly to the country's economic development.

- Incomes associated with palm oil cultivation and processing have risen steadily, while levels of return from small-scale investments in palm oil plantations are high. Over the last 15 years palm oil has recorded the greatest increase in real income out of major crops such as cocoa, copra and coffee.
- Palm oil smallholders on 2 hectare plots receive an annual income of K5,586 – almost double PNG's minimum wage.
- Smallholder returns from palm oil are almost 10 times those from cocoa.
- In PNG the Net Present Value (NPV) of palm oil crops is significantly larger than that of competing agricultural crops. Large scale palm oil plantations record returns of $US9275/ha compared with US745/ha returned from subsistence farming.

- Employment, export sales and government revenue resulting from the palm oil industry are high, and are expected to increase with greater industry growth. In 2007 export earnings from palm oil reached K640 million. One palm oil company alone contributed $US58.9 million in company tax during 2009, accounting for 2.6% of total government revenue. Around 166,000 people currently live in rural households that produce palm oil, with many more deriving incomes from peripheral activities.
- Simultaneous investments in processing and transport infrastructure provide the means for smallholder market access and reduce financial burden on government. One existing palm oil company alone provides comprehensive health cover to over 30,000 employees, spent over $US180,000 on infrastructure projects, maintains three primary schools and subsidizes the education of over 3000 pupils.
- The Sigite-Mukus project is expected to contribute royalties, premium payments, infrastructure levies and other community funding worth K834 million (2008 prices) over the life of the project. This is around K33.4 million ($US12.5 million) per year and would have a significant effect in driving economic development in East New Britain.

Palm oil and Climate Change

Environmental organizations have levelled accusations that palm oil is a driver of deforestation, unsustainable farming, and biodiversity loss. These are linked to the claim that palm oil expansion contributes to GHG emissions, mostly through drainage of carbon rich peat lands. Overall, close investigation shows palm oil has potential to provide net climate benefit to PNG.

- Many of these allegations are inaccurate and do not stand up to closer analysis. They are levied at other economies where drivers of deforestation are myriad. Contemporary research indicates urban growth, subsistence farming, housing and firewood collection are the primary causes.
- The most reliable scientific surveying shows that PNG peat lands, at 6-7% of total land area, make up a smaller percentage then in Indonesia and Malaysia. Analysis illustrates that current and proposed palm oil development is predominantly located in areas outside of peat lands. As such, GHG emissions from forest conversion in PNG will be considerably less than developments elsewhere in South East Asia.
- Furthermore, the campaign against palm oil fails to acknowledge any offsetting factors such as the contribution of palm oil plantations as a carbon sink, the development of plantations on degraded or already deforested land, or mention of environmental controls applied to industry.

Acronyms

ADB	Asian Development Bank
EIS	Environmental Impact Statement
EU	European Union
FAO	Food and Agricultural Organization of the United Nations
FFB	Fresh Fruit Bunch
GDP	Gross Domestic Product
GHG	Greenhouse Gas
ha	hectare
IDD	Iodine Deficit Disorders
IDR	Indonesian Rupiah
ILUC	Indirect Land Use Change
IPCC	Intergovernmental Panel on Climate Change
K	Kina
NES	Nucleus Estates and Smallholder
NGO	Non-Governmental Organisation
NPV	Net Present Value
OECD	Organization for Economic Cooperation and Development
PNG	Papua New Guinea
t	tonne
UNFCCC	United Nations Framework Convention on Climate Change
$US	United States Dollars

Chapter 1 – Introduction

ITS Global was commissioned by Rimbunan Hijau (PNG) Group to assess the economic benefits of palm oil production in Papua New Guinea (PNG). The industry has been growing strongly on the back of increased investment and has reaped the benefits of a sustained expansion in demand on the world market. As palm oil has been the country's most valuable agricultural export commodity for some time a review of its contribution to the economy is long overdue.

Palm oil has been the stand-out performer in the PNG agriculture sector in terms of its international competitiveness and export sales growth. The expansion in cultivation and processing facilities has had important development benefits in locations that attracted the investment. It has helped to alleviate poverty in those rural communities through the creation of jobs and associated income earning opportunities and through the provision of social infrastructure and services.

The success of the industry will naturally raise questions about the prospects for future growth and wider economic development benefits. This report examines recent industry performance from a number of perspectives and considers the prospects for further growth. It focuses on some of the key issues that will shape future industry development and gains for economy. They include:

- Projections for global palm oil demand.
- Nutritional and food security needs of PNG.
- The economic contribution of agriculture and constraints on future development.
- The benefits of palm oil production for the economy and rural communities.
- Returns from palm oil production.

The industry's contribution is examined in the wider context of PNG economic development. There are often challenges for developing economies with a dependence on a small number of export products affected by a commodity price boom. PNG is currently in this situation because of its heavy reliance on mineral and oil export earnings. Diversifying the base of the economy may be a consideration for policy makers and palm oil appears to be a viable option.

The assessment would not be complete without a review of the environmental case against palm oil that is currently being advanced by green activist groups. Environmental objection are primarily based on greenhouse gas [1]emissions from peat soil disturbance and the loss of natural habitats for charismatic mega-fauna such as orang-utan and tigers. As discussed in the report neither peat soils nor mega-fauna are under threat from the palm oil industry in PNG.

This report has been prepared as an objective, independent assessment of the industry benefits to inform policy makers, officials and the general public.

[1] Henceforth referred to as GHG

It has been produced as part of the company's efforts to reach a broad stakeholder group ahead of their proposed palm oil developments (namely the Sigite Mukus Integrated Rural Development Project in East New Britain Province and the Pulie-Anu Palm Oil Project in West New Britain Province).

It will complement the company reports that detail the social, economic and environmental impact assessments on the proposed investment. These reports have been submitted to the PNG government.

Chapter 2 – Palm oil and rural development in PNG

Palm oil is a product derived from the fruit of forest palms which are grown in tropical climates. It is a vegetable oil used for edible and non-edible purposes. In some countries it is an established part of the national diet because of its traditional use as a cooking oil. In other countries it is a strong competitor with crop based vegetable oils as a cooking aid and processed food ingredient.

For some time now the industry has been expanding and has become a sizeable component of the world market for vegetable oils. Global output has expanded and world trade has increased. The growth has been driven by stronger domestic demand in the major producing countries and a shift to healthier food additives in the developed economies.

In more recent times this demand growth has been enhanced by the use of palm oil as a biofuel. Governments have introduced policies to encourage the development of sustainable alternative sources of energy. This has been a common response to public concerns about carbon emissions and the high prices for fossil fuels. Palm oil has emerged as one of the alternatives and the extra demand has been a further stimulant to industry growth.

Indonesia and Malaysia are the world's largest producers of palm oil. In both countries the industry growth has been a major contributor to rural economic development and poverty alleviation. High returns have encouraged investment in the industry. But land use restrictions may constrain future development. This raises questions about the capacity of these countries to accommodate the increasing global demand.

PNG is a commodity-based economy with mineral and oil exports providing the primary source of wealth creation. Agriculture remains a vital part of the economy. The small holder sector is an important source of subsistence food production, employment and rural incomes. The plantation sector generates jobs in rural communities and in downstream processing activities.

Economic development and improved living standards in PNG will require investment in growth industries. The population is growing rapidly and a diversified economic base is important to limit exposure to fluctuations in specific global commodity markets. In agriculture, palm oil is one of the few growth industries. The industry is providing new development opportunities in contrast to mature industries such as coffee, cocoa and copra where growth has slowed or ceased altogether.

PNG is a small player in the global palm oil market and the industry is limited to particular lowland areas with adequate rainfall. But the world market is expanding and future growth prospects are promising. Further development of the industry in PNG will provide greater opportunity to raise living standards and alleviate poverty in selected rural areas.

2.1 Future prospects for global palm oil demand

Palm oil has a variety of applications as a food product and as an ingredient in non edible products such as biofuel. Currently around 80% of global palm oil production is used for food purposes.[2] It is widely used in cooking oils, margarines, noodles, shortenings, vegetable ghee, baked goods, chocolates, hot beverages and ice cream.

Palm oil and palm kernel oil[3] uses in non-food products have been growing. In part this has been driven by the general shift away from petroleum based inputs for a range of consumer goods because of cost competitiveness reasons. Palm oil is now widely used in the production of soaps, detergents and surfactants, cosmetics, pharmaceuticals and a variety of other household and industrial products.

An associated, more recent trend has been the growing use of biofuels to reduce the reliance on fossil fuels. It has created a demand for palm oil as a feedstock ingredient in the production bio-diesel. This is a policy driven demand expansion based on fuel blending mandates and other subsidy instruments. There is a risk that demand could weaken or evaporate if policy settings are altered to reduce the assistance. But while oil prices remain high and there are concerns about greenhouse gas emissions this risk seems low.

Geographical location of global palm oil cultivation

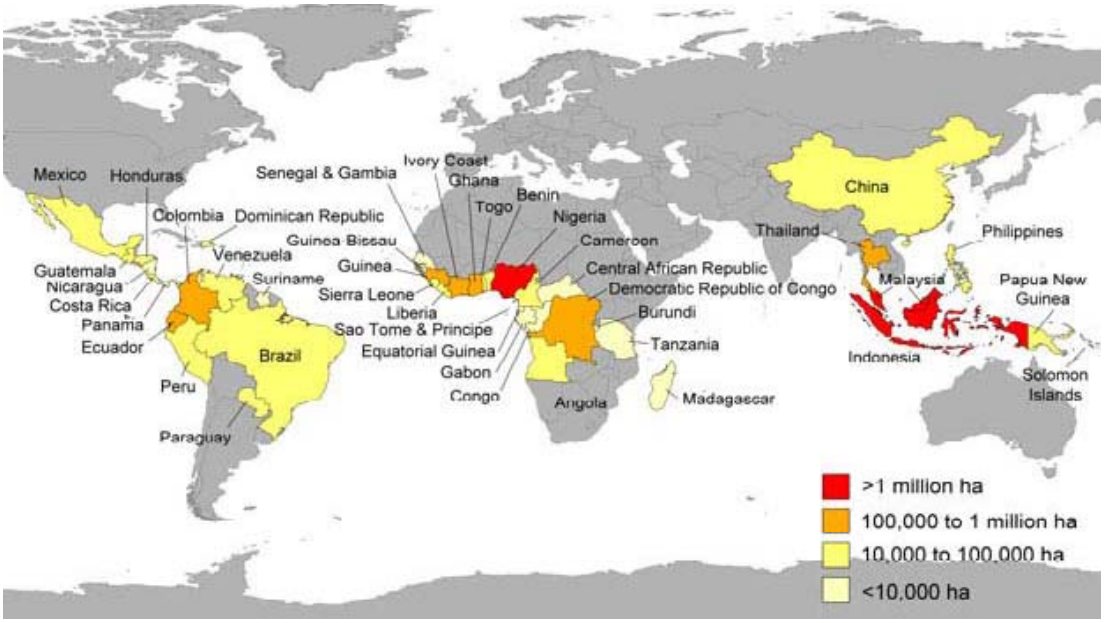
Palm oil cultivation is concentrated in the tropical areas of Southeast Asia (figure 2.1). The climatic growing conditions are ideally suited for palm oil trees in these areas. Alternative land uses are limited in most cases to other tree crops such as cocoa, rubber and coconuts. Declining returns for these alternative commodities have encouraged their replacement with oil palms.

Land-use conversions and the development of new cultivation areas have been especially evident in Indonesia and Malaysia. These two countries have become the dominant producers of palm oil in the world market. Industry growth by small holders and the plantation sector has been a major contributor to economic development and poverty alleviation in rural areas.

Indonesia and Malaysia account for more than 85% of global production. Annual output in Indonesian exceeds 20 million tonnes. Malaysian production is currently around 18.5 million tonnes. Total world production of palm oil is estimated at 45.1 million tonnes (figure 2.2).[4] Other palm oil producing countries include Thailand, Nigeria, Columbia, Equator, and PNG.

[2] Hai Teoh, C. (2010). Key Sustainability Issues in the Palm Oil Sector. World Bank Group
[3] Oil derived from the seed as opposed to the flesh of the oil palm fruit
[4] Food and Agricultural Policy Research Institute (FARPI) (2010) U.S. and World Agricultural Outlook

Figure 2.1 Oil palm cultivation in 43 oil palm producing countries in 2006



Source: Koh and Wilcove 2008

Figure 2.2 Projections of world palm oil supply and utilisation

	2009/2010 *('000 tonnes)*	2019/2020 *('000 tonnes)*	% change
Consumption	44 330	58 639	32
Production	45 132	59 264	31
Trade	30 760	41 649	35

Source: FAPRI 2010

Trends in the global consumption of vegetable oils

Over the last 30 years there has been substantial growth in the global consumption of vegetable oils. Between 1980 and 2008 consumption increased more than threefold from 40 million tonnes to over 130 million tonnes. Another noticeable trend over the past three decades has been the change in market shares held by the different types of vegetable oils.

In 1980 the main vegetable oil on world markets was soybean. It accounted for about a third of total consumption (Figure 2.3). The market share for palm oil was 11%. By 2009 the situation had changed appreciably. Consumption of soybean oil had increased by 22.5 million tonnes but its market share had fallen to 27%. Palm oil has become the most popular vegetable oil consumed on the world market:

- Between 1980 and 2009 consumption of palm oil increased by more than 40 million tonnes and its share of the world market has risen to 34%.[5]

[5] Hai Teoh (2010)

- Rapeseed and sunflower oil have market shares of 16% and 10% respectively.

The change in market share for palm oil is impressive but it doesn't adequately describe the rapid rate of growth and the change in consumer preferences. There has been a substantial increase in vegetable oil consumption at the same time as palm oil has increased its market share. Two of the major crop based competitors to palm oil – soybean, and sunflower – have experienced significant consumption growth but have lost market share:

- Over the past 30 years palm oil consumption has increased tenfold from 4.5 million tonnes to 45 million tonnes.
- The consumption growth for palm oil has been especially dramatic in the past decade – consumption has more than doubled in this period.

Figure 2.3 World consumption of vegetable oils, 1980-2008, quantity (million t) and % share

Type of vegetable oil	1980		1990		2000		2009	
	Qty	%	Qty	%	Qty	%	Qty	%
Soybean Oil	13.4	33.7	16.1	26.5	25.6	27.7	35.9	27.0
Palm Oil	4.5	11.3	11.0	18.1	21.9	23.7	45.1	34.0
Rapeseed Oil	3.5	8.8	8.2	13.5	14.5	15.7	21.5	16.2
Sunflower Oil	5.0	12.6	7.9	12.9	9.7	10.5	13.0	9.8
Palm Kernel Oil	0.6	1.5	1.5	2.5	2.7	2.9	5.2	3.9
Other Vegetable Oils	12.8	32.1	16.1	26.5	18.1	19.6	12.0	9.0
Total Vegetable Oils	**39.8**		**60.8**		**92.5**		**132.8**	

Source: Oil World, in Hai Teoh (2010)

Projected global demand for palm oil

Palm oil industry growth is expected to continue over the medium term. Favourable returns due to strong demand for vegetable oils are expected to support further investment in the industry. Cost competitiveness and the shift to healthier food additives in developed economies will favour palm oil demand at the expense of some of its competitors. Global consumption of palm oil is expected to rise by more than 30% over the next ten years.[6]

One of the factors favouring palm oil demand in food uses are its health and nutritional properties. Palm oil is high in mono-unsaturated fats which are considered to be advantageous for a lower risk of heart disease.[7] A further advantage is that it does not require hydrogenation to achieve a solid state for manufacturing margarine. This avoids the creation of the trans-fatty acids which are considered harmful to human health.

[6] OECD-FAO (2009), Agricultural Outlook 2009
[7] Malaysian Palm Oil Council (2008), Facts on Fats, Global Oils & Fats Business Magazine, Vol. 5, Issue No. 3

These properties have contributed to an increased use of palm oil in processed food production in some developed economies. It has become a strong competitor with vegetable oils made from soybeans and rapeseed that require hydrogenation to achieve a solid state.
Several other factors have contributed to the dramatic growth of the palm oil industry:

- The price competitiveness of palm oil has enhanced its substitutability with crop based vegetable oils. There are cost of production advantages in oil palm cultivation from lower land prices in the main producing countries and lower energy inputs. Palm oil is now being used in a range of products that traditionally used other oils.[8]
- Oil palms are a highly productive tree crop in comparison to crop-based oil seeds – oil yields are 5 to 9 times higher than the yields achieved by soybean, rapeseed and sunflower.
- Per capita consumption of vegetable oils has been increasing in some major developing economies due to strong income growth. Palm oil has benefited from this development and further per person consumption growth is expected to occur. In 2009-10 China and India accounted for over 40% of the net imports in world trade. Future economic growth in these countries will increase the demand for imported vegetable oils.

2.2 The use of palm oil as a renewable source of energy

Another factor supporting the global demand is palm oil's growing contribution to the biofuels industry. Developments in technology and policy are giving renewable energy and clean burning fuels greater prominence in international efforts to reduce GHG emissions. Increasingly countries are setting targets to reduce reliance on fossil fuels and encourage greater usage of renewable energy. One such renewable energy source that has grown significantly over the last decade is biofuel.

The term biofuel refers to a range of fuels that are derived from biomass – biological material such as components found in palm oil. Biodiesel is one of the most successful biofuel, as it is designed to be used in standard diesel engines without the need to convert the engine. As a result, countries can introduce biodiesel targets (summarised in Figure 2.3) without incurring major costs often associated with technology upgrades.

Palm oil is widely used as a feedstock in bio-diesel production. Although dependent on government policies, the increased use of biofuels is expected to facilitate further demand growth for palm oil.

Currently around 95% of the world's energy consumption is sourced from fossil fuels. By 2030 a 50% increase in energy consumption is expected to occur.[9] This

[8] Hai Teoh (2010)
[9] Sheil, D., Casson, A., Meijaard, E., van Noordwijk, M., Gaskell, J., Sunderland-Groves, J., Wertz, K., & Kanninen, M. (2009). *The impacts and opportunities of oil palm in Southeast Asia*. CIFOR, Occasional Paper No. 51.

is driving the development of alternative renewable energy sources such as bio-diesel. Future development of cleaner 'second-generation' biofuels will further enhance the demand for palm oil as feedstock ingredient.
Palm oil is the most cost-competitive vegetable oil for producing bio-diesel.[10] But in some cases market penetration has been distorted by government assistance measures. For example, the use of palm oil has been stymied by European Union (EU) protectionist policies in the form of subsidies for using rapeseed as a feedstock.

Currently palm oil accounts for less than 5% of the world's bio-diesel production.[11] This situation is likely to change in the future as countries adopt policies that encourage the use of palm oil. A number of recent developments illustrate the potential for a greater use of palm oil:

- Several countries have set fuel blending targets for bio-diesel. They range from 2% in the Philippines to a 10% target in the EU by 2020 (figure 2.3). If the blending mandates are enforced an extra 4 million hectares of oil palm would be needed to meet EU requirements alone. A further one million hectares may be needed to satisfy China's requirements.
- Investment in bio-diesel processing capacity is increasing. A Finnish oil refiner (Neste Oil) is building the world's largest bio-diesel plant in Singapore.[12] Another major producer (Sime Darby Berhad) has an annual processing capacity of 200,000 tonnes in the Netherlands.[13] Indonesia has a processing capacity for 3 million tonnes of bio-diesel per year.[14]
- The Indonesian and Malaysian governments have policies to develop a bio-diesel industry and targets of allocating 6 million tonnes of palm oil to the industry each year.[15]

The EU is the world's largest consumer of biofuels. Usage has more than tripled between 2000 and 2005.[16] This is largely a result of the biofuel mandates that have applied since 2003. The directive established national targets of replacing 5.75% of all transport fossil fuels with biofuels by 2010.[17]

In 2008 the European Parliament issued a directive that restricted the use of palm oil based biofuels, ostensibly due to environmental and social concerns. Several commentators have noted the policy is effectively a trade barrier to protect rapeseed producers and the oilseed processing industry under the guise of environmental concerns.

Europe's protectionist biofuel policy has implications for the global palm oil market. EU demand for palm oil as a feedstock will be restricted while this policy

[10] Thoenes (2006)
[11] Sheil et al (2009)
[12] Neste Oil (2007), *Neste Oil to build a NExBTL Renewable Diesel plant in Singapore,* Press Release available at: http://www.nesteoil.com/default.asp?path=1;41;540;1259;1261;7440;9494
[13] Sime Darby (undated), *website content*, available at http://www.simedarbyplantation.com/Biodiesel - Overseas.aspx
[14] Hai Teoh (2010)
[15] Thoenes (2006)
[16] Thoenes (2006)
[17] European Union (2003) *The Directive on the Promotion of the use of bio-fuels and other renewable fuels for transport (2003/30/EC)*, accessed at: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32009L0028:EN:NOT

directive remains in place. But at a global level most medium term projections show a significant increase in bio-diesel consumption. There will be consumption growth outside the EU and the primary feedstock will be vegetable oils such as soybean, rapeseed and palm oil:

- The OECD is expecting the global usage of vegetable oils in bio-diesel production to more than double between 2006-08 and 2018.[18]
- During this time total vegetable oil consumption will increase by 45%.

Figure 2.3 National biofuel and bio-diesel targets

	Target	Status	Policy initiatives
Brazil	2% in 2008, 5% by 2013	Implemented	Tax incentive, mandate
Canada	2% by 2010	Indicative	None
China	15% biofuels by 2020	No concrete policy	Tax support proposed
EU	5.75% by 2010, 10% by 2020	Implemented	Subsidies, tax incentives
India		Preparing legislation	
Indonesia	2 to 5% by 2010	Proposed	
Japan	5% in 2009	Preparing legislation	
Korea	5%	Implemented	Mandate
Malaysia	5%	Proposed	
Philippines	1% in 2007, 2% by 2009		
Thailand	10% by 2012	Implemented	Tax waver, future mandate
USA	28.4 billion litres of biofuel by 2012	Implemented	Tax credits, state mandates

Source: Sheil et al 2009; Unless specified in the table, figures refer to the percentage of biodiesel mix e.g. 5% = 5% of biodiesel mix.

2.3 Global palm oil production and opportunities for PNG

As the dominant producers, Indonesia and Malaysia are well placed to benefit from the expected growth in global consumption. In 2009-10 they produced 39.3 million tonnes of palm oil. This represents around 87% of world output of 45.1 million tonnes.[19] The industry is expanding in both countries but their future growth capacity will depend on land availability.

PNG has an opportunity to benefit from the increased demand for palm oil. By 2020 global palm oil usage could be close to 60 million tonnes. An increase of 15 million tonnes is consistent with many of the projections for total vegetable oil consumption. For example, Hai Teoh (2010) has suggested an additional 27.7 million tonnes of vegetable oils will be required by 2020.

Indonesia aspires to be the "best sustainable palm oil producer in the world" and has a target of producing 40 million tonnes of palm oil by 2020. It is expected

[18] OECD-FAO (2009)
[19] FARPI (2010)

half would be used for food and the remainder used for energy.[20] The target is ambitious - it represents a doubling of production over a ten year period.
A doubling of output will require large land conversion projects. But approval for such projects may be difficult to obtain following the recently announced two year moratorium on new forest clearing permits.[21] While the effectiveness of the moratorium remains to be seen, the immediate policy outlook would seem to conflict with a production target of 40 million tonnes.

Previous land clearing permits are likely to be honoured. The Sarawak government had previously announced the opening up of large new tracts of land for oil palm cultivation. If the developments proceed the national cultivation area will rise from 4.7 million ha to 5.4 million ha.[22] There are also plans to open up land areas in the eastern part of Papua province in Indonesia to oil palm plantations. Beyond this, the rate of production growth will slow if more land use constraints are imposed.

Malaysia also appears to have limited room for expansion because of land zoning restrictions. The government has designated a fixed allocation of 23% of the total land area to agriculture. They also have a policy that no virgin land can be used for agriculture. As oil palm cultivation is restricted to agricultural land there is a limited land base for future industry expansion.

Yield gains on existing cultivation areas are another way to expand output. But there are signs that improvements in plantation yields are slowing in Indonesia and Malaysia.[23] The cost of establishing new plantations is also increasing because of environmental requirements. If these trends continue and land use constraints become more restrictive there will be opportunities for other suppliers.

The favourable outlook for palm oil demand will encourage industry investment in other countries. PNG is in a good position to attract some of this new investment. Palm oil has become the country's most successful agricultural industry in terms of international competitiveness and export earnings. [24] In specific areas the climatic conditions and availability of land offer a good base for industry growth and further development of the rural economy.

But PNG is not the only option for industry expansion and much will depend on government efforts to facilitate new investment. Thailand is expected to increase oil palm areas by 80,000 ha per year until 2012.[25] Recent reports suggest Chinese companies are negotiating for land in DR Congo and Zambia for oil palm plantations.[26] There are also reports of investors looking at plantation growth in

[20] Hai Teoh (2010)

[21] Reuters (2010), Q+A-Indonesia issues draft rules on forest clearing, 6 July, available at: http://af.reuters.com/article/energyOilNews/idAFJAK26185620100706?pageNumber=2&virtualBrandChannel=0
[22] Hai Teoh (2010)
[23] Thoenes (2006)
[24] Bourke, R. M., & Harwood, T. (2009). *Food and Agriculture in Papua New Guinea*, Edited report published by ANU E Press
[25] Hai Teoh (2010)
[26] Economist (2009), *The scramble for land in Africa and Asia*, 21 May, available at: http://www.economist.com/PrinterFriendly.cfm?story_id=13692889&source=login_payBarrier

West Africa and Malaysian companies are looking at expansion opportunities in Brazil.[27]

2.4 Nutritional deficiencies and food security in PNG

In 2003 an FAO nutritional assessment of PNG found significant nutritional deficiencies in the national diet.[28] It also identified a range of nutrition related issues that adversely affect human health. These include chronic energy deficiency, iron deficiency anaemia, clinical vitamin A deficiency and iodine deficiency disorders (IDD).

The results of the assessment highlight the need for action to encourage improvements in the nutritional content of the national diet:

- In 1998-2000 PNG had an 'undernourished' population of 1.3 million, 27% of the total population (FAO 2003).
- Over the last 15 years there has been no improvement in the nutritional status of children.
- In rural areas there is a high prevalence of underweight children, a very high prevalence of stunting and a medium prevalence of wasting in children.

A moderate increase in palm oil consumption would help to improve the nutritional content of the national diet. Fats and oils provide the most food energy per gram of all the food groups. They also contain important 'fat-nutrients'. The human body needs unsaturated fatty acids for building cells, especially the cells of the brain and nervous system. It also needs omega-3 fatty acids for protection from heart disease. Palm oil is widely regarded as a good source of these 'fat-nutrients'.[29]

The FAO recommends the diet for older children and adults should have 15-30% of their energy needs supplied by fats.[30] For women of reproductive age 20-30% of their energy needs should come from fats. In its most recent review the FAO assessed PNG's fat consumption to be at the lower end of these scales. Fats accounted for 16.9% of total energy in the period between 1998 and 2000.

The PNG national diet would benefit from a moderate increase in fat consumption and a greater contribution of unsaturated fats. These human health benefits can be obtained by increasing the consumption of palm oil. For example, the FAO assessment refers to survey results that indicate there are areas in PNG which have high levels of clinical vitamin A deficiency. [31] Palm oil has the properties that specifically assist with vitamin A absorption.

[27] Reuters (2010), *Wilmar aims to grow sugar business in Indonesia*, Brazil, 6 July, available at: http://www.reuters.com/article/idUSSGE6650ES20100706

[28] FAO (2003) Nutrition Country Profiles – Papua New Guinea
[29] Burgess, A. (2004). Family Nutritional Guide. Rome: FAO.
[30] Ibid.
[31] FAO (2003)

The message that people should consume more unsaturated fats has been inhibited by food security issues. PNG is classified as a *Low Income and Food Deficit Country* by the FAO.[32]Currency devaluations have contributed to food price inflation through higher import prices.[33] This was evident when the price of imported rice increased in 1997.

Consequently PNG has a heavy reliance on local produce for its food needs. In 2006 an estimated 83% of food energy and 76% of protein was locally sourced. This has been a factor in the persistent nutritional deficiencies. The available food products do not meet all the necessary requirements for a balanced diet.

The remainder of PNG's food needs are imported and this includes 5-6,000 tonnes of vegetable oils.[34] Expansion of the palm oil industry will generate more export income. But it could also lead to greater domestic use of palm oil in cooking and as a food additive. This would have important nutritional benefits and reduce the dependence on imported vegetable oils.

2.5 PNG's development needs

PNG is a commodity-based economy with a rich endowment of natural resources. Minerals and oil are the primary source of wealth creation – they account for 77% of total export earnings.[35] But agriculture and forestry remain a vital part of the economy. They are substantial contributors to GDP, a key source of export earnings and the dominant source of employment. The ADB estimates that agriculture accounts for a 17% of export earnings and forestry accounts for 5%.

Most of the population live and work in rural areas. Agriculture and forestry provide occupations for more than 80% of the population. The agriculture sector has two components – subsistence food production and commercial farming by large scale plantations and small holders. Many people are directly engaged in farming or employed in downstream processing and service industries:

- Paid employment in urban areas and with mining companies is relatively small.

Growth in agricultural export earnings has played an important role in economic development. It has largely come from the plantation crops of palm oil, coffee, cocoa, vanilla and copra. In addition, local sales of cash crops have become an important source of income generation at both the national and household levels.[36]

[32] List available at: http://www.fao.org/countryprofiles/lifdc.asp?lang=en

[33] Manning, M. (2000). 'Food Security for Papua New Guinea' in *Proceedings of the Papua New Guinea Food and Nutrition 2000 Conference* (Ed. Bourke, Allen, Salisbury). ACIAR

[34] Bourke, R. M., & Harwood, T. (2009). *Food and Agriculture in Papua New Guinea*, Edited report published by ANU E Press

[35] Mellor, D. (2010). Social impact of commodity price volatility in Papua new Guinea. *Poverty and Sustianable Development in Asia.* (Bauer and Thant, ed.) Asia Development Bank.

[36] Ibid.

Despite the resource wealth, macroeconomic indicators over recent times highlight the fluctuating performance of the PNG economy. Declining per capita GDP, high levels of inflation, high interest rates, a growing external debt and a depreciating currency indicate there are significant problems with the PNG economy. [37]

PNG has a history of economic instability. This is particularly evident in the performance of the rural economy. For example, an 11.3% fall in agricultural GDP in 1998 was followed by increases of 4.3% and 9.1% in 1999 and 2000 respectively. This turn-around was immediately followed by a decline of 5.7% in 2001. More generally, current economic conditions point to a softening outlook:

- Overall GDP growth is expected to moderate to about 3.5% in 2010.
- The pace of economic activity in the first quarter of 2010 has slowed and total employment in the private sector has declined.[38]
- The annual inflation rate has eased to 5% which is an improvement on the 10.2% recorded in the first quarter of 2009.
- Inflationary pressures will remain a feature of the medium term outlook because of exchange rate movements and demands associated with the LNG (liquefied natural gas) project.

The economic instability has obvious implications for the rate of development, foreign investment and poverty alleviation. The delivery of basic public services has deteriorated to the point where PNG's social indicators are now lagging those of its South Pacific neighbours. The effect of this decline in service delivery has been especially disturbing in rural areas where the quality of life in many villages is now considered to be worse than it was a decade ago.

Poverty alleviation is primarily a rural issue that can only be addressed in a sustainable way by economic development. Most of the poor reside in rural areas where over 40% of the population are living below the poverty line.[39] More generally, a national survey has found that 37% of the population does not have enough income to buy the food requirements that meet the poverty line indicator on energy intake.

A number of commentators have strongly advocated the need for structural reforms to facilitate greater economic development. For example, Hughes (2004) has argued that an annual growth rate of 7% is feasible if targeted reforms were implemented. Key areas of reform include land tenure and property rights, industrial relations, trade protection and infrastructure. The need to encourage growth in PNG's agricultural exports is also a prominent feature of the proposed reforms.

There is evidence that suggests there are limited growth prospects for export earnings from PNG's traditional estate commodities of coffee, cocoa and copra.

[37] Holden, P., Bale, M., & Holden S. (2003). *Papua New Guinea – a private sector assessment*. Report prepared by the Enterprise Research Institute, page 7.
[38] Bank of Papua and New Guinea (2010), *March 2010 Quarterly Economic Bulletin*
[39] Ibid.

Export earnings have increased but there has been only moderate production growth in recent years. In part this probably reflects the decline in plantation producers and increase in small-holders. Industry productivity performance tends to be a little weaker among small-holders.

Currently palm oil is the only agricultural commodity with strong growth prospects in PNG. It has the highest export earnings and they are growing strongly. Some companies are reportedly looking to increase their investment in plantation estates. Further development of the industry will provide an opportunity to offset the weaker growth prospects for the other estate commodities.

This perspective is supported by the World Bank. They have identified palm oil as a key component for PNG poverty alleviation strategies.[40] Global demand is expanding and the outlook is promising. PNG has specific locations with favourable climatic conditions and land available for development. If the industry can expand in these areas there will be important poverty alleviation benefits for the rural population.

[40] World Bank (2007), Country Assistance Strategy for Papua New Guinea for the period FY08-FY11

Chapter 3 - Economic importance of palm oil to PNG

In 2008 GDP in PNG was estimated at $US8.1 billion. Over the preceding 10 years the average annual growth rate was around 2.1%. But the PNG population has been growing strongly. As a result annual per capita GDP has declined during this period by about 0.5%.

Population growth is an important issue for PNG's long-term economic development strategy. The population is growing at a faster rate than for most other developing economies. PNG census results show the annual growth rate was 2.7% between 1980 and 2000.[41] Current FAO estimates indicate the high rate of growth has continued.

This underlines the importance of continued development of agricultural export industries like palm oil. PNG has a population of 6.5 million people and most live in rural areas. Growth in commercial agriculture creates new income earning opportunities and supports higher living standards. This helps to improve law and order and reduces the pressure for rural to urban migration.

Agricultural accounts for about a third of GDP – 34% in 2008. Its contribution has been reasonably consistent over the past twenty years. For example, in 1988 it accounted for 32% of GDP and in 1998 its contribution was more than 35%. Mining, oil and manufacturing dominate the GDP estimates with a combined contribution of 48% in 2008. The services sector accounts for the remaining 18%.

Over the past decade mining and energy has become an increasingly important component of GDP. During this growth in the agricultural sector has been sluggish. The average annual growth rate has been 1.9%. In part this reflects seasonal conditions and fluctuations in global commodity prices. But it also reflects the longer term slowing in export sales growth for the traditional estate tree crops.

3.1 Agriculture's contribution to the PNG economy

Agriculture is a significant component on the PNG economy – cash sales of produce are the main source of income for people living in rural areas; exports of agricultural commodities are an important source of economic growth; government relies on tax revenues derived from commodity exports; and rural economies have benefited from infrastructure investment resulting from the agriculture sector. Yet the importance of agriculture has been dwarfed by the growing contribution of export earnings from minerals and oil.

The decline of PNG's agricultural sector

[41] ITS Global (2009)

PNG's major agricultural exports are palm oil, coffee and cocoa. They account for nearly 80% of agricultural export earnings. Over the past 30 years the production of most export cash crops has increased. The exception is copra which has experienced a substantial decline in production and export sales in recent years. Palm oil has been the largest export earner since the year 2000.

Between 1998 and 2008 PNG export earnings have grown at an annualized rate of 7.6%. Agriculture has contributed to this growth but its relative position has declined:

- In 2008 minerals and accounted for 77% of the total value of exports.
- Agricultural accounted for 19% of total export earnings.

The relative decline of the agricultural sector is due to a number of factors. Firstly, there has been a trend away from plantations towards small-holder producers in the coffee, cocoa and copra industries. Plantation production generally involves centralised farming of an estate by a single company who provide compensation and revenue to employees, landowners and government. Smallholder production, on the other hand, is a decentralised farming method whereby small scale farmers produce crops individually. Often smallholders form a co-operative for down-stream processing, marketing, or sales.

PNG's agricultural sector has seen a general trend of declining plantation production and increasing small holder production. This has slowed the overall output growth in these industries. The exception is palm oil where the industry is dominated by large scale plantation estates.

Figure 3.1 Annual growth rates of volume of oil palm, cocoa, coffee and rubber from the smallholder and plantation sectors, 1986–2005

Crop	Annual Growth rate (%)*	
	Smallholder	Plantation/estate
Palm Oil (fresh fruit bunch)	4.3	8.3
Cocoa	2.7	-4.1
Coffee	2.0	-2.9
Rubber	3.2	-3.3

Source: Bourke and Harwood (2009)
*Calculations are based on the growth rate from 1986 to 2005 The 1986 figure is a mean for the three-year period 1985–1987; likewise, the 2005 figure is a mean for the period 2004–2006 For rubber, the period is 1986–2000 (1999–2001)

Secondly, agricultural decline should be seen in the context of PNG's customary land tenure system. Plantation developments involve negotiations on land access rights and the payment of royalties to community groups. This has been a factor in the decline in the contribution of plantation estates. Small holders have now become the primary producers of export tree crops:

- Small holders account for about 84% of coffee production and 90% of cocoa production.
- Oil palm is the exception with a small holder contribution of about 33%.

Other factors have contributed to the decline in plantation crop production. Higher input costs, a deterioration of infrastructure and fluctuations in export returns have diminished the financial appeal of investments in large-scale plantations. For some traditional crops declining yields because of the age of trees has also contributed to lower plantation production.

Domestic consumption of agricultural crops

In addition to income derived by smallholders producing export crops, many rural villagers earn an income from cash sales of agricultural produce on the domestic market. The income is obtained from a variety of products including coffee, cocoa, staple vegetables, betel nut, copra, oil palm, firewood, tobacco, fish and minor products such as vanilla, rubber, balsa and tea. In most cases the cash sales generate a modest income but there are exceptions.

Domestic consumption however, tends to be reliant on the village food production system as opposed to crops grown by small holders or plantations. The rural village economy is largely based on a shifting cultivation system that involves clearing communal land for temporary agricultural production. The land is farmed for a period of time and then abandoned for a new area. After a lengthy fallow period the land is resumed for agricultural purposes. This form of rotational agriculture is common in the poorer, more isolated parts of the country where subsistence food production is a significant part of the rural economy.

Sweet potato, banana, sago, cassava, yam and taro make up the bulk of agricultural crops in the village food production system. These staples are generally limited to domestic consumption while small holder farmers and plantations tend to produce crops for export such as coffee, rubber and cocoa. Coffee for example has been commercially produced for thirty years, yet domestic consumption makes up approximately 0.1% of production.[42]

Potential for growth in agriculture

There is much potential for growth in the agricultural sector – both to supply domestic consumption needs and foster greater export earnings. But future growth will depend on several factors. Increased cultivation areas and yield improvements by small holders will be the critical ingredients in the coffee, cocoa and copra industries. These factors will also be important for the palm oil industry. But the prospects for growth are much stronger because of the potential for an accelerated expansion from increased plantation investments.

Yet a number of physical and structural impediments have constrained agriculture's contribution to the economy. Some are caused by topography and environmental limitations that are difficult to overcome. Others could be more immediately addressed by policy initiatives and by facilitating more investment

[42] Bourke, R. M., & Harwood, T. (2009)

in large scale developments. These impediments have prevented the sector from achieving its full potential and will affect future growth in the export industries.

The impediments that are constraining growth in agriculture have slowed the rate of economic development and poverty alleviation. Some of the major impediments that have been identified by analysts and international aid agencies include:

- Rapid population growth which is increasing the pressure on land use – this is especially evident in parts of the PNG Highlands and some island provinces.
- A limited availability of productive land for agriculture developments – just 7% of PNG's land base is rated as high quality agricultural land and 20% is rated as moderate quality.
- Land tenure arrangements which limit access to land for plantation developments.
- Limited and poorly maintained transport infrastructure, especially roads and bridges.
- Poor dissemination of market information on product requirements, trading conditions and technological improvements.
- Insufficient R&D on new varieties and productivity enhancing product developments that are adaptable to PNG's farming environment.
- Poorly developed post-farm supply chains for some export commodities with deficiencies in product processing, storage and handling, transport and marketing services – low quality products are supplied to markets that demand higher standards.
- Inadequate access to credit and working capital for suppliers of marketing services.
- Deficiencies in the provision of basic social services in rural areas such as education, health, policing and housing – ineffective and inadequate law enforcement is eroding community confidence to engage in economic development opportunities.
- Low incomes and poverty limiting the ability of a proportion of the rural population to shift out of subsistence agriculture into in the formal cash economy.
- Corruption and a breakdown in law and order that have created unstable land tenure arrangements.[43]

3.2 Palm oil's contribution to the PNG economy

PNG's agricultural sector has underperformed over the last thirty years due to a number of impeding factors. But despite the relative decline in agriculture, recent export earnings from the main estate crops have actually increased. The

[43] Curtin, T., & Lea, D. (2006). The Economics of Land Titling in Papua New Guinea. *Pacific Economic Bulletin, 2*(1), page 165.

size of the gain has varied between commodities, with palm oil recording high growth rates.

There is exists in PNG the necessity to foster growth in the agricultural sector – and palm oil has demonstrated potential to drive this growth. While higher export earnings mostly reflect the surge in global commodity prices that was evident in 2008 and 2009, they also serve to indicate the strong performance of palm oil as an agricultural commodity.

- Since 2005 palm oil export earnings have increased by 159%
- Coffee exports have grown by 10%, cocoa exports by 74% and exports of copra products by 123%[44]

The palm oil industry in PNG has recorded significant economic achievements. The commercial development of oil palms began in the late 1960s with the establishment of the Hopkins plantation area in West New Britain Province. Since then the industry has expanded into some other lowland areas. Production is concentrated in a few regions with suitable growing conditions. The industry is structured around a small number of large companies that cultivate and process oil palm fruit on estate developments.

The industry has been expanding rapidly in recent times. Harvest areas have doubled since 1990 and production has increased by about 165% (Figure 3.1). Oil yields compare favourably with those achieved in Malaysia and export earnings have increased substantially.

Figure 3.2 PNG oil palm industry performance

		1990	1995	2000	2005	2007
Area harvested	'000 ha	45.5	62.0	72.0	88.0	96.0
	% change	..	36.3	16.1	22.2	9.1
Palm oil production*	'000 tonnes	145	225	336	310	384
	% change	..	55.2	49.3	-7.7	23.9
Palm oil yield**	t/ha	3.2	3.6	4.7	3.5	4.0
	% change	..	13.9	28.6	-24.5	13.5
Value of exports (fob)	million kina	33	142	307	391	672
	% change	..	334.9	115.6	27.7	71.7

Source: Oil World 2008; FAO 2009b.
* Excludes palm kernel oil
** Palm oil yields are estimated to be around 3.9t/ha in Malaysia in 2008

In 2007 there were 96,000 ha of oil palms but more recent estimates suggest it has increased to 128,000 ha. Cultivation areas are almost evenly split between smallholders (58,000 ha) and large scale plantations (70,000 ha). The cultivation areas expanded at almost 7% per year over the period between 1995 and 2006. During this time, smallholder areas increased by 4.3% and plantation estates increased by 8.3%.

[44] ITS Global, (2009)

The amount of land used for oil palm is relatively small because the industry is limited to a few regions with suitable growing conditions. Around 166,000 people currently live in rural households that produce oil palm.[45] Many others earn incomes from occupations connected to the industry including those employed to maintain the oil palm cultivation areas.

Industry output is dominated by developments in the Hopkins plantation area. It accounts for about half of the total cultivation area. In 2007 the annual production of fresh fruit bunches (FFB) was estimated at 2.2 million tonnes. Yields are significantly higher for the commercial plantation areas. Approximately 0.7 million tonnes were supplied by small holders and 1.5 million tonnes were supplied by large scale plantations.

Most of the processed palm oil is sold on export markets. Palm oil surpassed coffee as PNG's top agricultural export earner in the year 2000. Over the decade palm oil has accounted for around 39% of PNG's agricultural export earnings. The rapid industry growth is clearly shown by a comparison with previous periods. In the 1980s palm oil's contribution to agricultural export earnings averaged around 13% and in the 1970s it averaged around 5%:

- Annual export earnings averaged around K420 million from 2004 to 2006.
- In 2007 export earnings were K640 million which reflected the high world price for crude palm oil that were evident in that year.

Taxation revenues on export industries are an important feature of PNG's budgetary position. The government currently applies a withholding tax of 5% on timber and fish exports. This tax is also applied to mining and petroleum exports. An additional flat rate duty is levied on all timber exports. There are no specific tax imposts on exports of agricultural products. But companies exporting these commodities contribute to government revenue through standard corporate taxation.

Figure 3.3.Contribution by value of the main cash crops to agricultural exports (%), by decade, 1951–2006

Decade	Cocoa	Coffee	Rubber	Tea	Copra / copra oil)	Palm oil
1951-1960	7	2	12	0	79	0
1961-1970	23	24	7	0.4	46	0
1971-1980	25	43	2	3	22	5
1981-1990	19	47	1	4	16	13
1991-2000	10	42	1	2	14	31
2001-2006	20	31	1	2	7	39
Overall % difference	**13**	**29**	**-11**	**2**	**-72**	**39**

Source: Bourke & Harwood (2009)

[45] Bourke, R. M., & Harwood, T. (2009). *Food and Agriculture in Papua New Guinea*, Edited report published by ANU E Press

Export growth for commodities like palm oil will generally lead to higher taxation revenues. In PNG, tax revenues derived from the rapid expansion of the palm oil industry has already added significant benefits for the economy. One company alone, New Britain Palm Oil Ltd, paid $US58.9 million in company tax in 2009. Government revenue in 2009 was $US2,264 million.[46] Therefore the tax payments by New Britain Oil Palm Ltd contributed for 2.6% of total revenue.

3.3 The contribution of palm oil to local economies

Industry development has been largely based around a cooperative plantation approach known as the *nucleus estate and smallholder* (NES) model.[47] This involves the establishment of large scale cultivation and processing facilities by a palm oil company. Local villagers are encouraged to establish individual cultivation plots on land surrounding the estate. They have a lease that requires them to grow oil palms. The company purchases and processes their output.

This sort of development has substantial poverty alleviation benefits for the local community. Apart from the small holder plots it creates jobs and income earning opportunities. They enhance regional economic development as well as supporting downstream job creation and earning export income for the benefit of the wider economy.

This approach can also be highly beneficial for local communities from a social welfare perspective. It generally involves the provision of roads, bridges, community centres, health and education services and communication infrastructure. This reduces the financial burden on the government to provide social services.

There are approximately 166,000 households in Papua New Guinea where household members are involved in palm oil cultivation.[48] There are a further 16,000 people directly employed in palm oil processing. The industry is second only to the public service in terms of formal employment; and marginally ahead of PNG's forest industry.[49]

While this is a relatively small proportion of PNG's rural population it is important to remember the multiplier effects extend beyond the immediate village areas. Job creation and income generation benefits occur in service industries and downstream marketing activities. Expansion of the industry to other suitable locations would extend the development and poverty alleviation benefits:

- In some areas palm oil production offers a potentially more lucrative option in place of the weaker growth prospects for other agricultural production and alternative land uses.

[46] CIA World Factbook, Papua New Guinea Economy 2010, page 2.
[47] ITS Global, (2009)
[48] Bourke, R. M., & Harwood, T. (2009)
[49] World Bank (2010) Papua New Guinea: Smallholder Agriculture Development Project (SADP) (IDA Credit No 43740-PNG). World Bank, Washington.

- For some more remote, undeveloped village areas the industry offers a way to make the transition from subsistence food production to commercial agriculture and more reliable sources of income.

Agriculture is likely to remain a central pillar of the PNG economy for some time. The Government has recognized the need to encourage large scale agricultural projects as part of its medium term development strategy. The government sees the industry as a vehicle for rapid improvements in rural living standards and increased export earnings.[50]

The 2009 Annual Report of the New Britain Palm Oil Limited highlights the contribution of palm oil to the West New Britain economy. The Provincial Government is a shareholder and gains a return like other investors. Apart from job creation and government revenue benefits, the company also contributes to social welfare services and infrastructure development in specific locations:

- Comprehensive health cover was provided to 32,000 employees at four medical centers and 32 aid posts. The 80 staff members treated outpatients and made off-site attendance visits. A new medical centre and temporary aid post was constructed in a remote area.
- The New Britain Palm Oil Foundation spent $US181,516 on infrastructure projects.
- Education assistance is provided to employees through primary school fees subsidised by up to 90% for up to three children per family – three primary schools are fully maintained by the company. Full secondary school tuition is also provided for up to three children per family. There are 3,300 children of company employees enrolled in schools in West New Britain and the company provides transport to and from the schools.[51]

Small holders are a significant component of the supply chains for large scale plantation estates. For example, Ramu Agri-Industries Ltd is currently increasing its oil palm cultivation area from 5,500 hectares to 7,500 hectares. A portion of this expansion includes small holder plantation areas which will increase from 100 hectares to 750 hectares.

Small holder cultivation has also become an independent source of income for women. For example, in 1997 the Oil Palm Industry Corporation introduced a scheme in the Hoskins project area that enabled women to set-up their own account at the milling company. Payments for collecting fresh fruit bunches for processing are made directly into their accounts. Women that participate in the scheme receive an average weekly income of K49:

- Establishing separate FFB delivery accounts for women have ensured a higher proportion of income generated by small holder growers is spent on family needs.

[50] World Bank (2010)
[51] New Britain Oil Palm Corporation Limited (2009), *Annual Report 2009.*

Incomes from small holder production and employment in plantation cultivation and oil palm processing have a substantial multiplier effect on village level economies.

3.4 Potential for development of PNG's agricultural resources

A number of physical and structural impediments are holding back the development of PNG's agricultural sector. There is considerable scope for the sector to boost its contribution to the country's economic development. But the potential to harness the natural resource endowment for this purpose will depend on policy and institutional settings.

Economic development benefits could be achieved in a number of rural industries. For example, it has been suggested that PNG could easily double its forestry production. The benefits of more jobs, tax revenues, local royalty payments and export earnings could generate a proportionate rise in the country's GDP.[52] Around 10,000 people are employed in the industry. Doubling the industry output would have a substantial positive development impact in a number of regional economies:

- It was estimated that PNG lost around $US20 million in government revenue in 2004 by failing to fully utilise its annual sustainable harvest from native forests.[53]

For the agricultural export industries a natural limitation on future development is the availability of suitable land. PNG is a highly mountainous country with large tracts of inaccessible, forested land. The main tree crops are restricted to areas with the required climatic conditions. For example, coffee is grown in the highlands and oil palms are grown in specific lowland areas:

- Only 7% of the land base is high quality agricultural land and 20% is of moderate quality.[54]
- From a development perspective PNG needs to fully utilize the land suitable for agriculture.

The government's development strategy notes the importance of large scale agricultural projects such as oil palm plantation estates. There are concerns about deforestation and PNG land use in general. But the amount of agricultural land is only just over 1 million ha – about 2% of the total land area. The growth in agricultural land areas has not been especially excessive and since 1990 it has increased by just 163,000 ha.[55]

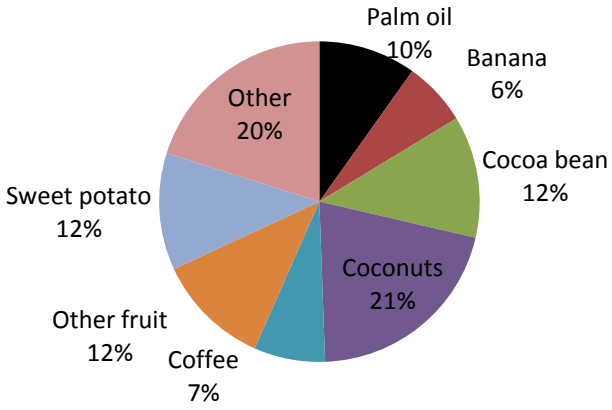
Developments of tree crops such as oil palm, coffee and cocoa are not large users of the land suitable for agriculture and there is considerable scope for growth.

[52] Curtin, T. (2004). How Poor is Papua New Guinea? How Rich Could It Be? page 11.
[53] ITS Global, (2006)

[54] Bourke, M., & Allen, B. (2009). 'Twenty myths about Papua New Guinea Agriculture', in Food and Agriculture in Papua New Guinea (Ed. Bourke, R. M. and Harwood, T). Edited report published by ANU E press.
[55] ITS Global (2009)

About 190,000 ha are used for coffee and cocoa and the amount of land currently used for oil palm plantations is minimal – an estimated 128,076 ha in 2007.[56] In some cases the land used for oil palm developments has been previously used for forestry and subsistence agriculture.

Figure 3.4 Harvested area of major crops as a proportion of PNG's total agricultural land



Source: FAO Stat (2008)

Current and planned expansions of oil palm cultivation areas are not excessive from a land use perspective. Further growth can be accommodated and additional investment should be encouraged with appropriate consideration of the environmental impacts. With suitable policy settings output is likely to expand over the medium term in view of the promising global outlook for demand.

Continued accelerated development of PNG's agricultural resource base is the best course of action for alleviating poverty – especially in the remote and poor regions of PNG. Industry developments will have to match up with locations that have the required growing conditions. Palm oil has strong prospects for sustainable long term growth and is ideally suited to particular lowland areas:

- The evidence from previous oil palm developments shows the benefits for regional and village level economies.
- Policy and institutional settings need to ensure that sufficient suitable land is made available for the expansion of cultivation areas of oil palm oil and other export crops that can generate high returns.

[56] Bourke, R. M., & Harwood, T. (2009)

Dutch Disease in PNG

Dutch disease is an idea that seeks to explain the apparent relationship between increased exploitation of a natural resource and a decline in the country's manufacturing sector. The term was coined by the publication *The Economist* to describe the decline of the manufacturing sector in the Netherlands following the discovery of a large natural gas field in 1959.

In a simple model of a small open economy with two exports - one based on the exploitation of a natural resource and the other on manufacturing - the expansion of the natural resource sector increases exports from that sector. This in turn, has two impacts on the rest of the economy:

- First, the expansion of natural resource exports increases the demand for certain domestic resources, particularly labour. This increases wages in the natural resource sector (given a fixed supply of skilled labour in the short run) and results in rising wages in both the non-traded and manufacturing sectors. The outcome is a reduction in the international competiveness of the manufacturing sector. This is known as the 'resource movement effect'.
- Second, the additional foreign exchange earned can cause an appreciation of the real exchange rate and lead to further eroding of the international competiveness of the manufacturing sector. This is the 'spending effect'.

Both are short run effects. Their impact over the medium run depends on how the additional national income is spent. To the extent that it is used to increase productivity, these effects will tend to offset the initial spending and resource movement impacts on relative prices. For example, if all the additional foreign exchange is invested in assets denominated in other currencies — such as through a Sovereign Wealth Fund — the potential impact on the host economy would be largely neutralised. For this reason, the net impact of the additional income cannot be predicted *a priori.*

The source of the increased foreign exchange that triggers the 'crowding out' of the other economic activity could come from any source. It does not have to be limited to an increase in exports from a natural resource sector such as mining or petroleum, but could be caused by a shift in global demand favouring the good in question, an increase in foreign aid or inwards foreign investment.

The overall effect of this process is to reduce the competitiveness of a country's exports and increase reliance on imported goods. This has the effect of pushing up the domestic price of goods and effectively de-industrialising a nation's economy.

Contracting 'Dutch Disease' – risks of a resource boom in PNG
The PNG resource sector is currently experiencing a boom in demand for its products. Several large resource projects are currently being developed, most notable PNG's $16 billion LNG project. The resource boom brings many potential benefits to PNG's economy, but also raises the risk of Dutch Disease.

In PNG's context, a large inflow of foreign capital due to the current resource boom could cause the real exchange rate of the PNG Kina to appreciate. This could result in a de-industrialisation of the economy by reducing the competitiveness of PNG's exports and increasing demand for imported goods.

Avoiding the symptoms of 'Dutch Disease'
The economic processes are complex, and as such it is difficult to accurately 'diagnose' Dutch Disease. Nonetheless, PNG would be wise to institute pre-emptive measures to avoid the problem.

Economists believe diversified economies are better equipped to avoid the problems associated with Dutch disease. Economies that rely on a particular resource export are particularly susceptible to the processes outlined above. Investment in PNG agricultural industry has the potential to off-set the risk of Dutch Disease. PNG's palm oil industry in particular, should be seen as a viable option for a diversified national economy.

Chapter 4 – Micro level impacts of PNG palm oil production

Industry developments suggest the returns on investment in large scale oil palm plantations in PNG are relatively high. This view is supported by the willingness of companies to fund local infrastructure developments and the provision of social services. There are also strong indications that small holder producers enjoy good returns from their involvement in the industry.

Small holders attached to the '*nucleus estates*' retain an independent interest in their communal land. The establishment of central processing facilities provides access to export markets and returns based on world trading conditions. Apart from the direct benefits for growers this approach provides a basis for village communities to become more integrated into the market economy.

Communities involved in the palm oil industry benefit from job creation and improved social welfare services. Higher incomes circulating in the local economy has a multiplier effect on economic activity. They also gain better transport and communication services which improve their linkages to other centres of commerce.

The economic returns on palm oil production is central to the proposition that further investment and industry growth would be beneficial for the development of PNG economy. It is worthwhile reviewing the available evidence on the size of these returns.

4.1 Returns from palm oil production

Palm oil has become a major component of economic activity in the regional economies where the industry is located. The World Bank reports that there are approximately 18,500 smallholder lots in Papua New Guinea. Increases in household incomes for palm oil growers have been sustained for the past 15 years. An assessment of PNG's four key cash crops – coffee, palm oil, cocoa and copra – between 1994 and 2009 shows palm oil delivered the highest cumulative increases in real incomes.[57]

The World Bank has projected high returns for smallholder plantings (2 hectares) in Papua New Guinea.

Projected financial rates of return are approximately 24 per cent, representing higher rates of return than any alternative smallholder investment opportunities. Returns to land and labor are also high at approximately K2,793/ha and K130/workday. This compares favourably to K1,136/ha and K21/workday for cocoa. Workday returns for coffee (K13) are 10 per cent of those for palm oil. Smallholders on 2 ha plots receive an annual income of K5,586. A full time

[57] Mellor, D. (2010). Social impact of commodity price volatility in Papua new Guinea. *Poverty and Sustianable Development in Asia,* Figure 3, page 69, *Poverty and Sustainable Development,* Asian Development Bank.

worker on minimum wage received K3200 annually.[58] These estimates were backed up with empirical data that showed smallholder incomes from oil palm blocks had been above average smallholder incomes for other crops in Oro Province, even when world palm oil prices were low.[59]

The Bank also notes high economic rates of return at approximately 16.7 per cent, with an net present value (NPV) of USD1258/ha. It should be noted that these figures are for cultivation only and for smallholder production, which has yields roughly 50 to 75 per cent of commercial estates.

Another study on PNG calculated the estimated NPV of palm oil returns to be $US9,275 per hectare.[60] In comparison the estimated NPV of returns on commercial mixed farming was $US2,247 per hectare. Returns on tropical teak plantations in NPV terms were estimated at around $US3,500 per hectare.

Figure 4.1 Economic returns from PNG land uses

Activity	Net Present Value (US$/ha)*
Large scale oil palm plantation	9 275
Subsistence crops	745
One-off timber harvesting	1 099
Voluntary carbon payments **	994

* NPV in 2007 dollars based on a 10% discount rate over 30 years.
** Based on an assumed carbon price of US$4.40/tonne.
Sources: Grieg-Gran 2008; Butler 2009.

The large difference in returns evident in these studies confirms the attractiveness of investing in oil palm cultivation. It also suggests returns for small holders would be highly favourable. The high returns on palm oil production are not limited to PNG. For example, returns from cassava, rice and smallholder rubber production in Indonesia have been estimated at $US19, $US28 and $US72 per hectare respectively.[61] It is not surprising that developing economies in the immediate region have experienced a rapid expansion in the palm oil industry.

Other major oil palm producing countries have had similar experiences. In Indonesia the NPV of returns on a hectare of oil palms over a 25 year life span has been estimated at IDR2.9 million for a discount rate of 20 per cent.[62] The report that summarised this analysis suggested the high cost of capital may be a deterrent to smallholders in planting oil palms.

However, the analysis also found that returns to labour of IDR19,635 were significantly higher than returns on a range of other work opportunities in

[58] World Bank (2010)
[59] Op Cit (2010)
[60] ITS Global (2009)
[61] World Growth (2009). *Conversion: The Immutable Link Between Forestry and Development,* page 22.
[62] Papenfus, M, *Investing in Oil Palm: An Analysis of Independent Smallholder Oil Palm Adoption in Sumatra, Indonesia,* page 8.

Sumatra which varied between IDR5,000 to IDR10,000.[63] It concluded with the observation that "independent small holder oil palm offers the largest returns to land and labour" and that lower labour requirements for oil palm cultivation make it an attractive land use option for small holders.[64]

Another report estimated the NPV of returns for large scale oil palm plantations in Indonesia was $US3,340 per ha with small holders gaining a return of $US2,340 per ha. [65] It suggested small holders in Indonesia gained an internal rate of return of 19%.

4.2 Economies of scale and productivity improvements

Small holders are a large and growing proportion of oil palm cultivation in the major producing countries. This suggests the benefits of economies of scale from large scale cultivation may not be a critical factor at this stage of the industry's development. In fact the evidence indicates there is scope for higher net returns by small holders from farm performance improvements.

In Malaysia both small holders and estate plantations have been expanding but small holders are the major contributors to industry output.[66] In 2008 government settlement schemes for small holders accounted for 28% of Malaysia's palm oil areas and privately-owned small holders accounted for another 12%. In Indonesia some 43% of palm oil areas were owned by small holders in 2006.[67]

Oil palm yields vary with the introduction of new varieties, variations in seasonal conditions and alternative fertiliser application rates. A recent study by World Growth (2009) indicated there was considerable potential for small holders in Indonesia to expand output on existing acreages through the use of fertiliser and new genetic stock.[68] Higher yielding varieties illustrate the potential for output and income growth without the need for an expansion in acreages.

The scale of farming units and their output performance are questions that relate to productivity. In simple terms productivity refers to the efficiency of input use in a production process. Productivity levels measure the ratio of output to inputs. For example, an increase in per hectare palm oil yield would signify a productivity improvement for land inputs. A per tree yield increase would signify a productivity improvement for biotechnology inputs.

These are partial measures of productivity performance. They are often used to show the change in output relative to the use of a key input in the production process (for example labour productivity, land productivity, etc). Total factor

[63] Papenfus, op cit, page 9.
[64] Papenfus, op cit, page 10.
[65] Zen, Z., Barlow, C., & Gondowarsito, R. (2005). *Oil Palm in Indonesia's Socio-Economic Improvement: A Review of Options*, page 12.
[66] World Growth, *Palm Oil – The Sustainable Oil,* September 2009, page 11.
[67] Ibid.
[68] Ibid.

productivity is a more comprehensive measure of performance. It takes account of changes in the contribution of a group of key inputs.

Productivity growth occurs when output growth exceeds the amount of input growth over a specified time. In other words more output is created from a given level of inputs or the same output is obtained from fewer inputs. The key point of difference between small holders and plantations is labour. The low cost of labour in PNG dilutes the pressures to move to larger scale production units to achieve gains in productivity and net returns:

- Incorporating small holders into oil palm plantation developments has not been detrimental to the international competitiveness of the industry in PNG and the scope for productivity gains by these producers provides a means to further improve competitiveness.

Dispersing a portion of the oil palm maintenance and harvesting activities among small holders has some benefits for the processing companies. It reduces their labour costs and land rent expenses while retaining a guaranteed supply of FFBs. It also passes some of the production and international price risk to individual farmers:

- Integrating individual villagers into the market economy through small oil palm holdings includes a willingness to accept the fluctuations in market returns.

Some families retain a direct farming interest in their communal land areas through the nucleus estate developments. The entire community benefits from the companies investing a portion of their returns on local infrastructure and social services. The cost of these developments will be reflected in land rents and the returns received by small holder producers. This is a mutually beneficial outcome as it builds a more harmonious business relationship with the local community.

This approach can potentially generate significant socioeconomic benefits from investments such as the proposed Sigite-Mukus project in East New Britain. This is important in some areas of East New Britain where poverty and lack of access to social services is a major challenge. Palm oil projects can more rapidly deliver outcomes in areas where Governments have limited resources and implementation capacity.

The need for small holders in New Britain to expand cultivation areas is not seen to be a priority by the World Bank in its small holder agriculture development project. It noted that economic gains will come from "improving the productivity of smallholder oil palm blocks through the efficient use of fertilisers and improved harvesting practices".[69]

[69] Ibid.

Holden, Bale and Holden (2003) observed that small holder productivity and output is a cost effective driver of growth. It suggested accelerated small holder growth should be a development objective and that policies need to reflect the mutual dependence of smallholders and plantations.[70]

Another study found that oil palm has been one of the more successful rural developments in PNG.[71] It was based on an analysis of the outcomes of the Hoskins and Popondetta palm oil projects. The study concluded that the key challenge was to improve the per hectare productivity of small holders which is much lower than productivity on estate plantations.

The challenge of achieving sustainable yield improvements on small holdings of oil palm is significant. There has been progress but deteriorating transport infrastructure and insufficient extension officers is restricting the achievement of further productivity gains.[72] Some additional specific challenges for small holders in the Hoskins and Popondetta schemes include land disputes that inhibit replanting, rental arrears and a view that replanting is unnecessary.

Most studies have found that small holder oil palm producers can improve their financial situation through productivity changes on existing acreages. Increased scale through larger cultivation areas is not necessary to achieve this outcome. In general government policies and private sector nucleus plantation developments need to focus on two areas – encouraging the planting of higher yielding varieties and improvements in extension and infrastructure services.

4.3 Investments in local infrastructure

The economic benefits of infrastructure investments in oil palm estate developments often fail to get the recognition they deserve. The proposed Sigite-Mukus in East New Britain development provides an example of what can be achieved. The *Environmental Impact Statement* (EIS) for the project specifies that three oil palm mills with corresponding crude oil bulking stations will be constructed. They will be located near the coast, within pumping distances of jetties built to receive transport barges:

- The proposed Sigite-Mukus oil palm development includes an investment of K250 million ($US93 million) to build three oil palm mills.[73]

The project will have important social development benefits in the Pomio District. There are plans for the company to build new transport infrastructure as well as education and health facilities. A flow-on effect is that local authorities will need to provide other public services and facilities, including policing to

[70] Holden, P., Bale, M., & Holden, S. (2003). *PNG – a private sector assessment,* Enterprise Research Institute, ADB, pages 72-73.
[71] Kosczberski, G., Curry, G., & Gibson, K. (2001). *Improving Productivity of the Smallholder Oil Palm Sector in Papua New Guinea: A socio-economic study of the Hoskins and Popondetta Schemes.* Executive Summary, page xvi. Papua New Guinea Oil Palm Research Association.
[72] Kosczberski et al, op cit, page 146 and pages 151-160.
[73] EIS (2009). Environmental Impact Statement for Sigite Mukus oil palm development.

maintain law and order. The income and tax revenues generated from the project will enable the local authorities to fund these new services.[74]

A number of community welfare improvements will be generated by these investments. They include greater financial security, better housing, improved delivery of government services, access to more transportation and communication services, better education outcomes for schoolchildren, improved community health from access to medical facilities and higher government taxation revenues:

- The Sigite-Mukus investment in roads and bridges will improve community access to social services available elsewhere in the Province – this has been a major concern for the local communities for some time.

A road network that is properly maintained is a critical prerequisite for the oil palm and reforestation components of the project. It is essential for vehicles to have unimpeded access during the planting, maintenance and harvesting activities. Three types of roads will be built and to provide a network of linkages among rural villages and urban centres:

- FFB collection roads will provide access to the cultivation areas to consolidate the harvest.
- Transportation roads will facilitate the movement of the FFBs to processing mills as well as provide access for landowners and plantation workers.
- Main roads will connect the processing mills to the crude palm oil bulking terminals at the jetties built to receive transport barges.

But the construction and maintenance of road networks have wider economic benefits for the local communities. It provides new opportunities for commerce and employment that contribute to rural poverty alleviation. Road networks are vitally important for forestry projects in remote areas of PNG. They have also had wider development benefits in some regions and similar gains can be expected from oil palm investments such as the Sigite-Mukus project:

- Case studies on the forestry industry in the Gulf and Western provinces show that improved road services are highly valued by local people for reasons other than the industry supply chain requirements.
- Road maintenance expenditure by the logging companies are substantially greater than that provided by either provincial or National governments. [75]

[74] Ibid.

[75] ITS Global, 2006, *The Economic Importance of the Forestry Industry to Papua New Guinea*, pages 37-44 provides details of a case study of the socio-economic impacts of the Wavoi Guavi project in Western Province. Based on an analysis of the 2006 Western Province budget, it concluded (page 44) that "government spending on similar transport infrastructure in the region of the Wawoi Guavi project is a minute proportion of the investment by Rimbunan Hijau." ITS Global, 2007, *The Economic Contribution of Rimbunan Hijau's Forestry Operations in Papua New Guinea,* reports the outcomes from a similar case study on Gulf Province. It concluded (page 36) that expenditure on roads by the Gulf Provincial Government was low compared with road investments by Rimbunan Hijau. Both studies concluded that road investments by Rimbunan Hijau are valued highly by local people.

The expected benefits of the Sigite-Mukus project investment in road access are consistent with the views of the World Bank. Rehabilitation and maintenance of the provincial road system is seen as one of the four economic benefits of its small holder development project.[76] It is expected to benefit the wider rural economy while also increasing the effectiveness of the collection of oil palm FFBs.

The infrastructure levy in the Sigite-Mukus project is expected to deliver benefits of K28 million (2008 prices) to local landowners over a 25-year period.[77] Investments in regional road projects are likely to be much higher than government spending on road works. For example, East New Britain's Provincial Budget for 2008 allocated just K330,000 for road related projects out of total budgetary expenditures in the Pomio District of K2,034,000.

New Britain Palm Oil Limited makes a major contribution to regional road construction and maintenance. A tax credit scheme allows for up to 1.5% of a company's taxable revenue to be used for public infrastructure spending. In 2009 the Corporation spent K9.4 million on repairs to national highways, bridges and feeder road networks. A further 28 projects valued at K6.8 million have been identified and are awaiting government approval for 2010.[78]

Further evidence of the benefits of spending on road infrastructure is found in a World Bank report on a road maintenance and rehabilitation project in PNG. The project monitored poverty and social indicators over a three year period in six provinces including East New Britain. The report indicated better road access increases the number of girls attending secondary school and increases family incomes because more trips can be made to village markets.[79]

Maintenance of road access is critical for raising health and education standards in regional areas. In East New Britain the annual population growth rate averaged 2.5% between 1980 and 2000. There are 7,591 people per health centre and 2,621 per aid post in the province.[80]

Oil palm plantation developments like the Sigite-Mukus project help to alleviate the pressure on the limited health facilities that are available in remote areas. The Sigite-Mukus project is located in an area where health outcomes, particularly for children, are poor. Lack of proper sewage facilities and clean water supply in surrounding villages affects the health of the local population.[81] The development will lead to improvements in living conditions and human health outcomes.

[76] World Bank (2010)
[77] EIS (2009)
[78] New Britain Palm Oil Limited, op cit, page 26.
[79] CPCS (2007). *Special Report, Project Completion – Papua New Guinea.* Available at: http://www.cpcstrans.com/media_room/_special_reports/SR%202007%2010.pdf
[80] National Research Institute (2010) *East New Britain Province.* Available at: http://www.nri.org.pg/research_divisions/cross_divisional_projects/16%20East%20New%20Britain%20AND%20Manus.pdf
[81] EIS (2009)

The potential flow-on benefits from plantation developments extend to other areas of economic activity. There are direct expansionary effects for commercial services that support the development. It has a multiplier effect in areas such as stevedoring, transport services, input suppliers, mechanical maintenance services and food production. There are also potential opportunities for tourism and recreational businesses:

- There is evidence that shows the lowest rural poverty rates are found in areas surrounding Port Moresby and Lae, along the Highlands Highway, adjacent to major mining projects and in coastal areas with significant oil palm developments.[82]
- Infrastructure development, especially in the form of road access, plays an important role in stimulating commerce, jobs and improvements in social services.

4.4 Financial gains for community land owners

Another micro level benefit of the oil palm developments is the financial reward for communities in exchange for the use of their land. Companies pay land use royalties and contribute financially to community activities in other ways. For example, the Sigite-Mukus project is expected to contribute royalties, premium payments, infrastructure levies and other community funding worth K834 million (2008 prices) over the life of the project. This is around K33.4 million ($US12.5 million) per year.[83]

These direct financial payments provide an injection of wealth into the local communities. For the Sigite-Mukus project they will accrue over a 25 year period and come from two sources – timber from cleared land and oil palm from plantation trees. The *Economic Impact Statement* for the project provides some details of the expected size of these payments.

Over the 25 year period the Sigite-Mukus project is expected to make payments from the use of timber resources of:

- K12.3 million for royalty payments.
- K6.1 million for premiums.
- K28 million for Infrastructure levies.
- K1.2 million for other levies and contributions.

The Sigite-Mukus project is also expected to make payments from the production of oil palm from plantation trees of:

- K490 million for royalties on FFBs.
- K5 million for land rental fees.

[82]Gibson, J., Datt, G., Allen B., Hwang, V., Burke, R., & Parajuli, D. (2004). *Mapping Poverty in Rural Papua New Guinea*. Available at: http://www.ciesin.columbia.edu/repository/povmap/methods/PEB_Poverty_Mapping(Papua%20New%20Guinea).pdf. The importance of roads in East New Britain

[83] EIS (2009)

- K9.8 million for export development levies.
- K37.5 million for premiums from tree farming.
- K244.5 million for joint venture dividends.

Chapter 5 - Climate change issues for PNG palm oil

The role of forest lands in global greenhouse gas (GHG) emissions and climate change is an issue of some interest. Deforestation for alternative land uses and forest degradation from timber harvesting are considered by some to be a significant cause of increased emissions. An associated issue is the release of carbon when forest peat lands are used for alternative land use developments.

Many environmental NGOs claim carbon release from disturbing a natural forest cover is a sufficient reason to halt the conversion of forest land to oil palm plantations. It has focused attention on the industry's expansion in regions with large areas of natural forest. Land use changes in countries such as Indonesia, Malaysia and PNG have been subjected to world-wide scrutiny.

The growth of the palm oil industry has been the target of extensive environmental campaigns. But there are considerable uncertainties in measuring the net effect of GHG emissions from changes in forest land use. There are also important implications to consider about the effects of land use constraints on economic development and poverty alleviation:

- Land use constraints and/or limitations on oil palm developments will have an economic and social welfare cost in developing economies like PNG.

5.1 The political campaign against palm oil

Environmental NGOs have been running a political campaign against the palm oil industry in South East Asian developing economies for some time:

- Greenpeace has claimed that oil palm plantations are causing widespread deforestation in South East Asia which accounts for 20% of the world's GHG emissions.
- The Friends of the Earth organisation has claimed that oil palm plantations have been the leading cause of destruction of orang-utan habitats. [84]

Political decisions to set biofuel and renewable energy targets in some countries have strengthened the demand for palm oil. This has alarmed the NGO activists and they have intensified their campaign against new plantations. In general the campaign has focused on establishing a perception that palm oil is an environmentally destructive product and no further developments should be allowed.

The campaign has several elements under an over-arching theme of environment degradation. The industry stands accused of being a primary cause of

[84] Friends of the Earth (2005). *The Oil for Ape Scandal: How palm oil is threatening orang-utan survival.* Available at: http://www.foe.co.uk/resource/reports/oil_for_ape_full.pdf

deforestation, unsustainable farming practises and contributing to a loss of bio-diversity. These accusations are tied to claims that industry growth is contributing to higher GHG emissions.

Plantation developments on native forest lands are seen to be causing a substantial release of carbon through tree harvesting, burning unwanted forest material and exposing peat land swamps. It is an emotive, one-sided perspective that fails to acknowledge any off-setting factors.

There is virtually no recognition of the carbon absorption effects of planting oil palms. It also implies there are no environmental controls on the industry and that processors can do as they please. The over-all impression is that the scale of the land use changes in forested areas is huge. This is despite the fact that in countries like PNG the industry is a tiny user of the available land area.

The campaign is directed at growers, processors and consumers. It targets companies that invest in plantation developments and large corporations that use palm oil in processed foods or industrial products. There is a focus on the two major suppliers – Malaysia and Indonesia. Other countries such as PNG have also come in for attention even though many of the accusations are not applicable or have an insignificant impact.

A balanced evaluation of the claims made by environmental groups suggests the impact of palm oil developments has been exaggerated. The industry has been unfairly labelled as the leading cause of environmental damage and bio-diversity losses in particular countries. The over-riding impression is that oil palm cultivations have been the sole cause of native forest destruction and increased GHG emissions in Indonesia and Malaysia.

The case against palm oil appears to be motivated by a broader campaign against agricultural development and forestry land use in general. The net effect of land use changes on GHG emissions is a reasonable question to investigate. But the one-sided nature of the palm oil campaign suggests the issue is being used to raise the profile of objections to forest land use in general.

The campaign strategy is to encourage a consumer boycott of products that use palm oil. It also aims to pressure food manufacturers and industrial users into using alternatives to palm oil. A further element of the strategy is to have governments in developed economies put pressure on the major producing countries to halt the industry growth. Trade restrictions have been suggested as a way to achieve this objective.

Europe has been a primary focus of this aspect of the campaign strategy. In recent times a concerted effort has been made to persuade EU governments to restrict imports. EU demand has grown as some member countries looked at palm oil as a low cost feedstock for bio-diesel production. This has been driven by the imposition of ambitious renewable fuel mandates.

The 2009 European Union Renewable Energy Directive has indirectly established trade restrictions on imports of crude palm oil for bio-diesel production. It includes standards and conditions that will also essentially exclude bio fuels imports from economies like Malaysia and Indonesia. These restrictions have been justified on the grounds that biofuels produced from crops grown on deforested land will have a greater carbon emissions effect than fossil fuels.

5.2 GHG emissions and deforestation

The central claim of the environmental campaign is that conversion of forest lands to alternative uses like palm oil is a major source of GHG emissions. It cites oil palm cultivation on peat land and indirect land use changes (ILUC) as the reason why the industry is a threat to climate change. But there is considerable uncertainty and debate about the data and models used to support these claims.

Palm oil is accused of being the primary cause of deforestation in South East Asia[85]. But this view is based on anecdotal claims and on-the-ground observations by staff of the environmental NGOs. The available analysis does not appear to support this claim:

- The Stern Review found only 20-30% of tree removal across South East Asia was caused by oil palm cultivation.[86]
- This is supported by numerous FAO reports which indicate that urban growth, subsistence farming, housing and firewood collection are the primary causes of deforestation.[87]

Some environmental NGOs have used the 2007 IPCC Report to claim that deforestation causes 20% of global GHG emissions. The report relies on research by Houghton[88] and DeFries[89] to support its findings. But the research conducted by Houghton has been criticised by Achard[90], Watson[91] and DeFries for overestimating the rate of tropical deforestation.

There are large differences in the deforestation and carbon emission estimates in these studies. DeFries estimates GHG emissions from deforestation are 1GtCyr^{-1} for the Pan-Tropical region. In comparison Houghton estimates the emissions at

[85] For example - May 2009, Greenpeace, "Neste Oil's plans for global leadership in palm oil diesel will drive massive rainforest destruction and climate change", http://www.greenpeace.org/seasia/en/press/releases/neste-oil-s-plans-for-global-l

[86] Greig-Gran, M.(2009).*The Cost of Avoiding Deforestation: Update of the Report Prepared for the Stern Review of the Economics of Climate Change*. International Institute for Environment and Development.

[87] FAO (2010). *Global Forest Resource Assessment 2010*. Available at: http://www.fao.org/forestry/fra/fra2010/en/

[88] Houghton, R.A. (2003). Revised estimates of the annual net flux of carbon to the atmosphere from changes in land use and land management 1850- 2000. *Tellus*, *55B*(2), 378–390.

[89] DeFries, R.S., Houghton, R., Hansen, M., Field, C., Skole, D., & Townshed, J. (2002). Carbon emissions from tropical deforestation and regrowth based on satellite observations for the 1980s and 1990s. *PNAS*, *99*(22), 14256–14261

[90] Achard, F., Eva, HD., Stibig, H-J., Mayaux, P., Gallego, J., Richards., T, & Malingreau, J-P. (2002). Determination of deforestation rates of the world's humid tropical forests. *Science*, *297*(5583); and DeFries, R.S., Houghton, R., Hansen, M., Field, C., Skole, D., & Townshed, J. (2002). Carbon emissions from tropical deforestation and regrowth based on satellite observations for the 1980s and 1990s. *PNAS*, *99*(22), 14256–14261

[91] Watson, R.T. (2000). *Land Use, Land Use Change and Forestry*, p.7. Intergovernmental Panel on Climate Change, Cambridge University Press. Available at http://www.ipcc.ch/pdf/special-reports/spm/srl-en.pdf

2.2GtCyr^{-1}.[92] The IPCC report sidesteps the issue by using an average of the two estimates:

- Rather than give a range of possible outcomes or investigate and confirm the deficiencies of the Houghton estimates, the IPCC report used an approach that inflates their conclusions on the emission estimates from tropical deforestation.

Houghton's estimates are based on FAO data which is primarily gathered through national reports to the UNFCCC[93]. Grainger[94] and Tucker and Townshend[95] have criticised the FAO estimates. They are based on varying definitions of forest cover and there is limited satellite based cross-checking of the estimates. The failure to use satellite verifications of the estimates ignores the fact that deforestation in developing economies is typically concentrated in certain areas. As a result, the estimates are often over-stated.

There are also inherent uncertainties in the accuracy of FAO data on deforestation. For example, the most recent *FAO Forestry Resource Assessment* significantly reduced the estimated deforestation rate in Indonesia between 2000 and 2005. It was reduced from an annual rate of 1.8 million ha (2% per year) to 0.3 million ha (0.3% per year)[96].

Several studies have found much lower estimates of the rate of deforestation using satellite imagery. An analysis by Achard on the rate of tropical deforestation has developed estimates that are between 23% and 54% lower than the rates used by Houghton.

There is also considerable uncertainty on the carbon stock value of different types of forest. National reporting to the UNFCCC and satellite imagery are not capable of providing detailed estimates. As a result, the amount of carbon stored in forested land is highly uncertain[97].

Most recently, initial research commissioned by the Government of Norway and the World Bank, stated that deforestation emissions contribute approximately 5 to 12 per cent of greenhouse gas emissions.[98] This contradicts the claims made by many environmental campaign groups that deforestation is responsible for as much as 20 per cent of global emissions.

[92] GtCyr refers to Giga tonnes of carbon per year, i.e. 1GtCyr^{-1} equals one Giga tonne of carbon per year.
[93] Baumert, K.A., Herzog, T., & Pershing, J. (2005). *Navigating the Numbers: Greenhouse Gas Data and International Climate Policy*. World Resources Institute, Washington DC
[94] Grainger, A. (1984). Quantifying changes in forest cover in the humid tropics: Overcoming current limitations. *Journal of World Forest Resource Management*, *1*, pp. 3–63.
[95] Tucker, C.J., & Townshend, J.R.G. (2000). Strategies for monitoring tropical deforestation using satellite data. *International Journal of Remote Sensing*, 21(6&7), 1461–1471.
[96] FAO (2010). *Global Forest Resource Assessment 2010*
[97] DeFries, R.S., Houghton, R., Hansen, M., Field, C., Skole, D., & Townshed, J. (2002); and Achard, F., Eva, HD., Stibig, H-J., Mayaux, P., Gallego, J., Richards., T, & Malingreau, J-P. (2002).
[98] Nancy L. Harris, Sassan S. Saatchi, Stephen Hagen, Sandra Brown, William Salas, Matthew C. Hansen and Alexander Lotsch. New Estimate of Carbon Emissions from Land-Use Change. Research produced for World Bank's World Development Report 2010: Development and Climate Change and the Norwegian government through the Trust Fund for Environmentally and Socially Sustainable Development, published at Forest Day, Cancun, Mexico, 2010.

Another recent study by Van der Werf has contradicted claims that deforestation causes 20% of global GHG emissions. Van der Werf states that IPCC estimates were based on out-of-date information and that tropical deforestation rates had been overstated.[99] The study found that deforestation accounts for 12% of global emissions rather than 20%. This lower estimate was due to a revision of the rate of deforestation and an increase in the use of fossil fuels:

- Claims by environmental NGOs that the palm oil industry is a primary driver of deforestation and a large contributor to GHG emissions from land use changes, are highly questionable.

5.3 GHG emissions from peat land cultivation

Current knowledge on carbon releases from using peat land for agricultural developments is limited. Therefore it is difficult to quantify the GHG emissions effect of cultivating oil palm on these areas with any degree of certainty. Further research will be required before an objective assessment can be made. Current claims made about the emission effect of peat land cultivations should be treated with caution.

Peat land soils have stored a significant amount of carbon and some nitrogen. When these land areas are drained for agricultural development it exposes the oxidised layer of decomposed plant material. Greenhouse gases are released into the atmosphere but the dimensions of this effect have yet to be clarified:

- It is likely there will be some variability in the concentrations of stored carbon between different peat land areas and even within a particular area – the age and depth of the decomposed material would presumably be a critical consideration.
- The rate and time path of carbon release from exposed peat lands is a further area of uncertainty.
- it is not known if the analytical results in one country would be equally applicable in another given differences in climate and topography.

Studies by Hooijer[100], Furukawa[101] and Jauhiainen[102] have been undertaken into the impact of peat land exposure and the degradation of peat land on GHG emissions. There is widespread agreement on the key factor in determining the scale of the carbon emissions release – the peat land drainage depth. But the studies have produced widely varying results.

A study by Delft Hydraulics and Wetlands International (2006) has estimated that 632 Mt of CO_2 per year is released because of peat fires and the drainage of peat land.[103] But other scientists think this estimate is overstated. The research

[99] Van der Werf, G.R., Morton, D.C., DeFries, R.S., Olivier, J.G.J., Kasibhatla, P.S., Jackson, R.B., Collatz, G.J., & Randerson, J.T. (2009). CO2 emissions from forest loss. *Nature Geoscience 2*, 737–738.F
[100] Peat-CO2, Hooijer et al., Delft Hydraulics, 2006
[101] Furukawa, Y. et al, (2005) Effect of changing groundwater levels caused by land-use changes on greenhouse gas fluxes from tropical peat lands , *Nutrient Cycling in Agroecosystems,* Volume 71, Number 1 / January,2005
[102] Jauhiainen, J., et al, (2005) "Carbon fluxes from a tropical peat swamp forest floor", Global Change Biology, Volume 11, Issue 10, pages 1788–1797, October 2005
[103] Above, n 22

doesn't consider the six types of flora communities that exist on peat land or the unique composition of tropical peat. Diverse layers and undecomposed material (e.g. large logs) would affect the estimates for tropical peat.[104]

There is considerable uncertainty in quantifying the level of carbon emissions from peat fires. Some research has been done on the effects of the Indonesian peat fires in 1997. The fires were heavily influenced by political instability and the El Nino weather patterns. Carbon emission estimates from the fires have ranged between 900MtCO_2e[105] and 3,200MtCO_2e.[106]

The Malaysian and Indonesian Governments have been taking an active interest in this issue because of its implications for emission levels and agricultural development. Indonesia imposed a one-year freeze on peat land conversion and both countries have initiated research into the effects of peat land conversions. Preliminary work has found that temperate and tropical peat lands have different rate of carbon release:

- There is a wide variation in the level of below ground carbon stock on a per ha basis and it would be misleading to assume a common GHG emission rate across all peat lands. [107]

While important the peat land emissions issue should be kept in perspective. As there are different definitions of a peat land there are varying estimates of the land area. [108] [109] In Malaysia estimates varying between 2.0 and 2.7 million ha. This represents 6-8% of the total land area and most of the peat land is in Sarawak.

In Indonesia estimates vary between is 22.5 and 27.0 million ha, accounting for 12-15% of the total land area. This includes substantial areas in Sumatra and Kalimantan. There are oil palm developments in these provinces but it would be misleading to imply that all these peat land areas are subject to current or potential industry developments.

There is limited data on PNG soil types but current estimates of peat land vary between 2.6 and 3.0 million ha. This represents 6-7% of the total land area. The peat lands are not in areas where the palm oil industry is currently located. [110] Data suggests peat land conversion to oil palm cultivation has not been an issue for PNG:

[104] Paramananthan, S., Tropical Lowland Peats: To Conserve or Develop Them? Param Agricultural Soil Surveys (M) Sdn. Bhd. Petaling Jaya. Selangor, Malaysia.

[105] Levine, J. (1999) 'The 1997 fires in Kalimantan & Sumatra, Indonesia: Gaseous & particulate emissions', Geophys. Res. Lett., 26(7).
[106] Van der Werf et al., (2008), Climate Regulations of Fire Emission and Deforestation in Equatorial Asia, PNAS.
[107] World Growth (2009), Palm Oil – The Sustainable Oil, PNAS.
[108] Peat-CO2, Hooijer et al., Delft Hydraulics, 2006
[109] UNFCCC (2006), Fact Book for UNFCCC Policies on Peat Carbon Emissions.
[110] Bourke, R. M. & Harwood, T. (2009). *Food and Agriculture in Papua New Guinea*, Edited report published by ANU E Press

- The GHG emissions effect of PNG forest land conversions to oil palm will be considerably less than those that arise from Indonesian developments on peat land soils.

5.4 Using palm oil as a biofuel feedstock

The net impact on GHG emissions from replacing forest land with palm oil plantations has not been clearly established. From the earlier discussion it is clear the effect is not as great as the claims made by the environmental NGOs would suggest. Some carbon is released when the forest land is cleared but the carbon absorbing properties of tree cover are not lost. There are off-setting absorption properties from the planting of oil palm trees.

The other element of the GHG emissions issue for palm oil is its use in bio-diesel production. The emerging markets for biofuels and other renewable energy have resulted in greater scrutiny of the GHG implications of using palm oil as a biofuel feedstock. Questions have been raised about the emission reduction benefits of different types of biofuels in comparison to fossil fuels.

It is generally accepted that palm oil provides higher GHG emission savings than most other biofuel feedstock.[111] Van Zutphen found that fuel based on one tonne of palm oil releases 835 kg CO2 equivalent. This compares favourably with the 1,387 kg released from one tonne of soybean oil and 1,562 kg released from a tonne of rapeseed oil. [112] The equivalent CO2 released by fossil fuel was estimated at 4,288 kg.

If land use changes are taken into account, it has been suggested there is very little emissions savings from using palm oil biofuel instead of fossil fuels. However, this claim is based on an analysis that only considered the carbon absorbed by oil palms over one life cycle of 20 years. Other research has shown that palm oil can repay the 'carbon debt' associated with cultivation on primary forest land after 86 years:

- If palm oil is grown on land used for other tree crops, fallow farm land or degraded forest land it generates large GHG emission savings in comparison to fossil fuels. [113]
- Oil palm plantations can be considered a carbon sink in the long term

A further consideration is the extent to which the processing systems for alternative feedstock crops can reduce GHG emissions through energy savings. Oil palm mills have considerable scope to lower emissions by generating energy

[111] Zutphen, H.V. (2007). *The CO2 and Energy Balance of Malaysian Palm Oil: Current Status and Potential for Future Improvements*. Paper read at 2nd Symposium n Sustainable Resource Development, 6 June, Brussels, Belgium.
[112] Reinhardt, (2009), 'GHG Balances of Biofuel Oil Crops: State of the art balancing scientific accuracy with the demands of policy makers', presentation at the International Palm Oil Life Cycle Assessment Conference, Kuala Lumpur
[113] Fargione, J. et al, (2008).Land Clearing the Biofuel Carbon Debt. *Sciencexpress*, February 2008.

from recycling the empty FFBs and mill effluent. Studies have shown that emissions by processing mills may be reduced by 99% using this practice.[114]

5.5 Biofuel demand and the ILUC requirement

Part of the strategy behind the environmental NGO campaign against palm oil is to put political pressure on governments in developed economies to impose import restrictions. Explicit market access constraints are an option but there are WTO trade commitments to consider. Some countries are receptive to the concerns about emissions from land use changes for oil palm developments and are considering alternative regulatory measures.

Currently the EU is attempting to introduce a concept called *Indirect Land Use Change* (ILUC) into regulations governing the sale of biofuels. Some other countries are also attempting to apply the concept to biofuel standards. The ILUC concept aims to quantify the carbon emissions from land cleared for agricultural crops that are used for biofuel feedstock.[115]

The intention is to measure the area of land use changes for the production of biofuels feedstock. Estimates of the carbon release from the ILUC area are used to calculate the GHG emissions balance of the biofuel produced from the crop grown on the land. It sounds like a straight forward exercise but this has not been the experience so far:

- There are measurement difficulties with the ILUC concept which heightens the risk of uninformed or manipulated estimates that distort the regulatory controls.
- EU implementation of the ILUC has been delayed because of difficulties in defining 'indirect impacts' and uncertainty surrounding the methodology.

Research by CE Delft[116] and the International Food Policy Research Institute[117] has found that palm oil is most efficient biofuel feedstock available. But these studies have also found that ILUC emission effects would lead to the exclusion of all biofuels and most bio-diesels under the *EU Renewable Energy Directive*. This has stalled the application of ILUC to fuel standards.

EU efforts to establish a suitable ILUC measurement methodology have so far been unsuccessful. A further deficiency of the current view of ILUCs is that it does not consider the off-setting effect of 'avoided deforestation'. This refers to

[114] Zutphen, H.V. (2007). *The CO2 and Energy Balance of Malaysian Palm Oil: Current Status and Potential for Future Improvements*. Paper read at 2nd Symposium n Sustainable Resource Development, 6 June, Brussels, Belgium.

[115] European Union (2009). The Directive on the Promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC. Preamble Article 85.

[116] CE Delft, June 2010, "Biofuels: indirect land use change and climate impact" accessed at: http://www.ce.nl/?go=home.downloadPub&id=1068&file=8169_defreportHCMV.pdf&PHPSESSID=3e792862bca2d06eddbcf7ba2144a21d

[117] Al-Riffai, P., Dimaranan, B., & Laborde, D. (2010).Global Trade and Environmental Impact of the EU Biofuels Mandate. International Food Policy Research Institute, http://www.ifpri.org/publication/global-trade-and-environmental-impact-study-eu-biofuels-mandate

land clearing that has been avoided because of high crop yields which is an important consideration for palm oil:

- The per ha equivalent yield of bio-diesel is much higher than it is for other oil seed crops such as soybean and rape seed.
- Attempts to quantify the ILUC of biofuels made from different feedstock would be incomplete if there is no allowance for avoided deforestation.

Palm oil substantially outperforms the broad acre crop based oilseeds in terms of per ha oil yields. This should make it the best option for bio-diesel on the basis of GHG emissions in growing and processing feedstock. But there are conflicting views on how to measure the emissions performance of the alternative feedstock for biofuels.

Some studies have shown that palm oil has a lower carbon footprint than other vegetable oil crops. For example, a life cycle analysis of palm oil has estimated the typical GHG emissions effect at 835 kg carbon equivalent. [118] Soybean emissions were estimated at 1,387 kg and rapeseed emissions were 1,562 kg.

These estimates do not account for the carbon storage performance of oil palm trees which would strengthen the relative position of palm oil even more. This raises questions about changes in land use and the comparative performance of natural forest and palm oil plantations as a carbon sink. Oil palm plantations mimic the carbon absorption contribution of native forests to GHG reductions. But it is not clear which is the most efficient 'carbon sink'.

The debate on applying the ILUC concept to the GHG emissions effect of different biofuel feedstock is an important issue to resolve. It is an area of uncertainty for the future growth in global palm oil demand. It is also essential to have a balanced, objective approach to ILUC measurement. This will determine the size of the effective emission reduction benefits that can be achieved from using biofuels in place of fossil fuels.

5.6 The environmental impact of PNG palm oil developments

Most of the PNG population live in rural areas and most income generating activities are linked to land access. Agricultural developments like oil palm plantations are important for economic growth and poverty alleviation. The use of forest land for agriculture is one of the reasons why rural to urban labour migration has not been a feature of PNG's economic development:

- Policy measures that unduly restrict the opportunities for alternative land uses in PNG could lead to significant regional adjustment issues.

PNG's population is growing rapidly, with a large proportion relying on rural sector developments for employment or income generating occupations. A

[118] World Growth (2009), Palm Oil – The Sustainable Oil, PNAS

reduction in forest land is an inevitable outcome of economic growth in a developing economy. PNG has a limited economic base and needs to utilise its natural resources to its best advantage.

Protecting all PNG's forest land to the exclusion of other land uses is not a sustainable or rational policy position from an economic and social welfare perspective. A balanced approach is necessary to accommodate environmental concerns and development objectives. Climate change issues should be closely scrutinised and rejected if they are unsubstantiated or irrelevant to the circumstances in PNG.

The previous discussion has highlighted the different elements of climate change concerns that could affect future agricultural developments in PNG. They have implications for the palm oil industry and its contribution to the economy. This is because the global campaign by environmental NGOs is using climate change concerns to heighten public interest and build support to curtail the industry's growth.

Until now PNG has not had a high profile in this anti-development campaign – Malaysia and Indonesia have been the centre of attention. But it is increasingly being drawn into the claims and accusations made against the industry. This poses a risk for future access to land for plantation and small holder developments.

Agriculture is a major export earner for the national economy. Plantation crops of palm oil, coffee, cocoa, and copra account for most of these exports. Currently palm oil is the only industry with strong growth prospects. Global demand continues to strengthen and PNG has an opportunity to benefit from this growth:

- There are signs of emerging limitations on the capacity for palm oil industry growth in Malaysia and Indonesia.
- The potential for increased used of palm oil in bio-diesel production could be a strong stimulus for long term industry growth if trade barriers and regulatory controls in the developed economies are not discriminatory.

The importance of continued growth in the PNG agriculture sector is widely recognised by foreign aid and international development agencies. It is going to involve the conversion of some forest areas to arable land and oil palms are ideally suited to the climatic conditions in a few locations. However, there appears to be a growing perception that palm oil is causing excessive deforestation in PNG:

- Concerns about the rate of deforestation in PNG and the apparent implications for GHG emissions seem excessive and unbalanced.
- The anti-development views on PNG's palm oil industry do not give adequate consideration to the rights of people to seek improvements in their standard of living.

Concerns about deforestation and land use in PNG land are not supported by the facts. The amount of agricultural land is just over 1 million ha – about 2% of the total land area. Since 1990 agricultural land areas have increased by 163,000 ha.[119] This is not an excessively large expansion and it's not suggestive of widespread deforestation:

- The amount of land currently used for oil palm plantations in PNG is minimal – there were 96,000 ha in 2007 and current estimates suggest a total area of 128,000 ha.
- There is no indication of future investments causing a dramatic increase in oil palm areas.

The large areas of inaccessible land in PNG act as natural barriers on the rate of deforestation for agricultural development. Developments of permanent tree crops such as oil palm and coffee have only played a minor role in the deforestation that has occurred. Subsistence agriculture is a much larger user of forested land and these areas are allowed to regenerate.

In some cases the land that has been used for oil palm developments has been previously used for forestry or is fallowed land from subsistence agriculture. In other cases natural forest land has been converted to plantations. Only land designated for development purposes can be used for oil palm cultivation and environmental impact assessments are required for large scale developments.

Less than 3% of PNG's land area is currently used for commercial agriculture. This equates to 0.16 ha per person. In comparison Indonesia has 0.21 ha of agricultural land per person while Thailand and Malaysia have 0.29 ha per person. In New Zealand and Australia agricultural land use equates to has 2.9 and 20.0 ha per person respectively. [120]

In the future some further deforestation will occur if only because of population growth. The current deforestation rate is estimated to be around 140,000 ha per year. This is lower than most developing economies in the region[121]. Even if this estimate is correct the contribution of palm oil industry growth has been minimal:

- Since 1990 agricultural land areas in PNG have increased by just 163,000 ha and oil palm areas have increased by just over 80,000 ha.

Claims by environmental NGOs about the impact of oil palm developments on deforestation and GHG emissions in PNG are misleading. It is simply not credible to suggest the industry's growth is a serious concern for climate change outcomes. Future land use changes for industry growth may have an impact on carbon emissions and sequestration rates. But there is a much uncertainty about

[119] ITS Global (2009)
[120] FAOSTAT, http://faostat.fao.org/site/291/default.aspx, accessed in July 2010
[121] FAO, PNG country report, Global Forest Resource Assessment 2010 Country Report, http://www.fao.org/forestry/20262-1-118.pdf

the size of the net impact and no indication of a dramatic escalation in industry investments:

- This assessment assumes peat land development will remain a non-issue for industry growth – peat lands in PNG are not in areas where the palm oil industry is currently located.
- If peat land developments were to occur, estimates of the carbon release and the potential use of development regulations would be considerations in judgments about the net impact on GHG emissions.

Political responses to climate change concerns will have implications for the contribution of the palm oil industry to the PNG economy in another way. Public perceptions in the developed economies about the GHG emissions effect of an industry expansion may affect future demand growth. There is the added risk of trade barriers or regulatory controls on the use of palm oil in biofuels.

Domestic land-use policies, environmental regulations and foreign investment conditions are areas where the PNG government can shape and encourage the industry's development. But consumer perceptions and policy developments in the developed economies are beyond the direct control of industry players and the PNG government.

Despite this limitation the PNG government needs to be actively involved in shaping the way foreign policy measures are applied. Credible data and information on the GHG emissions effect of industry developments needs to be distributed. There needs to be an effective counter-balance to the campaign by the environmental NGOs. This will reduce the risk of discriminatory policies being introduced that will limit the industry's growth prospects.

References

Achard, F., Eva, HD., Stibig, H-J., Mayaux, P., Gallego, J., Richards., T, & Malingreau, J-P. (2002). Determination of deforestation rates of the world's humid tropical forests. *Science*, *297*(5583).

Al-Riffai, P., Dimaranan, B., & Laborde, D. (2010).*Global Trade and Environmental Impact of the EU Biofuels Mandate*. International Food Policy Research Institute. Available at: http://www.ifpri.org/publication/global-trade-and-environmental-impact-study-eu-biofuels-mandate

Bank of Papua and New Guinea (2010). March 2010 Quarterly Economic Bulletin
Baumert, KA., Herzog, T., & Pershing, J. (2005). Navigating the Numbers: Greenhouse Gas Data and International Climate Policy. World Resources Institute, Washington DC

Bourke, M., & Allen B. (2009). *Twenty myths about Papua New Guinea Agriculture,* in *Food and Agriculture in Papua New Guinea* (Ed. Bourke, R. M. and Harwood, T). Edited report published by ANU E press.

Bourke, R. M., & Harwood, T. (2009). *Food and Agriculture in Papua New Guinea*. Edited report published by ANU E Press

Burgess, A. (2004). *Family Nutritional Guide*. Rome: Food and Agriculture Organization of the United Nations. Retrieved from: http://www.fao.org/docrep/007/y5740e/y5740e00.HTM

Butler, R. (2009). REDD in the red: palm oil could undermine carbon payment schemes. *Conservation Letters* No. 2 2009.

Central Intelligence Agency (2010). *The World Factbook - Papua New Guinea Economy 2010. CIA, Washington, DC.*

CPCS (2007). *Special Report, Project Completion – Papua New Guinea.* Available at: http://www.cpcstrans.com/media_room/_special_reports/SR%202007%2010.pdf

Creagh, S., & Supriatna, Y. (2010, July 6). Q+A-Indonesia issues draft rules on forest clearing. *Reuters.* Accessed at: http://af.reuters.com/article/energyOilNews/idAFJAK26185620100706?pageNumber=2&virtualBrandChannel=0

Curtin, T. (2004). *How Poor is Papua New Guinea? How Rich Could It Be?* (Resource Management in Asia-Pacific Working Paper No. 56). Canberra, ACT: ANU Research School of Pacific and Asian Studies.

Curtin, T., & Lea, D. (2006). The Economics of Land Titling in Papua New Guinea. *Pacific Economic Bulletin*, *2*(1).

DeFries, R.S., Houghton, R., Hansen, M., Field, C., Skole, D., & Townshed, J. (2002). Carbon emissions from tropical deforestation and regrowth based on satellite observations for the 1980s and 1990s. *PNAS*, *99*(22), 14256–14261.

Economist (2009). *The scramble for land in Africa and Asia*, 21 May. Available at: http://www.economist.com/PrinterFriendly.cfm?story_id=13692889&source=login_payBarrier

EIS (2009). *Environmental Impact Statement for Sigite Mukus oil palm development*, page 10.

EUR-Lex (2010) 32009L0028. Accessed at:http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32009L0028:EN:NOT

European Union (2009). *The Directive on the Promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC.* Preamble Article 85. Available at: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:140:0016:0062:EN:PDF

European Union (2003). *The Directive on the Promotion of the use of biofuels and other renewable fuels for transport (2003/30/EC)*. Available at: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2003:123:0042:0046:EN:PDF

FAO (2003). *Nutrition Country Profiles – Papua New Guinea.* Available at ftp://ftp.fao.org/es/esn/nutrition/ncp/pngmap.pdf

FAO (2010). *Global Forest Resource Assessment 2010*. Available at: http://www.fao.org/forestry/fra/fra2010/en/

FAO (2010). *Global Forest Resource Assessment 2010 Country Report: Papua New Guinea*. Available at: http://www.fao.org/forestry/20262-1-118

FAO (2010). FAOSTAT. Accessed in July, 2010, from http://faostat.fao.org/site/291/default.aspx

Fargione, J., Hill, J., Tilman, D.,Polasky, S., & Hawthorne, P. (2008). Land Clearing the Biofuel Carbon Debt. *Science Express*, *319*(5867), 1235 – 1238.

Food and Agricultural Policy Research Institute (2010). *U.S. and World Agricultural Outlook.* FARPI, Iowa. Available at: http://www.fapri.iastate.edu/outlook/2010/

Friends of the Earth (2005). *The Oil for Ape Scandal: How palm oil is threatening orang-utan survival*. Available at: http://www.foe.co.uk/resource/reports/oil_for_ape_full.pdf

Furukawa, Y., Inubushi, K., Ali, M., Itang, A. M., & Tsuruta, H. (2010). Effect of changing groundwater levels caused by land-use changes on greenhouse gas fluxes from tropical peat lands. *Nutrient Cycling in Agroecosystems*, 71(1).

Gibson, J., Datt, G., Allen B., Hwang, V., Burke, R., & Parajuli, D. (2004). *Mapping Poverty in Rural Papua New Guinea*. Available at: http://www.ciesin.columbia.edu/repository/povmap/methods/PEB_Poverty_Mapping(Papua%20New%20Guinea).pdf.

Grainger, A. (1984). Quantifying changes in forest cover in the humid tropics: Overcoming current limitations. *Journal of World Forest Resource Management*, *1*, pp. 3–63.

Greenpeace. (2009). *Neste Oil's plans for global leadership in palm oil diesel will drive massive rainforest destruction and climate change* [Press release]. Available at: http://www.greenpeace.org/seasia/en/press/releases/neste-oil-s-plans-for-global-l

Greig-Gran, M.(2009).*The Cost of Avoiding Deforestation: Update of the Report Prepared for the Stern Review of the Economics of Climate Change*. International Institute for Environment and Development.

Hai Teoh, C. (2010). *Key Sustainability Issues in the Palm Oil Sector*. World Bank Group

Holden, P., Bale, M., & Holden S. (2003). *Papua New Guinea – a private sector assessment*. Report prepared by the Enterprise Research Institute for the Asia Development Bank.

Hooijer, A., Silvius, M., Wösten, H., & Page, S. (2006). *PEAT-CO2: Assessment of CO2 emissions from drained peatlands in SE Asia.* Delft Hydraulics report Q3943.

Houghton, R.A. (2003). Revised estimates of the annual net flux of carbon to the atmosphere from changes in land use and land management 1850- 2000. *Tellus*, *55B*(2), 378–390.

ITS Global (2006). *The Economic Importance of the Forestry Industry to Papua New Guinea* Melbourne. Available at: http://www.forestryanddevelopment.com/

ITS Global, (2009). *The Economic Benefits of Land-Use in Papua New Guinea*, Melbourne. Available at: http://www.forestryanddevelopment.com/

Jyrki Jauhiainen, Hidenori Takahashi, Juha E. P. Heikkinen, Pertti J. Martikainen and Harri Vasander, (2005), "Carbon fluxes from a tropical peat swamp forest floor", *Global Change Biology*, Volume 11, Issue 10, pages 1788–1797.

Joosten, H., & Kaat, A. (2009) *Fact Book for UNFCCC Policies on Peat Carbon Emissions*. The Netherlands: Wetlands International. Accessed at: http://www.wetlands.org/LinkClick.aspx?fileticket=BhvPtpWBPiw%3d&tabid=1911

Kosczberski, G., Curry, G., & Gibson, K. (2001). *Improving Productivity of the Smallholder Oil Palm Sector in Papua New Guinea: A socio-economic study of the Hoskins and Popondetta Schemes.* Papua New Guinea Oil Palm Research Association.

Levine, J. (1999). The 1997 fires in Kalimantan & Sumatra, Indonesia: Gaseous & particulate emissions. *Geophysical Research* Letters, *26*(7).
Malaysian Palm Oil Council (2008). Facts on Fats. *Global Oils & Fats Business Magazine, 5*(3).

Manning, M. (2000). 'Food Security for Papua New Guinea' in *Proceedings of the Papua New Guinea Food and Nutrition 2000 Conference* (Ed. Bourke, Allen, Salisbury). ACIAR

Mellor, D. (2010). Social impact of commodity price volatility in Papua new Guinea. *Poverty and Sustianable Development in Asia.* (Bauer and Thant, ed.) Asia Development Bank.

National Research Institute (2010) *East New Britain Province.* Available at: http://www.nri.org.pg/research_divisions/cross_divisional_projects/16%20East%20New%20Britain%20AND%20Manus.pdf

Neste Oil. (2007). *Neste Oil to build a NExBTL Renewable Diesel plant in Singapore* [Press Release]. Available at: http://www.nesteoil.com/default.asp?path=1;41;540;1259;1261;7440;9494

New Britain Oil Palm Corporation Limited (2009). *Annual Report 2009.*

OECD/FAO (2009). *Agricultural Outlook 2009 -2018.* OECD, Paris. Available at: http://www.fao.org/es/esc/en/highlight_599.html

Papenfus, M. (2000). *Investing in Oil Palm: An Analysis of Independent Smallholder Oil Palm Adoption in Sumatra, Indonesia* (Research Working Paper 15). ICRAF Southeast Asia.

Paramananthan, S. (2008,) *Tropical Lowland Peats: To Conserve or Develop Them?* Paper presented at expert consultation "Direct and indirect impact of biofuel policies on tropical deforestation in Malaysia", 20-22 November 2008, Kuala Lumpur, Malaysia.

Reinhardt (2009). *GHG Balances of Biofuel Oil Crops: State of the art balancing scientific accuracy with the demands of policy makers.* Presentation at the International Palm Oil Life Cycle Assessment Conference, Kuala Lumpur

Sheil, D., Casson, A., Meijaard, E., van Noordwijk, M., Gaskell, J., Sunderland-Groves, J., Wertz, K., & Kanninen, M. (2009). *The impacts and opportunities of oil palm in Southeast Asia*. CIFOR, Occasional Paper No. 51.

Sime Darby Plantation (2008). Biodiesel – Overseas. Accessed at: http://www.simedarbyplantation.com/Biodiesel_-_Overseas.aspx

Suhartono, H. (2010, July 6). Wilmar aims to grow sugar business in Indonesia. *Reuters.* Accessed at: http://www.reuters.com/article/idUSSGE6650ES20100706

Thoenes, P. (2006). *Biofuels and Commodity Markets – Palm Oil Focus 1*. FAO Commodities and Trade Division, Rome.

Tucker, C.J., & Townshend, J.R.G. (2000). Strategies for monitoring tropical deforestation using satellite data. *International Journal of Remote Sensing*, 21(6&7), 1461–1471.

Van der Werf, G.R., Morton, D.C., DeFries, R.S., Olivier, J.G.J., Kasibhatla, P.S., Jackson, R.B., Collatz, G.J., & Randerson, J.T. (2009). CO2 emissions from forest loss. *Nature Geoscience 2*, 737–738.

Watson, R.T. (2000). *Land Use, Land Use Change and Forestry*. Intergovernmental Panel on Climate Change, Cambridge University Press. Available at http://www.ipcc.ch/pdf/special-reports/spm/srl-en.pdf

World Bank (2007). *Country Assistance Strategy for Papua New Guinea for the period FY08-FY11*. East Asia and Pacific Division of the International Finance Corporation.

World Bank (2010). *Papua New Guinea- Smallholder Development Project, Frequently Asked Questions.* Available at: http://web.worldbank.org/WBSITE/EXTERNAL/COUNTRIES/EASTASIAPACIFICEXT/PAPUANEWGUINEAEXTN/0,,contentMDK:22140271~menuPK:333773~pagePK:1497618~piPK:217854~theSitePK:333767,00.html

World Bank (2010). Papua New Guinea: Smallholder Agriculture Development Project (SADP) (IDA Credit No 43740-PNG). World Bank, Washington. Accessed at: http://siteresources.worldbank.org/INTPAPUANEWGUINEA/Resources/PNGSADPProjectBrief090610.pdf

World Growth (2009). Conversion: The Immutable Link Between Forestry and Development. Arlington, VA. Available at: http://www.worldgrowth.org/assets/files/WG_Forestry_Conversion_Report.pdf

World Growth (2009). Palm Oil – The Sustainable Oil. Arlington, VA. http://www.worldgrowth.org/assets/files/Palm_Oil.pdf

Zen, Z., Barlow, C., & Gondowarsito, R. (2005). Oil Palm in Indonesia's Socio-Economic Improvement: A Review of Options. (RSPAS Working Paper 2005–11). Canberra, ACT: Australian National University.

Zutphen, H.V. (2007). *The CO2 and Energy Balance of Malaysian Palm Oil: Current Status and Potential for Future Improvements*. Paper read at 2nd Symposium n Sustainable Resource Development, 6 June, Brussels, Belgium.


ITS
global