ITS Global

Consultants on Global Issues

The Economic Benefits of Land-Use in Papua New Guinea

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Foreword

The role of forestry in reducing greenhouse gas emissions is an issue in UNFCCC discussions. It is expected to be discussed at the UNFCC conference in Copenhagen in December 2009. PNG and other developing economies with large forestry reserves have been invited to consider participating in a scheme know an REDD (Reducing Avoided Deforestation and Forest Degradation).

The REDD concept was originally conceived as a way for these economies to generate carbon credits to sell into a global emissions trading scheme. There is little prospect of a global trading system being developed. It means the only potential buyers of REDD created carbon credits will be those economies prepared to allow external credits to be part of their independent efforts to reduce carbon emissions. It is hard to see these opportunities arising because it will undermine the efforts of individual countries to meet their emission reduction targets.

The focus of the REDD concept seems to have shifted towards the issue of deforestation. There is a perception that deforestation is a major contributor to global emissions but this view is not supported by the facts on land use. The REDD concept involves self-imposed restrictions on the use and development of natural forest areas. Therefore it has major implications for economic development in developing economies such as PNG.

This report was commissioned by the PNG Forestry Industry Association to assess these economic development implications. It has been prepared as a contribution to PNG deliberations on participation in a REDD scheme. It examines the role of PNG land use from the perspective of agriculture and forestry industry development.

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Executive summary

Global discussions on ways to reduce GHG emissions have considered the role of forests. A concept known as REDD (Reducing Avoided Deforestation and Forest Degradation) has been proposed. It is being treated by donors, the World Bank and even some arms of the UN system as an agreed concept. But there is no agreement on what it will embrace. There are numerous practical difficulties in making the concept work in the real world.

A global trade in carbon permit does not look feasible or practical in the foreseeable future. It is highly unlikely there will be agreement on such as ambitious scheme in the upcoming UNFCC conference in Copenhagen. This means the large revenue benefits claimed by the proponents of the REDD concept may not eventuate.

The purchasing of REDD carbon credits by developed economies looks to be unrealistic. Developed economy aid in exchange for adopting a REDD scheme may be possible but the value of this approach in comparison to the opportunity cost of land use restrictions is highly uncertain.

Policy measures that affect the prospects for rural sector growth need careful assessment. PNG does not have the economic wealth to impose highly restrictive environmental policies that curtail development. Land use management practises in the forestry and agricultural industries are essential for sustainable long term growth. An appropriate balance is required between development needs and environmental considerations.

The scientific knowledge and technical analysis behind claims about the GHG emissions from forestry land use is not strong enough to make sound policy judgements. A cautious approach would seem prudent.

Most people still live and work in rural areas. Agriculture and forestry are substantial contributors to GDP, a key source of export earnings and provide an occupation for more than 80% of the population. Their contribution to the economy relies on continued access to natural forest lands for development purposes.

Agriculture will remain a central pillar of the PNG economy for the foreseeable future. Over the past decade agriculture sector growth has been limited while the population has grown. Most industries were either stagnant or had negative growth. Oil palm has been the exception and provided a means to redress this imbalance:

- land suitable for oil palm is limited so policy decisions that lead to land access constraints could erode one of the few bright spots for rural development.

The forestry industry makes a significant contribution to the PNG economy by creating employment opportunities in remote areas. An estimated 10 000 people were directly employed in the forest industry in 2007.

Strong population growth in a rural based society is not compatible with a scheme that restricts land use. Access to land is the critical ingredient for economic development in PNG. Over time a REDD scheme will intensify the land use pressures in the remaining areas. If the opportunities for jobs or cash based occupations are limited the pressure for people to migrate from their village areas will rise.

Forestry production is not a major factor in deforestation. Concerns about deforestation and PNG land use in general are not supported by the facts. The amount of agricultural land is just over 1 million ha which is just over 2% of the total land area. Forested land is still the dominant component of the total land area in PNG.

There is no evidence of substantial deforestation. Forested areas have declined since 1990 but the rate of change could not be described as a serious concern. The reality of population growth and the need for economic development is that some natural forest land will need to be used for other purposes.

From an economic development perspective it is crucial to consider the opportunity cost of implementing any schemes that involve leaving land idle. The opportunity cost of participating is the economic returns from the alternative uses of the land.

There has been some research on the assessing the alternative economic returns of the different land use options for natural forest areas in PNG. The estimates indicate there are high returns from oil palm in PNG at US$9,275 per ha. The estimated returns on pre-plantation timber harvesting are also substantial at US$1,099 per ha. The returns from shifting subsistence agriculture are estimated at US$745 per ha which shows the substantial gains in shifting from subsistence agriculture to commercial oil palm plantations.

Further analysis of the returns from a typical forest concession using a current log price of US$100 per cubic meter gave some illuminating results when compared with the value of the same land as a REDD concession based on selective logging. Using carbon prices of US$1/tonne based on average 2009 prices and a market peak of US$7/tonne in 2008, results show:

- returns for timber harvesting were between US$303 and US$500 per ha; and
- returns as a REDD concession were between US$45 and US$240 per ha.

The implications are straightforward. The carbon price would have to rise substantially from recent levels to compete with sustainable forestry production as the November 2009 price had fallen to US$0.10 per tonne. In comparison to returns on large scale oil palm of US$9,275 per ha the estimates show carbon storage does not give the necessary financial rewards.

If consideration is the REDD concept is to be pursued there is a need for an economic impact assessment that considers the regional development implications and a social impact assessment. In many areas the pressure to revert to a subsistence way of life or to migrate to other rural regions and urban areas would seem a realistic outcome.

REDD outcomes at Copenhagen should also support land use policies which underpin strategies to raise living standards as well as protecting the environment.

1. The role of forestry in GHG emission reductions

The role of forestry in reducing global greenhouse gas (GHG) emissions has become a topic of considerable interest in discussions on how to tackle global warming. A recent assessment has suggested changes to natural forest cover contribute around 17% of all GHG emissions (IPCC 2007). Deforestation for alternative land uses and degradation of forests are considered to be the primary cause of these emissions.

Some environmental NGOs have used claims about the carbon release from disturbing natural forest cover to advocate a halt in the use of forest land for other purposes. For example, WWF Sweden has recently claimed that ending deforestation is a highly cost effective way to tackle global warming (Newstrack 2009). This perspective is supported by statements in the Stern Review that curbing deforestation is a highly cost effective way to reduce GHG emissions (Stern 2007).

These views have focused attention on countries with large areas of natural forest that need to make land use changes for economic development reasons. This makes the issue highly relevant to developing economies in tropical regions. In the Asia-Pacific region land use changes in countries such as PNG, Indonesia and Malaysia have been subjected to world-wide scrutiny.

There is a perception that locking up the natural forest lands of the developing economies could be win-win outcome on the global warming issue. But there remain considerable uncertainties in the science of measuring the net effect of GHG emissions from changes in the use of forest land. Claims about the cost effectiveness of this approach are also not as straight forward as some would believe.

While it may seem like a good idea from the perspective of global warming concerns, constraints on land use have an economic and social welfare cost. Regulations or other measures that restrict the use of natural forest land will have implications for economic development and poverty alleviation efforts in developing economies.

Nevertheless, the World Bank has recently released guidelines to provide funding through a Forestry Investment Program which rule out funding in most cases where projects entail conversion of forest land to other purposes.[1] This program is supported by AusAID, DFID and the Norwegian Government.

The aim of this report is to review the development issues associated with global efforts to encourage developing economies to end deforestation and forest degradation.

[1] World Bank, 2009, July, Forestry Investment Program, " Design Document for the Forestry Investment Program, A Targeted Program under the SCF Trust Fund".

The REDD concept

Global discussions on ways to reduce GHG emissions have considered the role of forests. Recent UNFCC discussions have called for policy measures to reduce emissions from deforestation and forest degradation in developing countries (UNFCC 2008). This will be a key issue in the next UNFCC conference in Copenhagen in December 2009. A concept known as REDD – Reducing Deforestation and Forest Degradation – has been suggested as an option for discussion.

REDD is a simple concept but there's no agreement on what it will embrace or how it will be implemented. Advocates suggest it will be easy to achieve and provide a 'win-win' outcome. In reality it raises numerous questions about the complexities of:

- the measurement of carbon sequestration and release rates;
- the time period, geographical location and definition of avoided deforestation;
- verification and compliance; and
- the need for a global administration or assessment agency and its implications for country sovereignty issues.

There are different views on what REDD will achieve. Environmental NGOs see it as a way to provide direct aid to compensate developing economies for ending deforestation. Some international agencies see it as part of a global cap and trade mechanism to control GHG emissions. For some developing countries with forest reserves it is seen as a way to gain assistance for forest management programs and land rehabilitation efforts.

REDD is based on the concept that countries such as PNG will define a baseline of future rates of deforestation and forest degradation. They will 'sell' the rights to refrain from actions that will alter specified areas of natural forest. The rights may be 'exchanged' for direct aid funded by the tax payers of developed economies. Alternatively they could be sold to domestic or overseas commercial interests seeking emission permits:

- if the rights are sold as emission credits the measurement question and the real net effect on global emissions is an obvious important consideration.

Economic principles would suggest the most effective way to tackle carbon emissions is to address the source of the problem. Reduced consumption of goods and services with high GHG emissions would seem a sensible approach. A carbon tax is often advocated as the most efficient and effective way to achieve the required change in behaviour. But this approach has not been favoured by politicians.

A key principle of successful policy interventions is they work best when directly aimed at influencing the behaviour that needs to change. Indirect approaches increase the risk of unintended consequences and the creation of by-product economic distortions (Corden 1974). In this case land use restrictions are likely to have significant economic and social consequences in the economies that adopt the REDD concept.

If a permit trading approach is used with REDD a cost is paid by producers of goods and services. Ultimately this will indirectly affect consumption, production technologies and emission levels. If an aid exchange approach is used behavioural change is confined to recipient countries. In both cases a net reduction in global GHGs may be achieved:

- but a key question is the opportunity cost for the developing economies who have forgone an avenue to economic development and wealth creation;
- will the aid or price paid for the permits match or exceed the opportunity cost?

Despite uncertainties surrounding the practicalities of the REDD concept, PNG and other forested developing economies have been invited to consider implementing a scheme. Funding programs from international agencies and aid donors have been established to assist in the preparations. With the availability of new sources of aid money there may be an inclination to embrace the concept without adequately considering the by-product effects for economic development and social welfare.

Environmental NGOs and some development agencies consider a REDD scheme to be a 'win-win' situation. On the one hand it offers a way to compensate or create financial incentives for developing countries in tropical regions to end deforestation and forest degradation. There are also potential gains from global GHG emission reductions. On the other hand commercial interests in the developed economies could gain a new source of emission permits if the scheme becomes part of a global trade in credits.

But for developing economies that embrace the concept it is unlikely to be a 'winning' outcome from an economic development perspective. It will have consequences for the future capacity of these economies to improve living standards. Population growth and land use constraints that curtail the growth of rural industries seem to be incompatible outcomes, especially in the context of poverty alleviation efforts:

- the rate of employment and income growth is constrained;
- this can lead to social issues associated with food security concerns and higher rates of rural-urban labour migration.

2. Carbon sequestration through forestry

The United Nations Framework Convention on Climate Change (UNFCCC) developed an environmental treaty on greenhouse gas emissions at the 1992 Rio de Janeiro 'Earth Summit'. The treaty did not set mandatory limits on GHG emissions and is legally non-binding for the countries that signed up. It did attempt to establish a national inventory of greenhouse gas emissions. Forestry was recognised as a factor in each of the individual national assessments.

UNFCCC deliberations and the state of knowledge

In general the UNFCCC deliberations did not conduct a rigorous assessment of the role of forestry in the carbon cycle. Forestry was viewed as a carbon sink with sequestration in the tree cover and ground soil. There were two perspectives on the role of forest land. Restricting deforestation would allow the preservation of existing carbon sinks. Forestry regeneration and the adoption of sustainable forestry practises would allow an expansion in carbon sinks:

- since then issues such as the rate of selective tree removals from native forests, burning trash from clear felled forests and the draining of peat forest lands have become prominent points of discussion.

It is fair to say the UNFCCC accounting rules do not adequately cover the full carbon cycle effect from changes in land use involving native forests. Forestry regrowth and the replacement of native forests with plantation tree crops are not considered. Measurement of the amount of carbon stored in natural forest land with variable tree cover continues to be an issue in the global deliberations.

The state of scientific knowledge of the contribution of forestry in tropical developing economies to GHG emissions is weak. The IPCC Fourth Assessment Report suggests deforestation accounts for 17% of emissions. This report has been criticised with some experts suggesting it understates the extent of climate change and others suggesting it overstates the problem. More specifically, criticisms can also be made about the estimate of deforestation contributions to GHG emissions.

The Stern Review stated that deforestation and land-use change is responsible for 18 % of global greenhouse emissions. Some environmental NGOs claim the figure is 20%. These estimates do not appear to be based on a rigorous scientific analysis. In general they are based on questionable data and methodologies. Doubts about the veracity of the estimates are not surprising:

- there is considerable uncertainty in measuring carbon absorption and release rates of forests with varying tree densities and growth rates in different countries.

Despite these deficiencies there has been tendency for climate change policy advisers to accept the claims without adequate scrutiny. This has obvious implications for the GHG emission reduction strategies of forested developing economies. If they are accepted as legitimate measurements of GHG inventories, policy responses may be unfairly biased against deforestation and commercial forestry as the way to reduce emissions:

- a natural policy response could be to curtail the growth of the forestry industry by restricting access to natural forests;
- a further possible policy response could be to halt the conversion of natural forest to arable farming land;
- over time this could lead to food security concerns and limit the prospects for employment and income growth to accommodate a growing population.

For example, it is also often claimed that Indonesia is responsible for a third of the global emissions from deforestation. As a result they have been assessed as one of the world's largest GHG emitters – 18% of global emissions are` attributed to land use changes in Indonesia. This is a somewhat surprising outcome of the UNFCCC approach to emission measurement. It needs to be verified through a more rigorous assessment process.

Environmental NGOs accuse the forestry industry and palm oil plantation developments in Indonesia of increasing global emissions. Similar accusations are made about the palm oil industry in Malaysia. Concerns have been raised about the impact of commercial forestry and plantation crops on PNG forests. But these views fail to acknowledge three key points about land use in these economies:

- commercial forestry activities involve the selective removal of a limited number of trees and regeneration occurs after the harvesting;
- where deforestation does occur it is driven by a need for economic development to alleviate poverty and to compensate for urban land encroachment; and
- some of the land use changes involve the establishment of plantation tree crops that have carbon absorption benefits.

The rural sector is an important contributor to PNG economic development. Most of the population live in rural areas and agriculture is a major source of employment (table 1). Poverty alleviation is a major issue, especially in rural areas. The World Bank estimates that 70% of the population live on less than US$2 per day (World Bank 2005). There is a wide gap between rural and urban income levels.

Economic development of the rural sector is clearly an important consideration. Creating opportunities for employment and income growth is the only way to achieve higher living standards. Numerous reports by international agencies highlight the need for sustained growth in mineral and rural commodities such as forestry and plantations crops:

- forestry is a significant contributor to the economy (ITS Global 2006);
- oil palm, coffee and cocoa are key sources of jobs and small holder farming.

1. Economic development indicators in PNG

		1995	2000	2005	2008
Population	*million*	4.7	5.4	6.1	6.6
*Rural polulation **	*million*	4.0	4.7	5.3	5.8
	% share	*85.9*	*86.8*	*87.4*	*87.5*
*Employment in agriculture ***	*%*	*..*	*72.3*	*..*	*..*
*Poverty indicator ****	*%*	*57.4*	*..*	*..*	*..*

** Includes population involved in agriculture and those living in rural areas.* *Source: ADB 2009; FAO 2009a.*

*** Per cent of total employment.*

**** Per cent of population with less than US$2 (PPP) per day. Indicator for 1996.*

Policy measures that affect the prospects for rural sector growth need careful assessment. PNG does not have the economic wealth to impose highly restrictive environmental policies that curtail development. Land use management practises in the forestry and agricultural industries are essential for sustainable long term growth. An appropriate balance is required between development needs and environmental considerations.

The scientific knowledge and technical analysis behind claims about the GHG emissions from forestry land use is not strong enough to make sound policy judgements. A cautious approach would seem prudent. The oft-quoted figure on emissions from land use changes in Indonesia relies on research by the World Resources Institute (Houghton 2003). It has been acknowledged by the author that the analysis has some weaknesses.

The analysis calculated net sources and sinks of carbon resulting from land-use change in 9 world regions. It was based on data for rates of land use change and per hectare changes in carbon storage from the land use changes. Regional estimates were subsequently used to develop national estimates. Measurement uncertainties suggest the errors associated with the national estimates of emissions could be substantial:

- carbon emissions from tropical countries maybe high by a factor of two;
- carbon stock estimates for tropical forests have an error margin of ±50%;
- therefore the estimates of national sources and sinks of carbon from land-use change have an error margin of ±150%.

These deficiencies make it difficult to judge the net effectiveness of a REDD scheme to reducing GHG emissions in economies like PNG. It raises questions about the capacity of these economies to develop a carbon baseline from forest land use. This will be a crucial aspect of a REDD scheme and a difficult exercise. Given the potential ramifications for future economic development a rigorous methodology is required:

- the FAO has developed a methodology but adoption will need aid funding.

The focus of UNFCCC deliberations has naturally centred on the environmental aspects of global warming. However, there is an overriding requirement that emission reduction strategies should not impede economic development. This concept is reflected in the 'Bali Mandate' which set the agreed terms of reference for the current negotiations among parties to the UNFCCC.

A REDD scheme that restricts land use options will have development implications that do not seem sensible for countries like PNG. Economies where the population is largely rural based risk a reduction in growth. A heavy reliance on rural commodities for jobs and income growth suggests an economic impact assessment of the scheme is required:

- the developed economies will exclude agriculture from GHG reduction targets;
- REDD will have a direct impact on agriculture in forested developing economies.

Deforestation and carbon release

The REDD concept focuses on the GHG emission outcomes of a change in natural forest land caused by human intervention. References are made to deforestation and forest degradation. The definition of these terms is important as it will influence the practical application of a REDD scheme and policy responses more generally.

In the climate change discussions the term deforestation is a relatively loose concept. In practical terms it means land use conversion for economic development which is the central issue. It is a highly visible contributor to GHG emissions. But the impact depends on the extent of deforestation and subsequent land use.

If all tree cover is cleared and burned there will be a release of carbon. But if some timber is used commercially the carbon release effect will be smaller. Loss of the tree cover means the loss of a sink that over time could absorb more carbon. But if the land is used for a plantation tree crop the effect on future carbon absorption rates is reduced.

These considerations highlight the difficulties in measuring the effect of deforestation on GHG emissions. It is not a static concept. Yet the general perception is the loss of natural forest means a large short term increase in emissions and the permanent loss of a carbon absorption capacity. But the outcome is not necessarily as bad as it may seem:

- a rigorous, dynamic assessment of the GHG emission effect of past deforestation is essential in calculating a baseline for a REDD scheme;
- individual deforestation events in a country like PNG are unlikely to have the same effect on emissions.

An accurate assessment is an important practical consideration in applying the REDD concept to real world situations. A baseline methodology using implicit assumptions of the emission effects of deforestation is unacceptable. It will be a complex exercise to address this issue and a firm, globally accepted definition of deforestation is required.

Similar considerations are relevant for the concept of forest degradation. In practical terms it focuses on the logging of natural forests. But it may also be applicable to land used for shifting subsistence agriculture which is an important consideration in PNG. In either case the forest regenerates over time so the net impact on carbon emissions over time has to take account of the dynamics of regrowth.

In addition forestry involves the selective removal of trees and there are often restrictions on the timber off-take rate. The harvested trees are not burned so the carbon release effect may be negligible. The emissions impact will vary between regions and countries just as tree regeneration growth rates will vary.

The situation becomes even more complex with traditional subsistence farming practises in countries like PNG. Transient agriculture means the natural forest is partially cleared and used for a limited period. It is then fallowed for a period of time and some forest regeneration occurs. There is a carbon absorption effect during this period.

It is not clear how these forest degradation land uses will be incorporated with deforested land in a baseline for a REDD scheme. The emission reduction benefits from restricting land degradation activities will be smaller which reduces the value of the credits. This is a critical issue in assessing the opportunity cost of participating in a REDD scheme. If most land use changes are forestry and subsistence agriculture the economic returns of locking up particular forest areas may be well below the returns on alternative land uses.

The two concepts are fundamentally different in terms of their net impact on carbon emissions. Removal of selected trees is a principal of sustainable forest management. The effect on the biomass will depend on the type of forest, species composition, market conditions, management plans and several other factors (Martin 2008). Defining forest degradation and accounting for these differences in a REDD scheme will be a challenge.

Removal of selected timber resources from a site under sustainable management practises does not necessarily create an on-going problem for carbon emissions. Over time these areas regenerate. At any point in time there are likely to be areas of degraded, abandoned cultivated land that is returning to natural forest vegetation either naturally or through plantings. This issue will be especially relevant for PNG.

From an economic development perspective differences in land degradation will be an important consideration implementing a REDD scheme. National baseline calculations will determine the size of the potential loss of land for development purposes. The bigger the baseline the greater the scope for constraining economic growth in regional areas.

It will be essential to have firm definitions and measurable parameters for deforestation and forest degradation. Assuming this is possible the critical issue becomes the effect on future rural economic development. The amount of land tied up in a REDD scheme, the time period and the returns from alternative uses of the land are important questions for the broader objectives of government development policies.

In forested developing economies like PNG the consequences will depend on the level of participation by communal land owners. This will involve judgements about the future

stream of returns for alternative uses of the land. The information required to make sound decisions is not readily available. Government policy officials and rural communities face the same difficulties:

- it is unrealistic to expect communal land owners in PNG to have the capacity to assess the longer term opportunity cost of alternative land uses;
- for this reason alone it would seem essential to prepare regional economic impact assessments on the impact of REDD.

3. The rural sector and economic development

The role of the rural sector in PNG economic development is an important consideration for participation in a REDD scheme. Agriculture and forestry are substantial contributors to GDP, a key source of export earnings and provide an occupation for more than 80% of the population. Their contribution to the economy relies on continued access to natural forest lands for development purposes.

Most people live and work in rural areas. They produce food for home consumption and agricultural products for cash sales in the domestic and export markets. Some people rely on jobs in plantation agriculture, forestry and rural service industries for a cash income. Others are engaged in various informal business activities such as trading, processing and selling rural products. The number of people in paid employment in urban areas and with mining companies is relatively small.

The economic contribution of agriculture

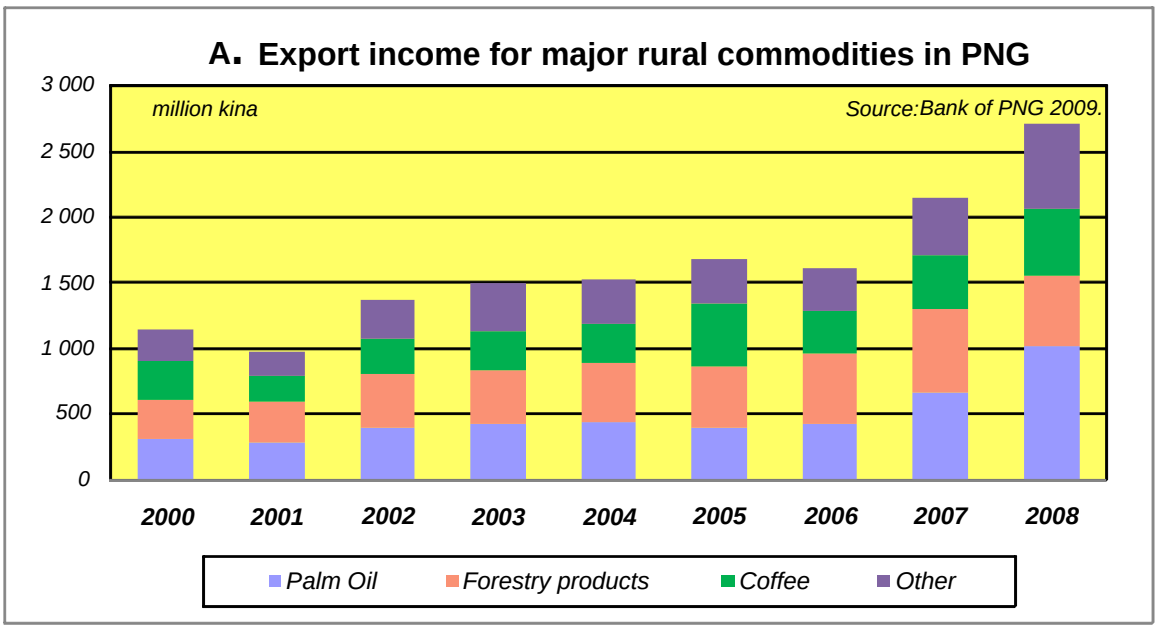
Agriculture has been a major contributor to the economic development of PNG. The sector has two components – farming for cash sales and subsistence food production. The commercial agriculture is based around plantation crops such as palm oil, coffee, cocoa and coconuts. But it also includes small scale farms producing cash crops and livestock products for domestic consumption. Subsistence food production is also a feature of the poorer, least-developed parts of PNG.

Agriculture produces most of the country's food requirements. It is also a major export earner for the economy. In 2008 agriculture accounted for around 15% of total exports earnings – minerals accounted for more than75% (Bank of PNG 2009). Palm oil, coffee, cocoa, and copra product accounted for most of the exports (chart A):

- since 2005 palm oil export have increased by 159% to 1,012 million kina;
- coffee export have risen by 10% (520 million kina);
- cocoa export have risen by 74% (346 million kina); and
- exports of copra products have increased by 123% (248 million kina).

The strong growth rate in export earnings in part reflects the general increase in global commodity prices that occurred in 2008. But an upward trend has evident for each of these commodities since the year 2000.

The growth in export earnings from plantation crops has been important for the national economy. At a regional level they have generated jobs, incomes and cash sales for small farm holdings. Most rural villagers earn some cash income from informal sales of fresh food or other agricultural activities. In general the amount of cash earned is low but some people earn higher incomes as small holder producers of plantation crops.



The regional production of plantation export crops varies because of differences in growing conditions. Coffee is an important source of village income in the Highlands; coconut cultivation is restricted to coastal locations. Oil palm and cocoa are grown in particular lowland areas with adequate rainfall. Most regions have limited options in the type of plantation crops that can be grown.

In general the rural population is highly responsive to new job opportunities and better returns for their labour (Bourke & Harwood 2009). They aspire to higher living standards just as people do in other economies. As the population has grown areas of natural forest land have been used for small scale farming or agricultural developments:

- there are some large plantation companies that grow, buy, process and export commodities such as palm oil, coffee, cocoa and copra products;
- but there is a substantial small holder presence in these industries.

The customary land tenure system is a feature of the rural economy. Land areas belong to village community groups. Access for plantation developments requires negotiations on access rights and the payment of royalties. In the past large scale plantations of export crops have been important for generating local jobs and incomes. But small holders have now become the main producers of most plantation crops:

- small holder coffee producers currently account for about 84% of total production (table 2);
- the contribution of small holders in the cocoa industry is around 90%;
- oil palm is an exception as the rapid industry growth has been based on several large scale plantations – the small holder contribution is about 33%.

2. Smallholder contribution to selected PNG estate products

		1990	1995	2000	2005	2006
Coffee *						
Total production	*'000 tonnes*	56	59	65	75	51
Small-holder contribution **	*'000 tonnes*	41	44	53	64	43
	% share	*73.3*	*74.0*	*82.0*	*85.0*	*84.0*
Oil palm **						
Total production	*'000 tonnes*	598	982	1 618	1 855	2 012
Small-holder contribution	*'000 tonnes*	248	279	531	614	656
	% share	*41.5*	*28.4*	*32.8*	*33.1*	*32.6*
Cocoa *						
Total production	*'000 tonnes*	38	31	34	45	45
Small-holder contribution	*'000 tonnes*	25	21	27	40	41
	% share	*63.9*	*68.1*	*78.2*	*89.7*	*90.1*

* *Year ended September.* *Source: Bourke & Harwood 2009.*

** *Areas of < 5ha.*

*** *Harvested fresh fruit bunches.*

The growing importance of small holder producers in these industries is an indicator of the increasing involvement of villagers in commercial agriculture. It suggests that over time people are using more of their communal land areas to produce export cash crops. As the population grows continued access to land for an expansion in small scale farms will be crucial for future income growth:

- access to land resources for larger scale plantation developments will also be important for rural employment and income growth;
- continued expansion of the palm oil industry will depend on land availability.

Palm oil industry development

The expansion of the palm oil industry shows the value of gaining access to customary land holdings for development purposes. The industry has expanded at a faster rate than other export tree crops and palm oil is now the top agricultural export earner. The area harvested has doubled since 1990 but the amount of land used is relatively small (table 3). Oil yields are favourable in comparison to those achieved in Malaysia.

Production is concentrated in a few regions with suitable growing conditions. Around 166,000 people currently live in rural households that produce oil palm (Bourke & Harwood 2009). Many others earn an income in occupations connected to the industry. This includes people working on the large plantation estates.

3. 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

** Excludes palm kernel oil* *Source: Oil World 2008; FAO 2009b.*

*** Palm oil yields are estimated to be around 3.9 t/ha in Malaysia in 2008.*

In recent times the industry's development has been largely based on a concept called the nucleus estate and smallholder (NES) model. It involves a developer establishing a large scale plantation and processing facilities. The developer also facilitates the establishment of small holder plots for villagers on land surrounding the (nucleus) estate. The estate purchases and processes their output and provides technical advice.

These developments generally involve the provision of infrastructure and services for the benefit of the local community. It often includes roads and bridges, community centres, health services, education services and communication infrastructure. Research by the World Bank has shown the strong link between infrastructure development and poverty alleviation in PNG (World Bank 2009). Developments like palm oil plantations reduces the financial burden on governments to provide social services:

- with limited public finances there is often little prospect they would be provided in many areas of PNG in the absence of a plantation development.

These sorts of palm oil estate developments are highly beneficial for village communities from a social welfare perspective as well as generating jobs and export income growth. They are important ingredients for longer term economic development in areas suitable for oil palm. It raises two issues about the effect of REDD on oil palm developments.

First, NES oil palm developments can only occur in certain areas of selected provinces with the necessary growing conditions. A REDD scheme may curtail industry growth in the most suitable areas. These developments are not necessarily transferable to areas with no REDD participation:

- there are obvious development implications if REDD land use restrictions are concentrated in the areas most suitable for oil palm plantations.

A second issue is the capacity of customary land owners to make a realistic assessment of the opportunity cost of the alternative uses of their land and the associated benefits from the provision of infrastructure and services. Over time land values will change if a new development becomes feasible. It would also be necessary to value the infrastructure and services benefits in conjunction with the expected returns from oil palm cultivation.

The time dimension of REDD contracts and the value of alternative land uses will be critical issues. Locking up potential oil palm land areas in exchange for REDD payments requires careful assessment. PNG cannot afford to restrict development opportunities for forest areas suitable for conversion to arable farm land that can deliver high returns:

- creating estate jobs, small farm plots or other income generating activities gives people an opportunity to pursue higher living standards;
- REDD payments to leave potential arable land idle will limit these opportunities;
- depending on the size of the payment and the restrictions imposed it could lead to social problems and increased migration pressures.

Agriculture will remain a central pillar of the PNG economy for the foreseeable future. Over the past decade agriculture sector growth has been limited while the population has grown. Most industries were either stagnant or had negative growth (MAL 2007). Oil palm has been the exception and provided a means to redress this imbalance:

- global demand for palm oil has been growing strongly and further industry growth in PNG could deliver substantial regional development benefits;
- land areas suitable for oil palm developments are limited;
- policy decisions that lead to access constraints on suitable land could erode one of the few bright spots for rural economic development.

The economic contribution of forestry

Forestry is another important contributor to the economic development of PNG. There are commercial forestry operations harvesting logs from natural forests. There are also the informal activities of villagers engaged in collecting and selling firewood as well as harvesting timber for cash sales or making wood products.

Forested areas have an important role in the subsistence economy. Apart from using the land for food production the rural population engaged in a subsistence way of life rely on forest wood for their energy needs. As the population has grown the need to access wider areas of natural forest lands for this purpose has also grown.

Commercial forestry ranks with oil palm as the driver of future growth in the rural sector. Access to lands for commercial forestry purposes requires the government to negotiate logging rights from customary land owners. The rights are allocated to forest companies in exchange for royalties and other cash and in-kind payments. In FMA based concessions, logs are harvested in a sustainable manner.

The industry makes a sizeable contribution to PNG export earnings. Since 2005 exports have increased by 13% to 538 million kina. Only palm oil contributes more to the rural commodity export earnings. Domestic use is limited and most of the industry output is exported. Raw logs account for most of the exports – plantation log exports are about 10% of total output (PNG FIA 2006). Exports of sawn timber and veneer have become more important in recent years.

Recent estimates have suggested about 30 million ha (67%) of the PNG land area is forested (PNG FIA 2006). Other studies have suggested the area may be closer to 70% (Bourke & Harwood 2009). But due to the rugged terrain and inaccessibility of many areas only about half of this area is suitable for forestry. Plantation production is less than 0.1 million ha but there is some potential for growth.

In 2006 there were 29 forest concessions in a production area of about 3.5 million ha. Environmental NGOs have raised concerns about commercial logging activities but in the context of the total forest area the amount of land involved is small (12%). The concerns are an overreaction. The amount of timber taken from the concessions is controlled. The government has a monitoring role in the forest management agreements (FMAs):

- between 1975 and 1996 the PNG forested area was permanently reduced through logging and land clearance by about 4% (Bourke & Harwood 2009);
- the remaining forest was estimated to be about 69% of the total land area;
- about 6% of this area had been logged and was left to regenerate.

The forestry industry makes a significant contribution to the PNG economy by creating employment opportunities in remote areas. An estimated 10 000 people were directly employed in logging in 2007. Most of the staff in logging companies are PNG nationals. The industry also generates jobs in other vocations that either service the industry or benefit from the multipliers effects of industry activities:

- forestry contributed about 9.2% of real GDP in 2005 (PNG FIA 2006);
- an issue for a REDD scheme is the likely reduction in the multiplier effect and its implications for economic development in remote areas.

The forestry industry contribution to PNG economic development is also found in other areas. In many cases the logging companies provide road maintenance, infrastructure and welfare services to the landowners. For remote areas these are important benefits on top of the land use royalty payments. The industry also makes significant contributions to government revenues through income tax and log export taxes.

Commercial forestry is the only viable industry in remote rural areas. It is often the only chance for villagers to secure a job and improve their living standards. The feasibility of establishing other industries is limited because of infrastructure deficiencies. If forest lands in these areas were locked-up by a REDD scheme it would encourage a revision to subsistence living or increased migration to urban areas.

4. Variability of FMA timber harvests

		Vailala FMA Blocks 2 and 3	*Middle Ramu FMA Block 1*
*FMA project area **	*'000 ha*	267.8	158.0
Net harvestable area	*'000 ha*	215.3	117.3
Annual net harvest area	*'000 ha*	14.3	17.3
Annual timber harvest	*'000 m^3*	200	138
*Average timber harvest **	*m^3 per ha*	14.0	8.0

** FMA - Forest Management Area.* *Source: PNG FIA personal communication.*

*** Based on net harvestable area*

A REDD scheme will involve some form of land use payment. The payment will have to exceed the loss of forestry royalty rights by a significant margin. It should account for the royalty payments as well as the value of associated benefits from local employment and the spill-over benefits of infrastructure development.

Logging yields in the accessible forest areas vary according to the terms of the FMAs. Apart from the requirements of sustainable management practices incorporated in the agreements, natural forest areas will have different potential yield rates. Typically the off-take rates will be 18-20 cubic metres per ha but they can go as high as 30 cubic metres per ha (PNG FIA 2006).

An example of the variability in timber harvest is provided in table 4. This shows how the per ha value of natural land for commercial forestry purposes will vary according to the off-take rate. It means the opportunity cost of a REDD land use restriction will vary for different land areas. The complexities of recognising such differences will be a challenge. More importantly:

- the loss of future economic returns will vary for different land areas
- if a REDD scheme valuation of a forest area is less than its value under an FMA it will have a negative impact of future rates of economic growth.

The long term sustainability of the forestry industry and its contribution to economic development will depend on access to suitable land. Industry participants need some level of certainty to plan production and processing investments. Areas locked up by a REDD scheme may increase the pressure on harvest rates in other areas. It may also encourage the harvesting of less accessible, higher cost land areas.

4. Population growth, land use and deforestation

Most of the employment and income generating activities in rural PNG have a common link. They rely directly or indirectly on access to land for producing raw commodities. It is a primary reason why extensive rural to urban labour migration has not been a feature of PNG economic development. The paid jobs and occupations in PNG are in the rural areas because agriculture and forestry are the dominant activities:

- there has been some migration and unplanned expansions of urban centres;
- but much of the migration that has occurred has been between provinces and associated with the search for opportunities to earn cash incomes.

The importance of continued growth and development of the PNG rural sector is widely recognised by foreign aid and international development agencies. There have been numerous studies on development options and the constraints on economic growth. If the rural sector is to become an engine for further growth there are several constraints that will need to be addressed.

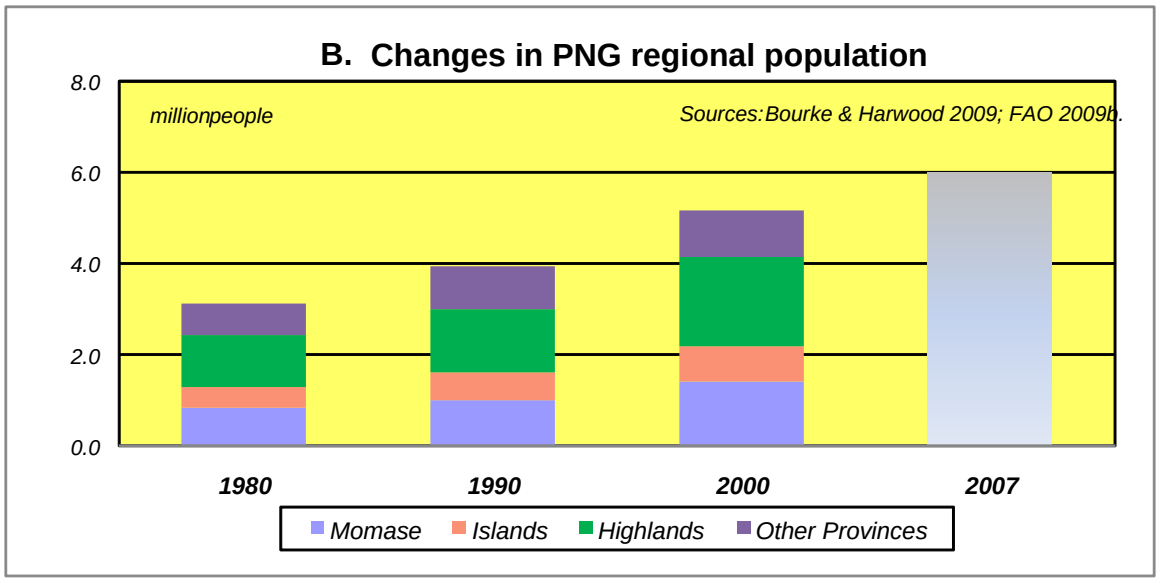
Among the constraints that have been identified by these studies there are several issues that stand out when considering the potential application of a REDD scheme:

- rapid population growth is putting pressure on land use especially in parts of the highlands and some island provinces;
- more intensive land use is raising concerns about soil fertility and longer term food security;
- transport infrastructure (i.e. roads and bridges) is limited and poorly maintained;
- deficiencies in the provision of social services such as education, health, housing are becoming more acute because of inter-provincial migration; and
- low incomes and poverty is limiting the ability of a portion of the population to participate in the formal economy and achieve higher living standards.

Land use demands and population growth will be critical factors in the future prospects for accelerating rural development. They have implications for the impact of a REDD scheme on economic growth and social welfare.

Population growth and migration pressures

The *2005-10 Medium Term Development Strategy* prepared by the Ministry for National Planning and Monitoring highlights the importance of rural development for the national economy (MNPM 2004). It notes the generally weak performance of most agriculture industries and the need to encourage large-scale, efficient agricultural projects such as the NES oil palm developments. A continuation of the contribution of the forestry industry is also important for jobs and income growth.



As most of the population resides in rural areas the growth of rural industries is essential for creating new income earning opportunities and improved living standards. It reduces unemployment and alleviates poverty which helps to improve law and order. It also reduces the pressure for rural to urban migration.

Population growth is one of the constraints identified in the development strategy. PNG has a population growth rate well above the average for developing countries. Census results show the annual growth rate was 2.7% between 1980 and 2000. FAO estimates suggest the strong growth rate has continued (chart B). Population growth is especially strong in the Highlands region where the development options are limited.

High population growth puts pressure on Government finances for social services such as health and education. There is also a strong correlation between population changes and land use changes (Nigal et al 2008). More people increases the demand for farm land and urban settlement areas. It also increases the need for jobs, occupations or the capacity to live a subsistence lifestyle.

Strong population growth in a rural based society is not compatible with a scheme that restricts land use. Access to land is the critical ingredient for economic development in PNG. Over time a REDD scheme will intensify the land use pressures in the remaining areas. If the opportunities for jobs or cash based occupations are limited the pressure for people to migrate from their village areas will rise.

PNG has not experienced strong rates of rural to urban labour migration like many other developing economies. The population of Port Moresby was 254,000 in the year 2000, less than 5% of the total population (table 5). But there is a problem with unplanned expansions of urban and peri-urban areas. Social tensions from inter-provincial migration have arisen in some areas as people search for income earning opportunities.

5. Regional distribution of PNG population

	Rural		*Urban*		*Total*
	'000	*%*	*'000*	*%*	*'000*
Momase *	1 212	*84.6*	221	*15.4*	1 433
Islands **	689	*92.9*	53	*7.1*	741
Highlands ***	1 889	*95.7*	85	*4.3*	1 974
Southern ****	714	*90.6*	74	*9.4*	788
Port Moresby	..	..	254	*100.0*	254
PNG	4 504	*86.8*	686	*13.2*	5 191

 # Based on year 2000 national census results. *Source: Bourke & Harwood 2009.*

** Provinces of Morobe, Madang, East Sepik & Sandaun.*

*** Provinces of Manus, New Ireland, East New Britain, West New Britain & Bougainville.*

**** Provinces of Southern Highlands, Western Highlands, Eastern Highlands, Enga & Simbu.*

***** Provinces of Western, Gulf, Central, Milne Bay & Oro.*

These developments reflect the strong population growth and the weakness of rural industry growth. Rural to urban labour migration is an inevitable outcome of economic development. But it can create social problems if the job opportunities in urban areas are limited. Law and order problems emerge and public health risks increase.

Almost 70% of the rural population reside in two regions – the Momase region and the Highlands. In the future the pressures for accessing land for development purposes will be greatest in these areas. If restrictions on land use through a REDD scheme were to be concentrated in these regions the pressure for migration will grow stronger.

It is important to consider the implications of increasing land access constraints under a REDD scheme in this context of a growing population. If opportunities for subsistence farming, forestry and large scale agricultural developments like oil palm are curtailed the migration pressures will rise. The social problems that are already evident are likely to increase as alternative non-rural occupations are limited:

- in three regions less than 10% of the population live in urban areas (table 5);
- if new provincial job opportunities do not emerge the migration pressure will focus on Port Moresby.

REDD participation will result in some form of compensatory payment for land owners. This may seem a reasonable outcome but an occupation or paid employment is the key to social cohesion. It gives people a focus in their life and the opportunity for higher living standards. There is also the question of how a REDD payment would be shared amongst a village group with a growing population:

- over time the dilution of shared payments is likely to encourage migration.

The PNG development strategy is based around export driven economic growth, rural development and poverty reduction (MNPM 2004). Agriculture and forestry are expected to remain the mainstay of the economy for some time. The strategy anticipates expanding opportunities in rural areas will reduce the migration pressures:

- the outcomes of a REDD scheme would seem to conflict with the sentiments and objectives of the development strategy – a social impact assessment would seem warranted on the migration pressures that could arise.

Land use and deforestation

High population growth makes land use restrictions a critical issue for future economic development. The *Medium Term Development Strategy* notes a possible need for land improvement programs and resettlement schemes because of increased demand for land in urban and peri-urban areas. Land requirements of manufacturing industries will have flow on effects for the availability of arable land.

This raises the issue of deforestation and land use in general. Some environmental NGOs have raised concerns about the rate of deforestation in developing economies with large forest reserves. In the Asia-Pacific region Malaysia and Indonesia have been a focus of attention because of palm oil developments and forestry production. Concerns have also been raised about the use of natural forest land in PNG.

It is important to recognise that forestry production is not a major factor in deforestation. Clear felling of land for forestry has never been permitted in permanent production forest areas in PNG. Timber is removed selectively based on size and merchantability criteria. There is a formal allocation of land areas available for forest use.

The concerns about deforestation and PNG land use in general are not supported by the facts. The amount of agricultural land is just over 1 million ha which is just over 2% of the total land area (table 6). The growth in agricultural land areas has not been excessive. Since 1990 it has increased by just 163,000 ha.

6. PNG land use

		1990	*1995*	*2000*	*2005*	*2007*
Agricultural land	*'000 ha*	877	934	1 005	1 030	1 040
	change	..	57	71	25	10
*Forestry land **	*'000 ha*	31 523	30 828	30 133	29 437	29 159
	change	..	-695	-695	-696	-278
*Other land uses ***	*'000 ha*	12 886	13 524	14 148	14 819	15 087
	change	..	638	624	671	268

** Includes land used for commercial logging and other forest areas.* *Source: FAO 2009b.*

*** Residual of total land area of 45,286 thousand ha - includes other wooded land and areas used for housing, infrastructure etc.*

7. Land used for selected agricultural crops in PNG

		1990	1995	2000	2005	2007 p
*Oil palm **	*'000 ha*	46	62	72	85	96
	change	..	17	10	13	11
*Coffee **	*'000 ha*	55	50	87	70	70
	change	..	-5	37	-17	0
*Cocoa **	*'000 ha*	89	80	98	110	120
	change	..	-9	18	12	10
Other cropping uses	*'000 ha*	553	582	568	575	564
	change	..	30	-14	7	-11
*Total farming land ***	*'000 ha*	742	774	825	840	850
	change	..	32	51	15	10

** Area harvested.* *Source: FAO 2009b.*

*** Defined as arable land and permanent crops - excludes agricultural land used for grazing.*

Forested land is still the dominant component of the total land area in PNG. There is no evidence of substantial deforestation. Forested areas have declined since 1990 but the rate of change could not be described as a serious concern. The reality of population growth and the need for economic development is that some natural forest land will need to be used for other purposes.

As the *Medium Term Development Strategy* notes agricultural developments such as oil palm are needed and this will require the use of some natural forest land. That land will be clear felled and the timber resources fully utilised. Only forest land designated for this purpose can be developed and environmental impact assessment are required for large scale developments.

In some cases the land used for oil palm developments will be land previously used for forestry and fallowed land from subsistence agriculture. The amount of land currently used for oil palm plantations is minimal – an estimated 96,000 ha in 2007. In general the data indicates that deforestation for agricultural developments is not a major concern:

- about 190,000 ha are used for coffee and cocoa tree crops (table 7);
- the 564,000 ha of other crop land includes areas used for subsistence agriculture;
- changes in the land areas since 1990 have not been especially dramatic.

There is some conjecture about the validity of the land use data. Forested land includes land that has been commercially logged. In these areas most of the tree cover remains and regrowth is occurring. Provided land designated for forestry is sustainably managed it is reasonable to include the areas in the natural forest base:

- the large area on inaccessible land is a natural constraint on the amount of land that can be used for commercial forestry and agricultural developments.

Forested land also includes land previously used subsistence agriculture that has been fallow for more than 5 years (Bourke & Harwood 2009). The shifting cultivation system involves a land use rotation process with a lengthy fallow period. During the fallow period regrowth occurs until the land is resumed for agricultural purposes. As regrowth is occurring it seems reasonable to include these areas in the forest land based.

The amount of land used in this way for subsistence agricultural is unknown. Even if an allowance is made for fallow subsistence land more than 5 years old the amount of forested land in PNG is substantial. The 564,000 ha of land used for other cropping uses in 2007 gives a reference point. If this area was increased by a factor of 10 the estimate of forested land would still amount to around 50% of the total PNG land area.

Deforestation in PNG is not as extensive as the claims made by environmental NGOs would suggest. Commercial forestry activities do not cause deforestation. Developments of permanent tree crops such as oil palm and coffee play a role but the amount of land involved is small. Subsistence agriculture is a much larger user of forested land and these areas are allowed to regenerate:

- this means the application of a REDD scheme to limit deforestation would be largely based on previous land use for subsistence agriculture;
- given the limited opportunities for economic development it does not seem sensible to encourage land use restrictions on this aspect of the rural economy;
- if subsistence agriculture areas are quarantined in some way then the impact will fall on the industries with growth prospects – oil palm and forestry.

The other factor that contributes to deforestation is non-rural land uses brought about by human settlement. Other land use accounted for more than 15 million ha of the PNG land area in 2007. This area includes scrub land and other types of non-forested land. It also includes land used for housing, infrastructure, roads and other urban requirements. As the population grows the demand for land for these purposes increases. The rise in other land uses since 1990 would reflect these demands:

- between 2000 and 2007 other land uses increased by about 940,000 ha;
- over the same period forestry land fell by about 970,000 ha (see table 6).

It is important to recognise that increased land use for human settlement purposes affects the rate of deforestation. It can have a direct effect but often the impact is felt indirectly. Urban land use typically absorbs some of the agricultural land that surrounds urban areas. The pressure on the agricultural land base requires an extension into natural forest land. In effect agriculture is on the front line of the encroachment into forest land:

- in the PNG case this pressure is probably most evident in the need for land to accommodate the demands for subsistence agriculture;
- the population is concentrated in rural areas and subsistence agriculture is the dominant cropping activity.

8. PNG regional production of selected rural commodities

	Timber in 2007		*Palm oil in 2007*		*Coffee in 2006*		*Cocoa in 2006*	
	'000 m³	*%*	*'000 tonnes*	*%*	*'000 tonnes*	*%*	*'000 tonnes*	*%*
Momase region *	651	*22.9*	0	*0.0*	0	*0.1*	9	*21.6*
Islands **	1 378	*48.6*	1 588	*73.2*	0	*0.0*	34	*78.0*
Highlands ***	0	*0.0*	0	*0.0*	47	*93.2*	0	*0.0*
Southern region ****	807	*28.5*	583	*26.8*	3	*6.7*	0	*0.4*
PNG	2 835	*100.0*	2 171	*100.0*	51	*100.0*	44	*100.0*

** Provinces of Morobe, Madang, East Sepik & Sandaun.* *Source: Bourke & Harwood 2009.*

*** Provinces of Manus, New Ireland, East New Britain, West New Britain & Bougainville.*

**** Provinces of Southern Highlands, Western Highlands, Eastern Highlands, Enga & Simbu.*

***** Provinces of Western, Gulf, Central, Milne Bay & Oro.*

The intensification of agricultural practices and forest plantations development could create opportunities to reduce the impact of inefficient land and resource use, such as through subsistence agriculture and traditional firewood collection:

- the FAO has estimated annual firewood removals in PNG at more than 6.4 million cubic metres;
- If REDD programs are to be implemented, they must adequately address both food and energy security.

There is no case for adopting a REDD scheme in order to halt deforestation or forest degradation from commercial forestry, especially when consideration is given to the implications for future economic development. The availability of land for subsistence agriculture and rural industry developments like forestry and oil palm will be a key factor in achieving the goals of the *Medium Term Development Strategy*:

- the *National Agricultural Development Plan for 2007-16 (*NADP) notes the need to empower the rural population through sustainable agricultural development (MAL 2007);
- land access constraints will make it difficult to realise the objectives of the plan.

If population growth is combined with existing land use for commercial purposes it is possible to get an indication of the likely adjustment pressures from a REDD scheme. The highlands region is totally dependent on coffee and the Momase region is heavily dependent on timber (table 8). Almost 70% of the rural population reside in these two regions. The oil palm industry is concentrated in East New Britain and the Southern region. These regions will be the focus of future growth in the palm oil industry.

These regional concentrations would suggest:

- the economic welfare of the highlands is vulnerable to a REDD scheme that limits land access for subsistence agriculture and small holder coffee plantations;
- if the scheme affects land access for commercial forestry the Momase region could experience a significant loss in economic welfare;
- if it restricts land clearing for oil palm plantations economic development in the southern region and East New Britain will be curtailed.

Deforestation, biodiversity and conversation

PNG has the world's biggest concentration of tropical rainforest. An issue that has been raised in the context of the REDD concept is concerns about deforestation and forest degradation on biodiversity. The forestry industry and the limited areas of plantation tree crops are perceived to be a threat to the loss of habitat for native flora and fauna.

There is no denying the fact that economic development puts pressure on biodiversity in specific locations. So it is important to strike a balance between the need to use forest land for economic development and to manage the wider environmental consequences. Governments generally respond to this issue by establishing permanent conservation areas and national parks:

- forest conservation is best achieved by deliberate policies to conserve certain areas of significant biodiversity;
- it is not achieved by adopting policies that encourage the permanent cessation of deforestation for agricultural development purposes

The use of forested land for agriculture, forestry and non-agricultural uses does not automatically mean there will be biodiversity losses. It depends on factors such as the location of the land conversion areas, the amount of land involved and the amount of remaining forest land in that location. The impact on wildlife habitats will depend on the size of the population and their favoured living areas:

- it does not automatically follow that all native forest areas are critical for the survival of a particular species;
- population surveys and ecological research are needed to establish the facts.

The UN has established a target for forest conservation and most developing economies with large forest reserves have land set aside for conservation purposes that exceed the target. PNG has protected land areas for conservation purposes. The most recent data indicates that PNG has protected land areas of almost 45,000 square km which is almost 10% of the land area (ESCAP 2008). A REDD scheme is not necessary to address the issue of land conservation for biodiversity protection:

- it would be an indiscriminate and high cost way to address the issue;
- in PNG it could have significant implication for economic development.

Apart from protected conservation areas the topography of PNG ensures there will be a substantial area of native forest land that will remain untouched by the forestry industry and agricultural developments. Almost half of the forested land in PNG (about 15 million ha) is considered to be inaccessible or unsuitable for forestry production. This provides a natural hedge against the impact of land use changes on biodiversity.

5. Economic returns from alternative land uses

There are numerous practical difficulties in making a REDD scheme work. There are also uncertainties about the science and measurement of the impact of forested land use changes on GHG emissions. Applying the concept of farming carbon emissions through forests does not seem feasible. Efforts to demonstrate the economic returns generally rely on carbon pricing assumptions of US$30 to US$50 per tonne:

- the only realistic reference point available at this stage is the price for carbon on the Chicago Carbon Futures exchange;
- in recent times the price has been hovering around US$1 per tonne.

The feasibility of using forests as carbon sinks to reduce GHG emissions does not seem realistic. It relies on the major emitters agreeing to establish a regulated global market for carbon. Even if it were to become feasible there are wider considerations associated with the impact on economic activity. From an economic development perspective it is crucial for forested developing economies to consider the opportunity cost of implementing any schemes that involve leaving land idle:

- the opportunity cost of participating is the economic returns from the alternative uses of the land.

Land use returns

There has been some research on the assessing the alternative economic returns of the different land use options for natural forest areas in developing economies. The estimates that are available are conditional on the assumptions used and data associated with the variations in the physical performance of land areas with different growing conditions. Given the potential effects on development an assessment of land use returns should be a high priority for governments in their deliberations on the GHG emissions issue:

- the PNG government should commission a detailed, independent analysis of the economic returns from different land use options;
- the analysis should take a regional perspective; and
- it should be used as a basis for assessing the required return from proposals such as REDD that would require land to permanently remain idle.

As an indication of the potential differences in returns it is worth considering some recent estimates on Indonesian land use (table 9). The estimates are based on the net present value of returns over a 30m year time period. They show the high annual returns from large scale oil palm plantations – US$3,340 per ha. Small holder producers also earn high returns although much depends on the yield performance. Some small holders gain technical support from plantation companies and can generate high yields.

9. Economic returns from Indonesian land uses

Alternative land use	*Returns from forest land conversion **
	$US/ha
Large scale oil palm plantation	3 340
Small holder oil palm plantation - high yield	2 340
Small holder oil palm plantation - low yield	960
Small holder rubber plantation	72
One-off timber harvesting prior to planting	1 099

** Net present value in 2007 dollars for a 10% discount rate over 30 years. Source: World Growth 2009.*
Estimate for rubber plantations based on 20% discount rate over 30 years.

The returns from timber harvesting in Indonesia are also substantial – US$1,099 per ha. This is a primary reason why investments in palm oil plantations have accelerated in recent years. Economic returns from rubber plantations are smaller at US$72 per ha.

Similar sorts of returns could be expected in PNG. Recent commercial proposals for oil palm plantation developments in East New Britain would have been based on this sort of assessment. There are some estimates available that give an indication of the differences in PNG land use returns (table 10).

These estimates also indicate there are high returns from oil palm in PNG. The estimate of US$9,275 per ha is much higher than the estimate for Indonesia but it is important to note that differences in the underlying assumptions on markets returns and yields would explain some of the difference. The estimated returns on forestry are similar to the estimate obtained for Indonesia.

It is difficult to assess the returns from shifting subsistence agriculture because of data deficiencies. But a study has estimated the returns at US$745 per ha (Greig-Gran 2008). This estimate is comparable with the estimated returns on oil palm and it provides an indication of the substantial benefits that could be obtained by encouraging shift from subsistence agriculture to commercial oil palm plantations.

If these estimates are a plausible reflection of what can be achieved in PNG the key question is how they compare with the value of the land as a REDD carbon sink:

- a reasonable estimate of the land value as a carbon sink would need a surveyed estimate of the carbon stored in a typical forest area that would be suitable for oil palm cultivation or is currently used for timber harvesting;
- the carbon stored (tonnes per ha) would show the US$ carbon price required to be on par with these alternative land uses.

10. Economic returns from PNG land uses

Alternative land use	*Returns from forest land conversion **
	$US/ha
Large scale oil palm plantation	9 275
Subsistence crops	745
*Voluntary carbon payments ***	141

** NPV in 2007 dollars based on a 10% discount rate over 30 years.* *Sources: Grieg-Gran 2008; Butler 2009.*
*** Based on an assumed carbon price of US$1/tonne.*

An attempt has been made to estimate the return on land used as a carbon storage reserve (Butler 2009). This estimate of US$994 per ha is based on a number of assumptions and it should only be regarded as indicative. However it does provide a point of comparison for assessing alternative land uses. The estimate is well below the returns from oil palm and is even less than the returns of forestry.

The validity of the estimated economic return on land used as a carbon sink is not crucial to the analysis. The other estimates show the opportunity cost of what is forgone if land is left idle. They show the minimum REDD payment required to avoid a loss of economic wealth. But it is important to remember it only shows the land output returns. It does not include a value for the benefits of:

- direct job creation and the multiplier effects in the local economy; and
- an imputed value of the benefits from infrastructure and service developments that are associated with forestry and oil palm plantations.

Given the importance of forestry to the PNG rural economy some further analysis of the returns from logging in comparison seems warranted. The net present value of returns from a 267,820 ha forest concession were calculated using two scenarios for timber harvest rates. Cost assumptions were based on industry estimates and the assumed timber price was US$100 per cubic meter.

In this case the net present value estimates were based on a 40 year time period and a 10% discount rate. An estimate of the value of the same land used as a REDD concession based on selective logging was also calculated for carbon prices of US$1 per tonne (based on 2009 prices) and US$7 per tonne (based on a historical market high for 2008). The details of the calculations can be provided upon request but the key results were:

- the economic returns for timber harvesting were between US$303 per ha and US$500 per ha; and
- returns as a REDD concession were between US$45 and US$240 per ha.

The implications are relatively straightforward. The carbon price would have to rise substantially from recent levels to compete with sustainable forestry production. Returns from the land used as a REDD carbon concession area are likely to be overestimated as the carbon price at November 1 2009 is US$0.10 per tonne. In comparison to large scale oil palm these estimates clearly show the carbon storage option does not give the necessary financial returns for leaving the land idle.

The strategy for deliberations on REDD

A global trade in carbon permit does not look feasible or practical in the foreseeable future. It is highly unlikely there will be agreement on such as ambitious scheme in the upcoming UNFCC conference in Copenhagen. This means the large revenue benefits claimed by the proponents of the REDD concept may not eventuate. The purchasing of REDD carbon credits by developed economies under a global scheme endorsed by the UNFCCC looks to be unrealistic.

Some industrialized economies may seek to secure credits from developing countries under bilateral arrangements. This is foreshadowed in Australian planning for its Emissions Trading Scheme. Membership of the Kyoto Protocol will limit its options. The EU has ruled out large scale purchase of carbon credits from developing countries, at least during a second phase of commitments to reduce emissions under the Kyoto Protocol, if there is one.

The leading current focus in discussions over REDD is that industrialized economies will provide funding to assist developing countries to prepare for REDD. Aside from current commitments to World Bank funding programs, there is no certainty there will be agreement at Copenhagen among developed economies to provide large amounts of assistance.

Developed economy aid in exchange for adopting a REDD scheme may be possible but the value of this approach in comparison to the opportunity cost of the land use restrictions is highly uncertain.

Other tropical forest developing economies insist REDD should be "REDD Plus" (and even "Plus, Plus") meaning that assistance should also be provided to assist developing countries to develop their forestry industry as well as the sustainable management of it. They have also indicated in preliminary discussions in the preparations for Copenhagen that inclusion of a "no conversion" provision in any REDD related package of measures is unacceptable.

There does not appear to any sound reasons for the PNG government to rapidly embrace the REDD concept. There is no need for forested developing economies to prematurely adopt strategies to reduce emissions before global consensus is reached among the major emitters. The pressure from environmental NGOs and some international agencies to use land use restrictions as a way to meet GHG emission targets should be assessed against the alternatives.

If consideration of the REDD concept is to be pursued at the very least there is a need for a thorough economic impact assessment that considers the regional implications for economic growth and development. There is also a need for social impact assessment as any policy development that regulates or encourages restricts land use options will have significant social implication. In many areas the pressure to revert to a subsistence way of life or to migrate to other rural regions and urban areas would seem a realistic outcome.

PNG commitments to permanently cease the conversion of forest land to more productive purposes are a recipe for slower economic growth and development. This is because the rural sector will remain a central feature of the economy for some time. Opportunities for economic development in rural areas are limited – the forestry and oil palm industries appear to be the only options at present:

- it would be prudent to carefully consider the implications of any policy considerations that could affect land access.

It is in PNG's national interests to see REDD programs based on sound technical analysis and oriented as well towards supporting development of land use policies which support strategies to raise living standards, as well as protecting the environment.

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