Cost-Benefit Analysis of a Shift to a Low Carbon Economy in the Land Use Sector in Indonesia

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Executive Summary

> ***"Both developed and developing nations must do more and do away with "business as usual" mentality. Developed nations must take the lead, but developing nations must also seriously do their part."***
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> ***"With international support, we are confident that we can reduce emissions by as much as 41 percent. This target is entirely achievable because most of our emissions come from forest related issues, such as forest fires and deforestation."***
>
> (President Susilo Bambang Yudhoyono - Pittsburgh G20, September 2009)

Indonesia is a major emitter of greenhouse gases, and will be crucial to the success of any global strategy to reduce such emissions and head off the risks of man-made climate change. A large proportion of the country's emissions arises from the land use sector, which may be the most amenable to mitigation at reasonable cost.

This is because the low carbon economy happens to largely coincide with good land use policy. Indonesia has to make important reforms in the land use sector, but has been shielded from doing so for years because of the sheer size of its forest. Now is the perfect opportunity for policy-makers with an interest in rural development and economic performance to shape a land use strategy that moves away from unsustainable primary resource extraction. A sustainable development path need not be traumatic, carries few risks and may yield significant benefits.

Indonesia therefore has nothing to lose and much to gain from reforming the land use sector and in the process significantly cutting emissions.

The current situation

The land use sector in Indonesia, particularly the forestry and palm oil industries, is the focus of plans to mitigate emissions. This may be achieved through schemes such as REDD - which aims to reward activities that leaves the forest intact - or through specific interventions such as eliminating fires or rehabilitating peatland. Forestry and palm oil make an important contribution to the economy, and in the case of palm oil, has great potential to expand further in future. These industries provide millions of jobs in remote areas, generate profits for Indonesian companies and are significant exporters. Any policies that may constrain such an important sector need to be considered carefully.

However, these industries are not as good as they could be. Millions of hectares of production forest lie idle, and two thirds of timber plantations are yet to see a single sapling. The timber processing industry is in decline in many provinces, and lacks a sustainable supply of raw material. The palm oil industry has low yields per hectare, especially amongst small farmers that comprise almost half of the estates, making the industry far from competitive on an international level.

Governance and management of the country's natural assets is also a problem, especially at the local level. Primary forests are converted for plantations while degraded land lies idle. Peatland over three metres deep is drained, despite laws forbidding such practices. Timber concessions often fail to follow regulations, fell trees indiscriminately and inefficiently, and have little incentive to consider the long-term health of the forest. Meanwhile local people have unclear tenure, hold customary claims that are dealt with ambiguously by the law and constitution, and in many cases are excluded from the financial rewards of natural resource management.

Sources and drivers of emissions from land use sector

Sector	Source of emissions	Share of 2030 emissions	Key drivers
Forestry	Deforestation	23% (750 MtCO2e)	- Increasing pressure to convert forest - Failure of reforestation programs - Timber industry short of raw material - Low productivity in oil palm sector
	Degradation	8% (250 MtCO2e)	- Natural forest concessions are unsustainable - Non-active concessions become open access areas - Illogical forest zoning and spatial planning
Peat land	Fire	18% (580 MtCO2e)	- Cheap land clearance method for plantations and agriculture
	Decomposition	12% (395 MtC02e)	- Expansion of palm oil industry into marginal areas - Plantations cannot replace the carbon released
Agriculture	Nutrient and residue management	9% (164 MtCO2e)	- Low agricultural productivity - Unclear tenure, limited access to finance, low investment

The carbon emissions from land use reflect the institutional and economic conditions that shape the forestry, peatland and agriculture sectors. The amount of emissions, and the key drivers that cause them, are listed in the table above.

The current pattern of land use and governance in Indonesia is unsustainable. Even if the country decided to take no action on greenhouse gas emissions, it would still need to be engaging in a profound re-think of the drivers, policies and decisions that lead to land use change, and an alternative economic development plan that does not wholly rely on natural resources extraction, and the conversion or degradation of existing landscapes.

The costs of reducing emissions

Based on data from the National Climate Change Council (DNPI) and other sources, this report estimates the total annual cost of meeting the land use sector's share of the government's target of 41% emission reduction by 2020 as approximately $6.6 billion, or equivalent to **1**% of Indonesia's 2009 GDP. In order to achieve the maximum feasible abatement by 2030, costs will rise to $13 billion per annum, which is **2**% of GDP. If climate finance is forthcoming, for instance from international carbon markets, then these costs can be greatly diminished. For instance, if the

carbon price is $5 per ton CO2e, then annual costs will reduce by almost half. If the carbon price rises to around $13, the costs are reduced to zero.

One of the most significant potential costs in reducing emissions is the opportunity cost of the revenue that could have been derived from the forest or peatland, had it been converted to a more economically attractive activity, such as an oil palm plantation. However, this report argues that it is most unlikely compensation would be due to a private firm in such circumstances. This is because sufficient degraded land is available for future development, even if quite optimistic growth scenarios for oil palm and pulp are taken into account. That said, there may be cases at a local level where a district that has a high proportion of peatland may face constrained economic growth through the lost opportunity to convert the land. In such a case some targeted compensation may be due to the affected communities, in order to support livelihoods.

Although this report argues that opportunity cost should be set lower than has been assumed by other reports, it also makes an attempt to include realistic costs for the institutional reforms necessary to enable abatement to take place, and the transaction costs to ensure efficient and equitable distribution of abatement funds. This adds significantly to the total costs of shifting to a low carbon economy, in fact in order to meet the 2020 target these costs make up over 90% of the total, eclipsing the actual implementation activities.

Benefits of shifting to a low carbon economy

Indonesia is a developing country, with aspirations to eliminate poverty, disease and hunger and reach standards of living that are now commonplace in advanced economies. It would not make sense to undertake a development path that may impose costs on the economy and inhibit progress towards the goals of advancing human welfare. If mitigation of carbon emissions costs jobs and growth, then it may be too high a price to pay.

However, the good news is that many of the necessary changes in the land use sector yield more benefits than costs. As the Ministry of Finance observed: '…the shift to a lower-carbon pathway will improve economic efficiency even if environmental benefits are not taken into account'.[1]

In summary, some of the benefits are as follows:

- Plantation companies have indicated their willingness to cover the cost of land swaps as it will save them time and money in seeking suitable land and assistance negotiating access with local people
- Palm oil tends to exhibit higher net returns from mineral soils compared to peatlands, which combined with better management is worth $2.5bn of additional GDP
- Restoring value to forests, including ecosystem services generates benefits of over $300 per hectare
- Stimulating investment in community plantations protects the $16bn per annum processing industry. Further growth could double the size of the industry by 2030
- Increasing palm oil productivity, especially among smallholders, has potential to triple farmer income and add $4bn to GDP
- Sustainable Forest Management holds the key to revitalising the production forest, reversing the decline in a $5bn sector of the economy while also boosting rural incomes

- Preventing fires in peatland and forests could prevent $860m per annum in economic losses.
- Improving spatial planning and reforming and tenure can release under-utilised land, increase yields, and improve livelihoods for as many as 20 million people.
- Managing watersheds and rehabilitating peatland will reduce the severity and impact of natural disasters such as floods, landslides and droughts. This not only saves lives and reduces misery; it could save the economy up to $500 million per annum.

Indonesia still has a substantial forest estate and extensive peatlands. Sensible management of these landscapes in the context of global carbon markets has great potential to release some of the 'utility' value that reflects the true economic, social and environmental value of the forest, not just the short term extraction value. This will improve the welfare of millions of rural Indonesians, whilst also setting the economy on a path of higher productivity and more resilient prosperity.

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1. Introduction

The purpose of this paper is to analyze the estimated costs and benefits of shifting Indonesia's land use sector onto a low carbon development pathway. It demonstrates that the sustainable use of natural resources in Indonesia is likely to have medium and long term economic and social benefits that outweigh the costs, whilst also reducing greenhouse gas (GHG) emissions.

In order to ensure that this is a useful tool for policy discussion within Indonesia, the wider costs and benefits of reducing greenhouse gas emissions on a global scale are not considered in detail, nor is the political background to the carbon market mechanisms that may arise from international agreements, except to make assumptions about their revenue impact. This study is interested only in the balance of advantages and disadvantages within Indonesia, and attempts to present a neutral case for the most rational courses of action regardless of how these may be perceived by parties either within or outside the country.

The 'low carbon economy' is defined in detail in Annex 1, but in brief it describes a state whereby all reasonable efforts have been made to reduce the carbon intensity of the economy (that is the amount of carbon emitted per dollar of GDP), as well as the absolute level of emissions, within the constraints of what is both technically viable and cost effective. Globally, the transition to a low carbon economy is a necessary condition for reducing GHG emissions and averting catastrophic climate change. However, the speed at which this is possible, and the costs and benefits of the most viable routes vary from country to country.

In a rapidly developing country such as Indonesia, moving towards a low carbon economy requires political will, guided by economic rationality. Therefore the 'low carbon economy' needs to be evaluated in terms of its likely impact on future economic growth, employment, the alleviation of poverty and other measurements of human progress. This document will be a brief discussion of the available evidence to establish how shifting to a low carbon economy could be made to be consistent with Indonesia's development plans.

2. Overview of current situation

This report focuses on what has become known as the 'land use, land use change and forestry' sector (LULUCF) as a major contributor to greenhouse gas emissions from Indonesia and the main area of debate for global approaches to reducing emissions from tropical countries. Land use patterns contribute to GHG emissions in a number of ways, as summarized in Table 1. More detail can be found in Annex 2.

Table 1 - Land use and greenhouse gas emissions

Sector	Activity	Cause of GHG emissions
Land Use	Agriculture (for food or estate crops), pasture	Methane, nitrous oxide, some C02 absorption by long-cycle tree crops (e.g. oil palm, rubber)
Land Use Change	Draining of peatland, fires, clearance of forest for other uses	Rapid emissions of C02 on burning, and/or long term C02 emissions on decomposition of peat, reduced capacity for forest to absorb C02
Forestry	Logging, timber plantations	Disturbance to forest canopy, increased flammability, unsustainable logging leading to eventual loss of forest. Some C02 absorption by growing plantation.

2.1. Big emitter, but with big plans

According to the latest report from the National Climate Change Council (DNPI), Indonesia's 2005 emissions were estimated as 2.1 billion tons of CO2e,[2] placing the country fourth in the world behind China, USA and Brazil.[3]

The means by which emissions are measured is an inexact science, and data are often subject to revisions and caveats. However by whichever measure one chooses, if the LULUCF sector is included then Indonesia is certainly a significant emitter of carbon in global terms. From a planning perspective, Indonesia's world ranking is less relevant than its relative position in terms of carbon emissions per capita and intensity per unit of GDP, as shown in Table 2 below:

Table 2 - Emissions compared with EU

Country	Emissions intensity	Per capita
	tCO2e/$m (PPP)	tCO2e/cap
Indonesia	2896	9.3
Norway	231	10.9
UK	327	10.7
EU	383	10.3

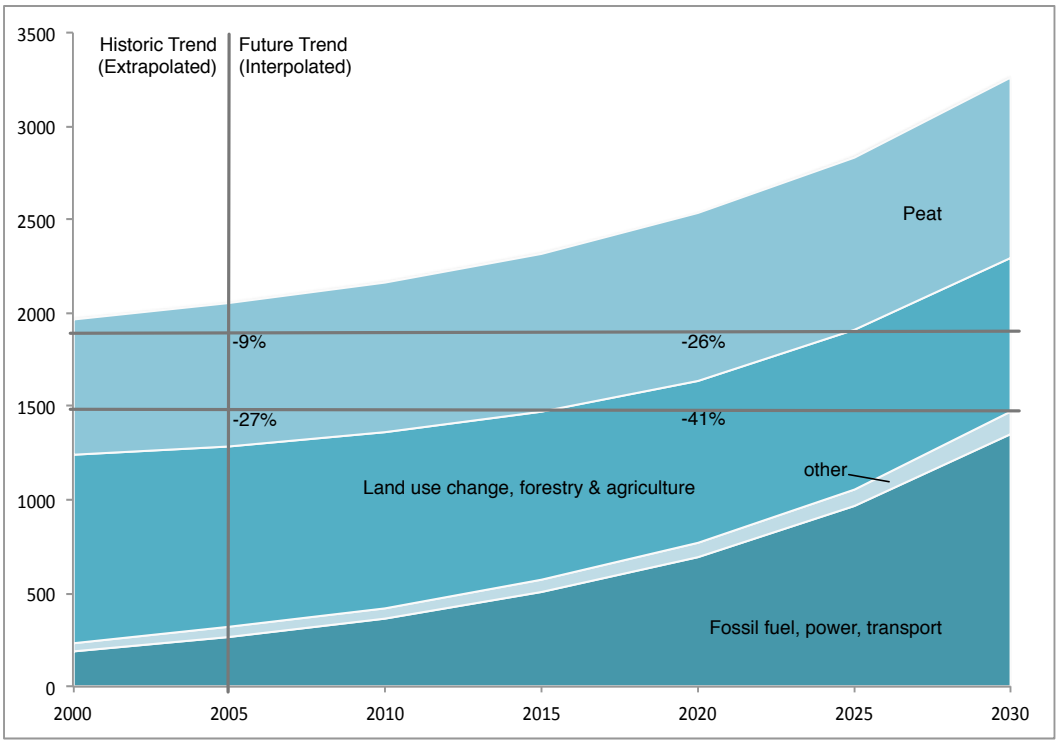
Source: WRI-CAIT, all GHG incl. LULUCF, 2005

Emissions per capita are at almost EU levels but without the corresponding standard of living. Indonesia's share of global emissions is significantly higher than its share of real global GDP, which was 0.6 percent in 2005, as the country emits far more carbon per unit of GDP than most other countries[4]. In 2005 Indonesia's emissions accounted for approximately 4.5 percent of global GHG emissions, and this proportion is predicted to remain the same through to 2030 unless changes are made.

LULUCF is by far the dominant factor in Indonesia's carbon profile, comprising up to 85% of total emissions.[5] The main activities causing emissions are fire (in both peatland and dryland forests), peatland drainage and decomposition, deforestation and degradation. Total LULUCF emissions (including agriculture) in Indonesia in 2005 were 1.74 GtCO2e, almost as high as the total emissions from global air and sea transport (1.8 GtCO2e). Thus land use in Indonesia is now regarded as being of global significance.

At the 2009 G20 meeting in Pittsburgh, the President of Indonesia committed the government to making a 26% reduction in emissions by 2020, or as much as a 41% reduction if funding is provided by other nations or international carbon markets. These reductions are based on the projected emissions that would otherwise occur if no action is taken - the 'business as usual' (BAU) scenario. Few other countries, particularly major emerging economies such as Indonesia, have been as bold with their commitments. Figure 1 shows the BAU trend, and how the target reductions are 9% and 27% of the 2005 level of emissions.

Figure 1 - Projected emissions and targets, 2005-2030



Source: based on DNPI data (2010)

In order to contribute to global targets on emissions reductions, Indonesia will need to aim for an emissions intensity of approximately 200tCO2e per $1mGDP, compared to 2,896tCO2e in 2005. This requires an annual improvement in efficiency of 10% per annum. By comparison, the average performance of USA and EU in reducing carbon intensity in the period 2000-2008 has been 1.8%-2.2% per annum. This indicates that Indonesia has quite a task before it.

2.2. The business as usual scenario in the land use sector

If carbon emissions can be taken as a proxy of economic activity, the very high emissions from LULUCF suggests that this sector is very important to the Indonesia economy. As shown in Figure 1, emissions from the land use sector are expected to increase slightly over the next 20 years, although as a percentage of total emissions the LULUCF sector will become less significant as other sectors (e.g. energy) grow rapidly.

Determining the role of LULUCF in the economy, and the extent to which its carbon intensity is unavoidable, is the first step in evaluating the costs and benefits of any rationalisation of the sector. The main areas to consider are forestry, palm oil and agriculture, and to also consider the wider trends that are currently shaping the economy. The importance of these sectors to the economy, is shown in Table 3.

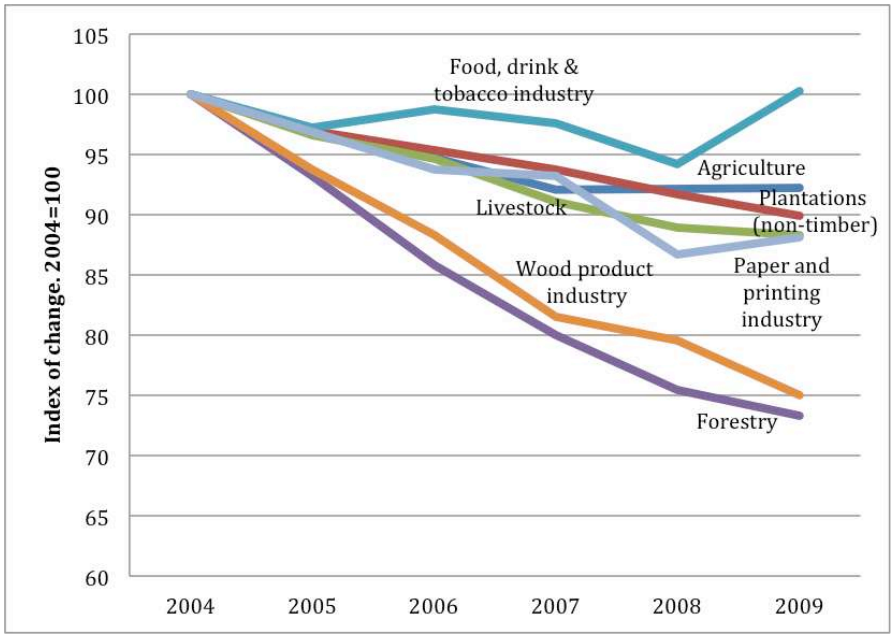
Table 3 - Share of economy & size of sector in 2009

	Current share	$bn
Agriculture	7.46%	46.6
Plantations (non-timber)	2.00%	12.5
Livestock	1.85%	11.6
Forestry	0.80%	5.0
Food, drink & tobacco industry	7.49%	46.7
Wood product industry	1.43%	8.9
Paper and printing industry	1.09%	6.8

Source: BPS (2010). 2009 GDP at current prices

The land use sector represents around a fifth of the economy, including downstream industrial processing. However, some sub-sectors have been thriving (e.g. palm oil) whilst others have been in long term decline (e.g. forestry). Figure 2 shows how all land use sectors have declined as a share of the economy since 2004, and only the food and drink industry has remained stable.

Figure 2 - Value of land use sector to economy - trend 2004-2009



3. Current trajectory and options for mitigation

The high level of GHG emissions from the land use sector, and the fact they are not expected to diminish over time, arise from a number of underlying causes and drivers, which are summarized in Table 4.

These drivers are themselves caused by certain conditions that prevail in the forestry, palm oil and agricultural sectors, as well as in the wider economy. Addressing these conditions will allow Indonesia to move towards the low carbon economy.

Table 4 - Key drivers of land use sector emissions

Sector	Source of emissions	Share of 2030 emissions	Key drivers
Forestry	Deforestation	23% (750 MtCO2e)	- Increasing pressure to convert forest - Failure of reforestation programs - Timber industry short of raw material - Low productivity in oil palm sector
	Degradation	8% (250 MtCO2e)	- Natural forest concessions are unsustainable - Non-active concessions become open access areas - Illogical forest zoning and spatial planning
Peat land	Fire	18% (580 MtCO2e)	- Cheap clearance method for plantations and agriculture
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In Indonesia the potential emissions that could be released from future land use change are huge, particularly from peatland. Thus for Indonesia to move to a low carbon economy, it must involve a profound re-think of the drivers, policies and decisions that lead to land use change, and an alternative economic development plan that does not wholly rely on natural resources extraction, and the conversion or degradation of existing landscapes. Such a plan may encompass the following:

- More efficient use of existing land, increasing economic value per hectare
- Improved regulation and enforcement of rules designed to reduce emissions
- A system of incentives that rewards low emission activities, leading to long-term behavioral change
- Systematic spatial planning, where the planned usage of carbon-rich landscapes reflects their total economic, environmental and social value.
- Current rates of deforestation are halted and reversed, leading to net gains in forested areas (or enhancement of forests that are currently partially degraded)
- Remove market and regulatory distortions that currently favour extraction of raw materials from non-sustainable sources (e.g. pulpwood from natural forests), and allow market forces to stimulate investment in long term planting by private sector, particularly small enterprises.
- Indonesia could build a competitive advantage (and a good reputation) in higher value-added sustainable products from forests and estates, such as edible oils, biofuels, furniture and paper.

Some of these plans make sense regardless of the problem of emissions from the land use sector, but they also require changes and interventions that will incur costs in both the private and public sector.

An analysis of the key drivers and conditions is presented below, with some brief notes on the abatement opportunities that exist in each case, where appropriate.

3.1. Increasing pressure to convert forest

Whilst peatland continues to emit carbon long after it has been disturbed, forestry emissions occur at the point of deforestation or degradation, or shortly afterwards. Projections of future business as usual emissions are based on deforestation trends, and scientific estimates of the impact of conventional logging practices that can cause long term degradation. The two issues are closely linked: degraded forest is more susceptible to fire and further incursions until all trees are removed. Future forest loss could be as much as 28 million hectares by 2030, based on past trends and likely future demand for land.

The assumptions behind this deforestation forecast are as follows:

- Government plans for increasing pulp and palm oil production will require 11-15 million ha of currently forest covered areas to be converted (6- 8 Mha for pulp, 5-7 Mha for oil palm)
- To feed and support the growing population another 10-13 million ha are required for croplands
- General increasing demand for wood products in construction and bioenergy might require even larger areas

If deforestation were to continue as forecast, then by 2030 Indonesia will have very little natural primary forest remaining outside the conservation and protected areas. Almost all ordinary production forest (HP) will be gone; leaving only limited production forest (HPT) leading to an enforced contraction of timber processing industries.

Scope for emissions abatement

- *Use degraded land.* The DNPI provincial peatland plans, the BAPPENAS peatland strategy and the Papua sustainable development plan all assume a certain amount of the abatement opportunities arise by diverting plantation and cropland development away from forests and on to degraded land.
- *Raise rural incomes.* Improving smallholder agricultural productivity increases returns per hectare and per household, encouraging investment in settled agriculture.
- *Diversify crop production.* Encourage cultivation of drought resistant crops in eastern islands (e.g. NTT), reducing reliance on rice as a staple.

3.2. Planned expansion of palm oil industry needs more land

Palm oil is the driver of much of the land use change in Indonesia, and the country is now the largest producer in the world, surpassing Malaysia after some years of very strong growth. It now generates $12.6bn of export income[6] and is thought to comprise 3% of GDP.[7] Palm oil contributes to the economy in two ways: firstly at the upstream end for smallholders as either independent outgrowers or on-farm employment in company-managed estates. Secondly in the downstream processing where oil palm fruit is transformed into crude palm oil (CPO), palm kernel oil (PKO) and other fractions, most of which are exported.

Since 2000, The palm oil estate has grown by approximately 5% per annum, reaching almost 8 million hectares.[8] If this trend continues and yields improve as slowly as they have in the past, then the estate will extend to nearly 20 million hectares by 2030, requiring an additional 12 million hectares of land.

Indonesia has expressed a target palm oil production of 40m ton per annum by 2020.[9] This is approximately double current production. This target is presumably based on a projection of

future demand for palm oil, as either edible oil or biofuel. Until now growth in Indonesian production has exceeded growth in demand, with an annual growth rate of 12% pa since 1995, compared to demand growth of 8% per annum. These growth rates are unlikely to replicated in the future. Furthermore, palm oil demand cannot be expected to rise indefinitely, nor for prices to continue on their current trends. Eventually the market will find equilibrium, and therefore it is most unlikely that it will be profitable to develop significant tracts of new plantations once the total estate has reached 13 – 15 million hectares. This is explained further in the Annex 6.

However, under current conditions, the role of oil palm plantations in forest conversion has to some extent been disproportionate to the amount of land actually required for plantations because of the way licenses have been granted at the local level. Regulations regarding execution and revocation of permits are rarely followed, leading to significant losses to the state. The government can revoke location permits and land use licenses allocated to oil palm companies if they fail to plant within 2 years; however in practice such revocation rarely occurs. For instance, location permits covering 5.3 million hectares of land for oil palm developments have been issued in West Kalimantan, while less than 1 million hectares of land have actually been planted with oil palm.[10] In East Kalimantan, 60 oil palm companies are operating without a full set of legal permits.[11] If these conditions continue, even if the oil palm estate expands by 5 million hectares it may result in deforestation of 10-15 million hectares because of the ratio between location permits and genuine plantations.

Scope for emissions abatement

- *Land swaps.* Work with palm oil industry to identify suitable degraded land for development. Where possible offer 'land swaps' to substitute degraded land for forest land. This can be done using existing legal processes, for instance through the Bupati or Governor proposing that degraded land within the forest estate is re-zoned as non-forest land. Land swaps are viable in districts that have a professional and transparent approach to spatial planning, and where the negotiations can take place with the Forestry Ministry to revise forest zoning.

3.3. Reforestation schemes not yet delivering results

Some LULUCF activities actually absorb carbon. For instance, eco-system restoration concessions (such as Birdlife Harapan in Jambi and the Ex-Mega Rice Project restoration in Kalimantan) halt deforestation and sequester carbon through tree planting, as does government initiatives such as GERHAN[12]. It is estimated that carbon uptake by such activities, even under the business as usual scenario, will reach 0.4 GtCO2e per annum by 2030.

However, this estimate is based on optimistic assumptions that current plans for re-greening Indonesia will somehow be markedly more successful than past efforts. For instance, DNPI assumes that GERHAN will lead to 400,000ha per annum being reforested, or 8 million hectares by 2030. Based on the track record of the community plantation (Hutan Tanaman Rakyat - HTR) scheme, this is highly ambitious.

The HTR scheme was originally conceived as a means to encourage communities to invest in developing timber lots, either individually, as cooperatives, or as a joint venture with a private company. This was an important part of the target of establishing an additional 9 million hectares of plantations by 2016, 5.4m ha from HTR and 3.6m from HTI. The financing would come from a revolving fund using capital from the Reforestation Fund (DR).

To date the project has been far from successful. The target was to have 1.2m hectares established by the end of 2009, which would then be producing pulpwood for industry from 2015 onwards. However, to date only around 21,000 ha of HTR plantations have actually been

approved, although local district governments have identified almost 350,000 ha of suitable plots of land.[13] At this rate of progress the scheme will achieve only 108,000 ha of community-managed plantation by 2016, a cumulative shortfall of over 5.2m hectares (see Table 5).

Table 5 - HTR permits and forecast shortfall

Year	Target	Area identified	Permits issued	Cumulative shortfall	
2007	200,000	0	0	200,000	
2008	400,000	150,554	8,794	591,206	
2009	600,000	197,169	12,363	1,178,843	
2010	770,000	*271,425*	*16,397*	*1,932,446*	*Projection*
2011	770,000	*271,425*	*15,866*	*2,686,580*	
2012	770,000	*271,425*	*15,866*	*3,440,714*	
2013	770,000	*271,425*	*15,866*	*4,194,849*	
2014	570,000	*200,925*	*11,745*	*4,753,104*	
2015	370,000	*130,425*	*7,624*	*5,115,480*	
2016	180,000	*63,450*	*3,709*	*5,291,771*	
Total	**5,400,000**	**1,828,221**	**108,229**	**5,291,771**	

This under-performance will have serious implications for future timber supply and thus forest usage and tenure. The Forestry Ministry has been working from projections (in the 2007 Road Map) that assume the HTR plantations will be meeting 30-40% of the total lumber demand from 2016. If such a significant portion of expected supply does not materialise then something has to give: either supply must be found elsewhere or industrial output must decrease. This may lead to more pressure to over-extract or convert natural forest.

Thus the timber processing industry is likely to enter a regime of raw material scarcity and sustainability problems even before any restrictions from a low carbon economy or REDD could be imposed.

Scope for emissions abatement

- *Stimulate Reforestation.* Reform HTR scheme to make it more attractive to smallholders and cooperatives. Provide DR and REDD financing where appropriate to cover period between planting and first cashflow.
- *Spatial planning.* Assist districts to work with communities to identify suitable land and fast-track the HTR approval process.

3.4. Timber processing industry faces shortage of raw materials

The timber processing industry, of which paper is the largest sector, is worth $15.7 bn, or 2.5% of the economy and employs around 240,000 workers. In real terms (at 2000 prices) the paper industry has grown slightly, but taken overall the forestry industry appears to be in decline relative to the rest of the economy. Provinces that used to rely on the forest industry to drive a large part of their economy are now witnessing a decline. For instance Jambi has seen 76,000 jobs lost from the forest sector in the period 2003-06.[14] In East Kalimantan the sector has declined in both absolute terms and also relative to the size of the economy since the 1990s[15]. Although it still occupies a huge area of land in that province (7.5m ha of production forest and industrial plantations), it yields just over $30 per hectare of income from logging, which is relatively unproductive.

The industrial forestry sector has been on an unsustainable path for some time, partly because of the historic over-investment in processing capacity (e.g. pulp, paper and plywood factories),

which demands more raw material than the production forests and plantations (HTI) can sustainably produce. In recognition of the predicted supply gap, an effort was made in 2006 to revitalise the timber industry and solve the supply problem by encouraging plantation development.[16] This set out a road map to increase plantation development and thus relieve the pressure on natural forests, with no further mixed tropical hardwoods going to particleboard or pulp. This was followed by a Ministerial decree that warned pulp companies that clear felling of natural forest in their concessions would be illegal after 2009.[17]

However, plantation development in Indonesia has historically been beset with difficulties. In the period 1989 – 2006, permits for over 10 million hectares of plantations were issued, but only 30% (3 million hectares) of the plantations were actually realised. In the case of the remaining 70%, natural forests were cleared to make way for the plantations, often fuelled by subsidies in the form of soft loans from the Reforestation Fund, but no productive investment took place,[18] or the plantations suffered from various calamities connected to the Asia financial crisis or forest fires. Even where plantations have been established successfully, they are not necessarily performing to best practice standards. The World Bank calculates that *'less than half of these lands are performing well in producing timber'*.[19] For instance, in East Kalimantan 800,000 hectares was cleared for industrial plantation (HTI), but only 165,000 hectares was actually planted,[20] and the yields from this estate are very low, at just 0.7 million cubic metres per annum, compared to the potential production of 23 million m3 if the whole area were properly managed.

Scope for emissions abatement

- *Intensive silviculture* to enrich both production forests and plantations, improving growth rates and resilience. This will boost yields (thus requiring less extensive felling of natural forest), and improve the carbon sequestration potential of growing forests.
- *Promote outgrower schemes* in partnership with industry supported by finance from the Reforestation Fund (DR) matched by REDD funds where appropriate. This is an efficient abatement strategy because it allows reforestation to occur more rapidly, and incentivizes communities and smallholders to restore degraded lands that may otherwise continue to be degraded. However, both financial returns and tenure security need to be sufficiently attractive to ensure commitment from smallholders.

3.5. Palm oil productivity below optimal levels

Palm oil yields have increased, but in recent years progress has leveled off somewhat, with yields averaging 2.7 tons of CPO per hectare.[21] This is lower than the Malaysia average[22] of 3.63 t/ha and very much lower than best practice yields being achieved on well-managed estates in Malaysia and Papua New Guinea. In general, smallholders (who cultivate 41% of oil palm plantations) experience yields that are 30-40% lower than large-scale estates.

Some plantations have led to improved livelihoods. For instance the Cargill plantation in Sumatra reports average gross incomes of Rp.5 million per month ($500)[23], which net of costs and monthly fluctuations may be take-home income of over $250, which is very high indeed for farmers in Indonesia. However, most other plantations do not report smallholder incomes of anything close to these figures. Smallholders at the PTPN plantation in Keerom, Papua, for instance, earn around Rp.575,000 per month ($63). Low smallholder yields do not reduce the profits of the processing mill (as long as they fulfill their capacity) but they do mean low incomes for farmers.

The key to better yield is good management, which can achieve good results even on poor soils. Conversely, bad management gets low yields out of even the best soils.[24] For instance, the state

owned enterprise PT Perkebunan Nusantara reportedly has some of the best land,[25] yet they have the lowest yields and PTPN XIV is one of the worst loss-making SOEs in Indonesia.[26]

Scope for emissions abatement

- *Raise smallholder yields.* Tackling the institutional and financial barriers to productivity, especially among smallholders, could significantly raise yields and thus reduce the amount of further land than may be required for oil palm plantations.
- *Set appropriate targets.* Provinces and districts should target production and yield rather than number of hectares.

3.6. Many natural forest concessions are not managed to achieve sustainability

The forestry sector (excluding industrial processing) is worth approximately 5 billion dollars per annum, representing less than one percent of the Indonesian economy.[27] The sector has declined since 2004 in both real terms and as a proportion of the total economy.

From a land use point of view, the forestry sector reaches across all parts of Indonesia. However, there is a mismatch between the amount of the production forest estate (Hutan Produksi and Hutan Produksi Terbatas) allocated to concessions and the amount of economic value actually being generated. The number of active HPH units has declined over the past decade; there are currently 299 concessions in Indonesia, of which 248 are active, covering 22 million hectares.[28] This has fallen sharply from 2001, when there were over 400 concessions covering 42 million hectares. 'Inactive' concessions may include those that have only recently received permits, as well as those that have had permits withdrawn, or where the business has been liquidated. However there are many concessions regarded as 'active' that are for all practical purposes dormant. (For instance the Ministry of Forestry data recognises 21 HPH units in Papua as officially 'active', but local officials regard only 6 as truly operational).[29]

Whilst some HPH units are no longer active, others are over-extracting, for instance to provide feedstock for the pulp mills in Sumatra. There is little regard for efficiency: for every cubic meter cut, at least an equal amount of wood is left behind and at least 8 million cubic metres of useable timber is left rotting in the forest every year.[30]

HPH units that do not submit valid management plans or provide evidence of active management are not held to account. Concessions therefore take on the characteristics of private freehold, with owners inviting offers for takeover but not being obliged to surrender their permits through breach of contract. This raises the private price of concessions, makes it virtually impossible for the state to cancel or reallocate under-performing permits. The net effect of this is economic losses for the state (through lower taxes and fees), private capture of the value of public assets and a perverse incentive to convert forest rather than manage it, as conversion licenses (IPK) are in the gift of the Bupati and thus easier to obtain than a new or existing HPH concession.

As companies are not held to account for the losses they cause to the forest asset, they have an incentive to take a short-term view. Badly managed concessions are eventually left to lie idle after the forest has been high-graded for the best timber. There is reportedly 16.4m hectares of 'open access' production forest in the former concessions[31], where illegal logging and absence of any management plan continues to degrade natural forest areas.

Scope for emissions abatement

- *Change management practices.* Encourage or regulate concession managers to use Reduced Impact Logging (RIL) techniques and invest in Sustainable Forest Management.

- *Reform permit process.* Design an incentive mechanism that penalises over-extraction and rewards companies that maintain the long-term health of the forest, perhaps tied to REDD payments. Widen HPH tender criteria to include sustainability indicators, so as to favour companies with a track record in sustainable forest management.
- *Revoke non-performing licences.* Where a concession lies idle, the license should be revoked and reallocated, or the company compelled to sell the unit as a going concern in an open bidding process. Where appropriate, provinces could set up a private-public partnership to take over non-performing concessions and manage them in partnership with local communities with a view to restoring the health (and thus carbon value) of the production forest.

3.7. Lack of harmony in forest zoning and spatial planning

Centralised forest zoning, based on historic precedents and limited formal gazetting, makes it difficult for provinces to make changes in their spatial plan that reflects local social realities (e.g. traditional tenure, settlements, small farms etc.), and economic realities (proximity to infrastructure, suitability of land for agriculture, potential for industry etc.).

The forest estate (kawasan hutan) contains much land that is not forested, but because of zoning cannot be developed. A rationalisation process is long overdue, and the palm oil companies have requested this repeatedly. 40 million Indonesians live in areas claimed by the state as forest but lacking tree cover.[32] Agriculture is not allowed in these areas, and investment in longer term farming systems, such as agroforestry or rubber is risky as access to the land may be denied by the time the trees are ready for harvest.

There is a mismatch between district, provincial and national spatial plans in terms of the scope and location of land available for conversion. Some spatial plans make zoning decisions that contradict national laws, for instance 2.5 million hectares of peatland over 3 metres deep is allocated for development as production forest or plantation, yet developing peatland over 3 metres is illegal.[33] Taken together, the various plans seem to indicate that a total of 63 million hectares has been earmarked for some kind of development, almost 60% of it involving forest conversion. Many of these plans and announcements carry little official weight and may never occur, but they serve to sow confusion in the REDD discourse, and reveal contradictions in the way Indonesia formulates development plans.[34]

Scope for emissions abatement

- *Invest in spatial planning.* Utilise REDD interim finance to build capacity for spatial planning, with donor-supplied technical assistance where appropriate. Develop centres of excellence in major universities to create an enduring culture of professional spatial planning.

3.8. Fires used as a method to clear land

Widespread fires in 97/98 cost the economy $2.3bn - $3.2bn[35] (excluding non-tangible costs such as carbon emissions), and in Central Kalimantan alone cost 8% of regional GDP. Fires were also serious in 2002 and 2006, although estimates of damage are not available. Fire control, with trained teams and appropriate equipment, supported by a public information campaign, can significantly reduce these fires.

Scope for emissions abatement

- *Behavioral change*. In the case of smallholders using fire as a cheap means to clear land, a solution can be to offer alternative methods of clearance as well as skills training and

extension to improve agricultural practices in general. Such intervention is likely to yield broader benefits beyond the initial goal of controlling fire outbreaks.

- *Fire prevention.* Ban fire as a land clearance technique, and provide appropriate tools for alternative means of land clearing. Strengthen fire brigades and ensure they are properly equipped, and install early warning systems. This will mitigate over half the emissions from peatland.

3.9. Peatland cleared for plantations and agriculture

Peatland is the main focus of efforts to reduce emissions because it is relatively inexpensive to achieve abatement in that sector, and also because it can be done with little impact in the economy. The BAPPENAS multi-disciplinary study[36] noted that:

'A provisional analysis of the current economic contribution of Indonesia's peat land area highlights that the utilisation of peat land probably contributes less than 1 percent of GDP yet accounts for almost 50 percent of emissions, resulting in a highly carbon intensive economy in peat land regions.'

Peat emissions alone in Indonesia, at 0.77 GtCO2e in 2005 are globally significant and similar to total emissions from Germany[37]. These emissions are manmade, and highly disproportionate to both the amount of peatland in the country (roughly 15% of land area) and the country's global share of peatlands: Indonesia has 5% of the world's peatlands, but generates 60% of global emissions from peat[38].

A large proportion of the emissions are caused by the fires used for clearance of the land, and by the drainage of peatland to make it suitable for planting, which dries out the biomass and sets in motion a long-term process of decomposition and emissions of GHGs.

The deforestation of peatland has not yielded economic gains. Between 2000-2006 the amount of forest in peatland declined by 2.2 million hectares, of which less than 10% became cropland.[39] It appears that peat forests are converted with the stated intention of developing a palm oil plantation, but once the timber is extracted the plantation never materialises, as it does not make economic sense to develop it at that location. Thus there is very little evidence that peatlands need to be opened up to provide cropland for food crops and palm oil.

Scope for emissions abatement

- *Restrict conversion.* Use regulations to restrict conversion of peatland, such as the decree to limit development to peatland less than 3 metres deep. The Business as usual scenario assumes that this regulation is enforced in future, even if it has not been very well enforced in the recent past.
- *Water management.* Work with existing plantations to install dams to restore the hydrology of the peatland and thus prevent the emissions caused when the peatland dries out and oxidises in contact with the air, releasing C02.
- *Rehabilitation.* As well as restoring hydrology, replanting with native species strengthens the structure of the peatland, helping to halt the process of decomposition that causes high GHG emissions.

3.10. Plantations may not always be carbon neutral

Pulp and oil palm plantations also absorb carbon whilst growing, but their contribution to the long-term carbon balance should not be exaggerated, as it takes a long time to offset the carbon released upon clearance of the original landscape[40] (especially those containing peat or rain forests). Even if the palm oil is used for biofuels, and thus the reduced GHG emissions from the fossil fuels they displace are included as a 'credit' to the carbon balance, the payback period for primary forest is 86 years and for peatland could be as long as 820 years (see Table 6).

As most palm oil is currently not used for biofuels, the actual payback times are longer than this, as the oil consumption has no impact on carbon emissions. Oil palms are felled and replaced on a 20-25 year cycle (thus releasing carbon on decomposition) and it is therefore impossible for an oil palm plantation to 'repay' the carbon debt it incurs upon forest clearance or peat drainage.

Table 6 - Carbon payback periods for projects on forests and peatland

Former Land use	Carbon per hectare (tons C)	Years to payback carbon 'debt'
Primary Forest	702	86
Peat <3m	1294	423
Peat >3m	3452	820
Source: Fargioni et al, 2008		

For this reason the DNPI data assumes the 'business as usual' expansion of pulp and palm oil plantations at combined total of 705,000 hectares per annum (14.1 million hectares by 2030), will sequester only 74 MtC02 per annum, or one sixth of the amount per hectare as reforestation activities. By comparison, the emissions from forest conversion to supply land for these activities will be approximately 490 MtCO2e per annum.

Scope for emissions abatement

- *Use carbon accounting.* Reforestation and sequestration schemes will only be credible where proper carbon accounting demonstrates the additional benefit brought about by the project.

3.11. Low productivity in agriculture sector

The agriculture sector (excluding estate crop plantations such as palm oil) represents 9% of the economy - $58bn - but is considerably more important in terms of employment. Even though official statistics report 42 million people as actually working in the sector (including plantations, forestry and fisheries), approximately 90 million people live in rural areas and are dependent on the land, either on a subsistence or cash market basis.

Agricultural yields are uneven across Indonesia, reflecting the difference is soil fertility, climate, infrastructure and development status of the various provinces. On average, with the exception of rice yields in Java, farming is relatively unproductive compared to other countries in Asia. Total production has increased by 24% from 1995-2005, while production increased by around 50% in Malaysia and China and by much more in Vietnam and Laos. Although labour productivity improved (yield per rural dweller), it did not improve at the same rate as other countries in the region, where on average productivity rose twice as fast.

Much farmland is unproductive because it suffers from erosion, poor use of fertilizer, inappropriate rotation and short fallow periods. Unclear tenure and poor access to finance means smallholders do not have the means to invest in improving the land. Low returns from agriculture lead to inefficient use of land and pressure on the forest frontier, for instance by slash

and burn practices. To some extent this is driven by rising population, but this may be an over-simplification. This is discussed in more detail in Annex 2.

Scope for emissions abatement

- *REDD smallholder agriculture.* Use REDD finance to cover cost of extension services to smallholders to restore degraded farmland, increase yields, diversify crops and seek opportunities to move into higher value products such as horticulture.
- *Promote agroforestry.* Secondary forests are often carbon rich and thus not suitable to be used as degraded land. Instead, existing agroforestry systems should be encouraged as they both improve livelihoods and enhance the forest.

3.12. Institutional barriers to increasing productivity

Many of the abatement levers mentioned above rely to some extent on improving the economic returns from existing productive land, so as to reduce the pressure to convert forests or peatland. They are mainly technical interventions designed to improve upon current practices, based on the assumption that the key barrier to improving productivity is lack of liquid funds or access to technology. However, in most cases the actual changes to be made on the ground will need to be carried out by smallholders, farmers, local forest communities and small enterprises. However willing these actors may be to improve their own financial condition, they face certain institutional barriers, such as:

- Technical capacity, access to quality education and training
- Access to appropriate inputs (seeds, fertilizer, perticides etc)
- Access to financial services (credit, insurance etc.)
- Access to fair and transparent markets
- Reliable infrastructure
- Legal status of tenure and customary rights

Tackling these issues, particularly the issue of clarity of tenure, is a key component of improving productivity and changing high GHG emission land use practices (such as slash and burn). Where smallholders have security of tenure, or communities are confident that their customary claims have some legal meaning, they are able to invest in the land for the long term.

Scope for emissions abatement

- *REDD smallholder agriculture.* Use REDD finance for training and extension services to increase the economic returns to settled agriculture to remove incentive to erode forest frontiers using high GHG emission activities such as burning.
- *Green Investment Funds.* Use regional funds to invest in joint venture partnerships with cooperatives and communities to supply financial services and market access.
- *Tenure reform.* Review and clarify overlapping legal and constitutional issues relating to tenure and promote land registration. Improved tenure is likely to make REDD projects more successful in the long term, enhancing the permanence (and thus value) of emission reductions

3.13. Unfavourable economic and investment climate

The structure of the Indonesian economy is heavily reliant upon natural resource extraction. However, the revenue from these activities is not being invested in long-term assets. There is a danger that the country could run down its natural resource wealth whilst failing to improve its underlying competitiveness (especially the skills and education level of the people). This trend is disguised by the demand for what Indonesia currently has to sell, particularly raw commodities to China. More detail on this issue can be found in Annex 3.

Reputable companies face difficulties getting access to land in Indonesia, either for oil palm plantations or timber concessions. Such companies need to meet international standards of transparency (similar to EITI),[41] and either cannot legally engage in the 'game' of obtaining permits from district governments, or do not know how to navigate the obstacles of bureaucratic hurdles, unofficial payments and brokers. This keeps good companies out of Indonesia, shielding domestic companies from competition for capital, land and labour, and thus perpetuating an inefficient forestry and palm oil industry.

Palm oil companies already report that they are seeking opportunities for investment outside Indonesia, for instance in PNG, Brazil and Malaysia[42] and there have been instances of companies disinvesting from Indonesia because of high costs and low profitability[43].

3.14. Summary of current situation

In summary, the economics of land use in Indonesia is delivering mixed results in terms of development. There is no direct causal link between economic progress and the historic pattern of deforestation and degradation. Indeed, it seems that Indonesia is squandering much of its natural resource endowment and has fostered institutional and political climate that does not necessarily serve the goals of long-term jobs and growth. The costs and benefits of moving to a low carbon economy in the land use sector needs to be considered in the context of a fact-based assessment of the business as usual scenario, rather than based on assumptions about the link between land use change and development.

4. Costs of moving to a low carbon economy

4.1. Overview of mitigation proposals

The government's commitment to reducing emissions by 26% from 2020 business as usual levels (or 41% if international finance is forthcoming) has stimulated a series of initiatives and plans. The most significant of these, and the one that will form the core of the discussion in this paper, is the plan presented by DNPI in August 2010: Indonesia's greenhouse gas abatement cost curve. In addition, the following reports are relevant:[44]

- East Kalimantan Environmentally Sustainable Development Strategy[45]
- Creating Low Carbon Prosperity in Central Kalimantan[46]
- Creating Low Carbon Prosperity in Jambi[47]
- Building a low-carbon economy for Papua Province[48]
- Reducing Carbon Emissions from Indonesia's Peat Lands[49]

All studies seem to agree that LULUCF is by far the biggest share of emissions but is also the sector that seems to be most amenable to cost effective mitigation.

4.2. Methodology

The approach of the plans produced so far has been to identify the largest areas of emissions and consider ways in which those emissions could be reduced, and at what cost. The DNPI reports use the Marginal Abatement Cost curve[50], which plots the amount of potential reduction and the cost per ton of C02, placing the activities in order of cost, so that the most cost effective activities are executed first.

This method calculates costs from the point of view of society, rather than individuals or firms. It therefore places emissions reduction opportunities in context, making it easier for policymakers to direct resources efficiently. It can be used to calculate the costs of mitigation in relation to the benefits of reduced emissions, but this does not generally tell policy makers about the wider costs to GDP through reduced economic activity. However, this issue is tackled by the Provincial low carbon development plans, that have explicit reference to impact on GDP, and how measures can be taken to improve the economic permission compared to the business as usual scenario.

The main abatement costs considered by the plans, and generally discussed in REDD discourse, is that of opportunity cost. There is some debate on the merits of the opportunity cost method, and this is discussed in more detail in Annex 11. In addition, there are implementation, transaction, social and institutional costs, as set out and described in Table 7. In many cases transaction costs are overlooked, yet they may add significant costs to abatement activities, particularly in remote areas.

Table 7 - Types of abatement cost

Type of cost	Description
Opportunity cost	Refers to the full foregone revenue a landowner gives up by not taking action they otherwise would have pursued (e.g. conversion of forest to oil palm)
Implementation	Project cost to install and operate low-emission technology or activity, including administration costs and overheads
Transaction	Cost to identify stakeholders, negotiate contracts, undertake impact studies, ongoing monitoring, reporting and verification (MRV)
Institutional	Cost of introducing governance and regulatory reforms, training of government staff
Social	Covers the loss of eco-system services such as water, as well as cultural value. Usually excluded from analysis as it is hard to value

4.3. Abatement costs by sector

DNPI has calculated abatement costs for each of the main land use sectors (and BAPPENAS has also made recommendations for the peatland sector) , based on the total potential emissions that could be abated by 2030. These actions are not aiming towards any target reduction, but attempt to identify all the activities that could be achievable within both practical and monetary constraints. These are summarised below.

a) Peatland

DNPI identifies the following abatement activities and costs in the peatland sector:

Table 8 - Abatement costs on peatland

Abatement	MtCO2e	USD/tCO2e	Cost ($m)
Fire prevention	320	0.35	112
Water management	90	1	90
Rehabilitation	156	5.21	813
Total	566		1015

On the other hand, the BAPPENAS peatland strategy identifies total mitigation target of 1281 MtCO2e[51] (see Annex 10), and demonstrates that the opportunity cost of shifting palm oil plantation development from peatland to degraded land is actually negative, as higher returns are available on mineral soils. The yields from palm oil on peatlands are the same or lower than those on mineral soils, and the establishment costs are higher. Therefore the only relevant costs are incurred through the management and implementation of land swaps, where proposed developments on peatland are shifted onto non-peatland.

For this reason, the BAPPENAS report estimates a much lower abatement cost than the DNPI for shifting development from peatland, as it is only the intervention and transaction cost that needs to be covered; the opportunity cost is zero.

b) Forestry

The most important lever in the DNPI plan is using the REDD mechanism to avoid further deforestation and degradation in areas where it would otherwise be likely to take place. REDD represents a combined abatement opportunity of more than 570 MtCO2e, of which stopping forest conversion to smallholder agriculture is the single largest opportunity at slightly more than 190 MtCO2e.

The detailed emission reduction estimates and costs are as follows:

Table 9 - Abatement costs for forestry sector

Abatement	MtCO2e	USD/tCO2e	Cost ($m)
Avoided deforestation			
REDD - smallholders	190	1	190
REDD- plantations	384	28	10,752
SFM / RIL	237	2	474
Afforestation	150	5	750
Reforestation	123	6	738
Intensive silviculture	78	10	780
Fire prevention	43	5	215
Total	**1,205**		**13,899**

c) Agriculture

DNPI propose a number of specific actions for agriculture, as shown in Table 10 below:

Table 10 - Abatement costs for agriculture sector

Abatement	MtCO2e	USD/tCO2e	Cost ($m)
Residue management	0.5	-65	-33
Cropland Nutrient management	4	-42	-168
Water management	37.5	-5	-188
Livestock vaccine	2.5	2	5
Grassland management	3.5	3	11
Degraded land management	35	12	420
Agronomy practices	9	13	117
Rice nutrient management	11	20	220
Livestock feed supplement	2	70	140
Total	**105**		**525**

Many of these actions have negative costs, that is to say their immediate benefits outweigh the costs. For instance, enhancing soil structure, managing nutrients and improving irrigation all have a positive effect on yields. Restoring degraded land brings dormant landscapes back into production, with positive implications for rural livelihoods.

4.4. Provincial Plans

It is difficult to compare the provincial plans with the national one as the underlying assumptions are often different, even in the case of Central Kalimantan and Jambi, that on the first glance follow a similar framework to the national DNPI document. A summary of the provincial plans is shown in Table 11.

Table 11 - Summary of Provincial plans

	Abatement tCO2e	% of National target	Unit Cost $/tCO2e	Annual cost $ million
Jambi	55	3%	1.56	112
East Kalimantan	135	7%	2.96	399
Central Kalimantan	272	14%	1.85	502
Papua	38	2%	3.08	117
Total	**500**	**27%**	**2.26**	**1130**

The four provinces together comprise over a quarter of the national abatement potential for 2030 outlined in the DNPI plan. However, the average cost is much lower than the national average of $8.23/tCO2e. This may be due to differences in methodology (certainly in the case of the Papua plan that was developed by a different team than the other plans), or to the way that different types of costs have been defined. The summary above includes only implementation costs, but the other costs (transaction, institutional etc.) can add significantly to these totals. In the case of Jambi the non-abatement costs add up to 83% and in the case of Central Kalimantan they add up to 62% (see Annex 4 for detailed breakdown).

4.5. Costs of meeting the Government of Indonesia's target in 2020

The costs outlined in each of the proposals above refer to the target of 2030. However, the target specified by the government is with reference to a reduction of 26% or 41% on the 2020 business as usual baseline. Taking the DNPI 2030 targets as the eventual goal of the low carbon economy,

one can estimate how much progress Indonesia will have needed to make by 2020, as shown in Table 12. If the 26% target is followed, then the country will need to have abated 30% of the total DNPI plan, with the remaining 70% of emission reductions happening from 2020-2030. This reflects the fact that abatement activities are likely to be slow to start, and the cheaper options will be tackled first during the first phase of 2010-2020 (it is assumed that no abatement has occurred from 2005-2010). On the other hand, if the country receives external funding and manages to meet the 41% target, then this will allow faster progress towards the DNPI goal, achieving 45% of the plan by 2020, and 55% of it from 2020-2030.

Table 12 - 2020 abatement targets

2020 targets	Target MtCO2e	Abatement	
26%	1872.2	657.8	
41%	1492.7	1037.3	
Abatement strategy I (26%)			LULUCF
2010-2020	30%	691.5	562.8
2021-2030	70%	1613.5	1313.2
Abatement strategy II (41%)			
2010-2020	45%	1037.3	844.2
2021-2030	65%	1267.8	1031.8

4.6. Analysis of cost assumptions: The compensation issue

It is not the purpose of this report to evaluate each abatement cost in detail. Many of the cost assumptions used in the DNPI plan are hard to analyse as the underlying formulae are not revealed. In the future there are some specific areas that may need debate and adjustment. However, the item attributable to 'REDD payments to plantations', at $28/tCO2e, is so dominant (it is two thirds of the total abatement budget) that it does merit further analysis.

The concept of making such large REDD payments to achieve abatement of emissions is based on the assumption that plantation companies (who have already obtained permission to open up forest for a plantation, but have not yet done so) will require compensation for their lost economic opportunity if the forest is to be preserved. The debate over the merits of opportunity cost notwithstanding (see Annex 11), the DNPI admits[52] that it is most likely that degraded land can be found for the plantation, and so there may not actually be any lost economic opportunity to compensate. Land swaps are a more viable (and efficient) route than compensation for the following reasons:

- The national target of 40 million tons of CPO can be reached with 3.5 million hectares if productivity improves to Malaysian standards.[53]
- The projected growth in palm oil demand to 2030 (which would take production over the 40 million ton target) could require up to 5 million hectares of additional land (see Annex 3), if productivity improvements are made.
- The amount of degraded land available (at least 8 million hectares) exceeds the projected increase in palm oil estate (3.5 - 5 million hectares)

- It is not appropriate for any REDD scheme to compensate the plantation owner for lost economic opportunities, as there should be no case (until 2030, at least) where a developer is unable to find suitable non-forest or non-peatland at an appropriate price.
- If supply of palm oil exceeds demand (and thus prices fall) then it is economically efficient for expansion of plantations to be constrained if alternative economic options are superior.
- It is more efficient to improve productivity on an existing plantation than build a new one.

If no compensation is due for the lost economic opportunity, then the only remaining difference between forest land and degraded land is as follows:

- Forest land holds the prospect of timber revenue
- Degraded land may have more complex land claims and tenure, leading to lengthy and expensive procedures to secure the land

However, the value of timber revenue should be reflected in the land price. If the developer has been able to secure valuable timber (which is either a state asset or may in some cases be owned by the local indigenous people) without paying its full cost, then this is a market failure - perhaps also a governance failure - thus it is not appropriate that it be compensated by REDD. Compensation costs tend to be higher on degraded land (which may be open-access regimes, with over-lapping claims and entitlements), as do the transaction costs to acquire the land or persuade local people to become outgrowers. However, studies have shown[54] that the total economic value of a plantation on mineral soils exceeds that of peat soils, and thus the improved business model easily covers the cost of the land swap[55]. This is explained in more detail in Annex 6.

There may still be cases where certain districts that have been planning to convert forests or peatland, and thus gain economic benefits such as GDP, local livelihoods and tax revenue, yet now will be unable to do so because the land swap areas are outside their domain. Indeed, there is almost an injustice in the notion that districts with more degraded land (evidence perhaps of poor governance in the past) will now benefit from economic opportunities as plantations are directed towards their area,[56] whilst more remote districts with better forest condition are cut off from future growth opportunities. In this case, if there is any compensation to be paid it must surely be to the district that has suffered the loss, rather than to the companies that have been able to move elsewhere. Of course for compensation payments to achieve social and political acceptability (aside from acceptability to those paying the cost of REDD) they require a distribution policy that directs payments in a fair and transparent manner, to ensure they do not become just another distorting subsidy or means of patronage.

The issue, then, is in how much compensation would be appropriate. The Papua Provincial plan may provide a model. It took a macroeconomic view, assessing the loss in tax revenue under various scenarios where the area of conversion forest was reduced. It concluded that in the case of the ideal scenario (where plantation development is confined to degraded land and secondary forest, but no primary forest or peatland is disturbed) the lost revenue would be in the region of $307 million per annum, which equates to a carbon price of around $8/tCO2e. Therefore rather than the higher figure of $28/tCO2e used by DNPI, It may be more realistic to use an abatement cost for shifting plantations of $8/tCO2e,. This is also closer to the global estimates of $1 - $5/tCO2e used, for instance, in the Stern Review, and thus are more likely to acceptable to the international bodies that will be managing REDD funds.

4.7. Transaction and Institutional costs

The national DNPI plan excludes transaction and institutional costs, but the provincial plans include these costs, adding from $1.60 up to $10.25 per tCO2e. However, it seems more likely that institutional costs will occur earlier in the scheme (2010-2020), whereas transaction costs will continue throughout. It may be prudent to assume transaction costs add 45%, based on the experience of the Juma reserve in Brazil, which acts a useful reference case for REDD projects in remote areas.[57] Non-REDD projects are unlikely to incur transaction costs as onerous as this, so a 45% across the board allowance is probably quite cautious.

Institutional costs, to prepare the enabling environment that allows the low cost economy to exist, are very hard to estimate with accuracy. Provinces and districts are obliged to carry out some of these activities (e.g. spatial plans) in any case, without subsidy, but additional budget could certainly improve the outcome. The average cost for 'critical enablers' identified by DNPI for Jambi and Central Kalimantan is $6/tCO2e at the higher estimate and $3.29/tCO2e at the lower end. It seems reasonable to assume the higher estimate for costs arising in 2011-2020, and that these reduce to the lower cost from 2021-2030. Table 13 summarises how costs have been treated for this analysis.

Table 13 - Cost assumptions for projections

	Cost ($/tCO2e)	Notes
Implementation Costs		
2010 – 2020	Varies according to activity	As per DNPI, except REDD for plantations, which is reduced to $8/tCO2e from $28/tCO2e
Transaction Costs		
2010 – 2020	$0.34	45% of implementation cost
2020 – 2030	$3.35	45% of implementation cost
Institutional Costs		
2010 – 2020	$6.00	Higher estimate of provincial study
2020 – 2030	$3.29	Lower estimate of provincial study

4.8. Predicted total costs

The predicted costs for 2010-2020, in order to meet the government's target of 41% emission reduction from the baseline, is shown in Table 14 which attempts to predict a rational abatement plan that would meet the specified goals through selecting the lowest cost abatement opportunities first. This table is over-simplified as it is unlikely that all activities would all commence together, and so some abatement opportunities will be delayed, as will the costs.[58]

Table 14 - Projected costs of meeting 41% target by 2020

Rational options 2010-2020	MtC02e	$/tC02e	Total ($m)
Peat			
Fire prevention	320	0.35	112
Water management	90	1	90
Total	410	0.49	202
Forestry			
REDD-smallholders	190	1	190
SFM/RIL	237	2	474
Fire prevention	43	5	215
Total	470	1.87	879
Agriculture			
Residue management	0.5	-65	-33
Cropland Nutrient management	4	-42	-168
Water management	37.5	-5	-188
Livestock vaccine	2.5	2	5
Grassland management	3.5	3	11
Total	48	-7.76	-373
TOTAL LULUCF	**928**	**0.76**	**709**
Transaction costs		0.34	319
Institutional costs		6	5,568
Total costs			**6,595**
% of 2009 GDP			**1.01%**

The total implementation cost for the LULUCF sector to slightly exceed (by 83 MtCO2e, or about 10%) the government's target of a 41% reduction in 2020 BAU emissions reaches $0.71 billion per annum. Including transaction and institutional costs, the total abatement cost is $6.3bn, which is approximately 1% of current GDP. This plan assumes that the more expensive abatement options are deferred until the period 2020-2030. This is economically rational - the future economy will likely be in even better shape to bear these future costs.

Table 15 sets out the remaining abatement activities identified by DNPI, which can be carried out in the period 2020-2030. These are not aiming towards a target as such, but towards the maximum potential abatement that can be achieved at reasonable cost within current technical constraints. For the period 2020-2030, implementation costs rise to almost $7bn per annum as the more expensive options are tackled, with institutional and transaction costs adding a further $6bn. By 2030, total abatement costs will have risen to 2% of GDP.

The costs of meeting the 2020 target and the 2030 potential goal can be expressed in terms of the average cost per tCO2e, including implementation, transaction and institutional costs. For 2020, the average cost is $7.11 per tCO2e, and for 2030 it is $13.78 per tCO2e.

Table 15 - Projected costs of potential abatement by 2030

Rational options 2020-2030	MtC02e	$/tC02e	Total ($m)
Peat			
Rehabilitation	156	5.21	813
Total	156	5.21	813
Forestry			
Intensive silviculture	78	10	780
REDD- plantations[59]	384	8	3,072
Afforestation	150	5	750
Reforestation	123	6	738
Total	735	7.27	5,340
Agriculture			
Degraded land management	35	12	420
Agronomy practices	9	13	117
Rice nutrient management	11	20	220
Livestock feed supplement	2	70	140
Total	57	15.74	897
TOTAL	**948**	**7.44**	**7,050**
Transaction costs		3.35	3,172
Institutional costs		3	3,119
Total costs			**13,066**
% of 2009 GDP			**2.09%**

5. Benefits of changing land use policy

The main motivation for the government to consider reform of the land use sector is to reduce GHG emissions and meet the stated targets by 2020. The LULUCF sector has the most scope to reduce emissions at the least cost per ton of carbon, so it will be the main are of focus. However, the benefits from action need not be measured only in tons of carbon abated. There are likely to be many other benefits that flow from the proposed activities and the institutional reform that accompanies them.

The Ministry of Finance acknowledges this wider aim, stating that 'extracting carbon finance inflows is not an end in itself for Indonesia',[60] and concluding that '...the shift to a lower-carbon pathway will improve economic efficiency even if environmental benefits are not taken into account.'

5.1. Necessary reforms, regardless of climate change

As discussed in an earlier section of this paper, the governance of the land use sector in Indonesia is far from ideal, and is not yet conducive to advancing development. Whilst some sectors are growing strongly (e.g. palm oil) many of the benefits are yet to flow down to the poorest rural communities. Other sectors, such as forestry, are in decline and have historically been inefficient in the use of land and labour, placing Indonesia on an unsustainable path that fails to generate long-term jobs, growth and welfare.

Indonesia has a rich endowment of land and natural resources, but it also has a large population, and the per capita resource wealth is lower than Malaysia. Indonesia will not achieve its target of becoming an upper middle income country by 2025 using natural resources alone.

There needs to be a change of mindset from seeing land (especially forest) as a 'free gift' to capital, and to consider more subtle ways of getting the most out of all factors of production (land, labour,

capital). At the moment, Indonesia uses land inefficiently and squanders human capital, which is not a sustainable pathway regardless of emissions. Plantations turn subsistence farmers into labourers, which may be a slight improvement to their circumstances, but not always at wage rates that will lead to development. Observers have noted that Indonesia needs to move off its natural resource dependency and build the secondary (industrial) sector if it is going to have any chance of generating jobs.[61] Arguably, therefore, the country would need to be making radical changes in terms of land use policy and governance even if there were no requirements to move to a low emission economy.

The DNPI province-level reports and the Papua sustainable development plan all include growth opportunities that are variously described as 'low carbon prosperity' and 'green growth'. The plans arise from the opportunity to deploy income from carbon abatement (e.g. from REDD) as investments in future growth areas. However, as most of the plans yield positive rates of return on investment, either the public or private sector could make them in any case, even if no carbon finance was forthcoming. These plans and their benefits are discussed briefly, below:

i) Value of forest reflects total economic value

As mentioned earlier, the forest sector has been the subject of much debate and research regarding the need for reform,[62] but thus far has experienced very little change. REDD could stimulate a new approach to the sector. Improved governance and spatial planning will effectively increase the value, and cost, of exploiting the forest, ensuring that forest values more closely reflect their total economic value, including the non-carbon ecosystem services they provide. For instance, the net present value of water services provided by the Leuser ecosystem is $2.42 billion[63]. Pollination services to coffee estates in Sulawesi are worth $63 per hectare, and ongoing deforestation could lead to a 14% reduction in coffee yields[64].

ii) Restructuring of processing industry

In the face of scarcity, industry will be motivated to innovate, move up value chain, and in invest in raw material supply (plantations) from sustainable sources. Based on experience in other countries, they may find that investing in locally controlled forestry is an efficient solution,[65] and this will have the useful side effect of enhancing rural household incomes and driving economic development in remote areas.

There is huge potential to boost community plantation development to meet long term supply gap in Indonesia. For instance, Vietnam has recently allocated 1.4 million ha to 500,000 families for 50 years, which as a proportion of their total forest estate is equivalent to Indonesia placing 9 million hectares under community control.

The East Kalimantan plan includes a project to increase the yield from the industrial plantation estate (HTI) that is chronically underperforming, and build two pulp mills with 2.6 million ton capacity to absorb the additional production. This would create around 100,000 jobs and add around $1.2 billion to the provincial GDP.

iii) Sustainable Forest Management

Reduced Impact Logging (RIL) leads to lower emissions over time (around 30% less) with no reduction in harvest volumes.[66] Improved harvesting practices such as the planning of skid trails and directional felling can substantially reduce collateral damage to non-target trees and hence increase carbon retention while extracting the same volume of timber. Other benefits of RIL include:

- Minimize canopy disturbance, so decrease flammability and thus risk of fire
- Improved biodiversity

- Future timber yield is enhanced: profitability does not need to decline with each rotation (as it tends to with conventional logging methods)
- RIL requires better planning of access roads, which may lead to more efficient use of capital
- Improved watershed function of the forest
- Properly trained staff using appropriate equipment means a safer working environment, with less downtime caused by injuries, and higher productivity.

Sustainable forest management is the solution to preserving Indonesia's forest products industry and not a threat. The low yield from forestry could be raised through better management and community involvement.

iv) Improvement in palm oil productivity

A recent report on smallholder palm oil, researched in collaboration with major palm oil companies,[67] showed that investments in raising smallholder yields have a positive rate of return (IRR of 22%),[68] and can have significant impact on rural incomes, which in turn benefits the district economy. Improved management can increase yields by 2 tons of CPO per hectare per annum, in many cases doubling smallholder incomes (an increase of $500 per annum). If this were replicated over the entire smallholder estate, rural GDP would increase by almost $1.5bn per annum. National GDP, including the value of the additional CPO production, would increase by over $4bn.

The Papua Sustainable Development Plan calculated that a mixed economy of best practice palm oil (in joint ownership with communities), agroforestry and sustainable forest management could increase rural household income in 2030 by over 55%, compared to the business as usual plan. More detail on this plan can be found in Annex 9.

Shifting palm oil production from peatlands to mineral soils also increases yields and profitability, improving Net Present Value by around $3600 per hectare.[69] The total benefit to the economy could be as much as $2.5bn per annum of additional GDP, if all 'at risk' peatland were to be set aside and land swaps found elsewhere for plantation development, which it turn are managed to best practice standards.[70]

v) Fire control

Catastrophic fires such as 1997-98 and 2006 seem to occur every eight years or so, and can cost up to 3.2 billion in economic losses (excluding intangible losses, e.g. carbon).[71] Regular annual fires probably cost at least $0.5bn per annum, so the average cost, smoothed over nine years, is around $0.86 billion per annum. Reducing these costs has direct financial benefit.

Furthermore, diplomatic relations with neighbouring countries (Singapore, Malaysia) could also be improved if Indonesia cuts the amount of pollution it exports.

vi) More Attractive to investors

As Indonesia improves its approach to forest management it will become a less risky prospect for foreign direct investment. This will reduce the cost of capital and allow projects that currently appear unviable to be able to attract investment.

vii) Improved spatial planning

Developing a professional and complete spatial plan is a time-consuming and expensive process that may require donor support (as was the case with the Papua Province spatial planning process). It requires wide consultation, a multi-disciplinary approach and political

leadership to navigate the various trade-offs and compromises. The benefit is that spatial planning can greatly improve economic performance.

Using good spatial planning to bring degraded land into production is efficient. Often such land is not suitable for sustainable annual crop production, so is often abandoned. However, such land is highly suitable for tree crops such as oil palm, providing yields that compare favourably with cleared forests.[72] Identifying the land and parceling it for auction to investors thus releases the value from the land, and may boost the amount of compensation paid to local people. A survey shows that companies are willing to pay up to $700 per hectare to access degraded land, if it is managed through a transparent auction process and no other unofficial fees are payable.[73] This could yield up to $1.5bn in compensation for local people, $1.9bn for local districts and $100m in fees for the Forestry Ministry.[74] Current data on the revenue from granting concession is very hard to find, but it is certainly very much lower than this figure. For instance, Cargill reported that it paid $14 per hectare for the HGU on a plantation in Sumatra.[75]

viii) Agricultural reform

The side effect of the reforms necessary for the low carbon economy (especially tenure reform) will be to improve the investment climate for family farms. This may lead to some consolidation as some rural dwellers move to cities or take local off-farm employment and sell or lease their land to neighbours. This process should eventually lead to a situation where farm sizes become more optimal and economies of scale can be made. This need not mean very large estates or plantations. Capital equipment can be shared amongst small farms, inputs can be purchased collectively and casual labour can be rotated in a community. In fact, some studies argue that small farms are more productive (per hectare, if not per unit of labour) than plantations and estates. A report by *The Economist* concluded that: 'Family farms, whatever their size, are more productive than those worked by hired labour'.[76]

The benefit to the economy will be increased investment, raising yields and productivity closer to best practice levels across the archipelago, thus generating more surplus income in rural areas, which can contribute to local economic development. The Jambi plan calculates that raising rice productivity to East Java levels alone would add 6% to agricultural sector GDP by 2030.

ix) Improved resilience to natural disasters

Many of the abatement activities will lead to environmental improvements that may protect people from the impacts of future natural disasters. For instance, restored forests in watershed areas regulate water supply. Reforested hills, valleys and slopes reduce the risk of landslide, thus protecting both people and infrastructure. Restored hydrology in peatland areas, through use of dams and waterways, can reduce the risk of flooding in the wet season, and ameliorate the effects of drought in the dry season, thus maintaining fish stocks and other economic benefits.

It is hard to accurately assess the current cost of natural disasters. As an example, flooding and landslides damaged or destroyed 100,000 homes in January 2009, and 22 people lost their lives.[77] The cost of repair and replacement of houses could be as much as $90 million for that month alone, excluding damage to crops, lost opportunities to work, healthcare costs and of course the loss of loved ones. Such costs could add substantially to the total economic cost.[78] Assuming such events are more frequent in the rainy season, and rare in the dry season, the annual costs of disasters attributable to environmental degradation (thus excluding volcanoes, earthquakes, tsunami and failures of manmade infrastructure) could be estimated as over $500 million per annum.

The benefit to the economy of improved environmental quality can thus be measured in terms of the economic costs avoided through ensuring communities are protected from floods, landslides and drought, or at least their effects are largely ameliorated through sensible ecosystem management.

5.2. Impact on GDP

The schedule of potential abatement levers set out in section 4.8 above indicates how much carbon revenue would be required in each case to defray the costs of such activities up to 2030. If the price of carbon is at least $5 per tCO2e, then 57% of the abatement can be achieved at no cost, and if it rises to $10 per tCO2e then almost all the abatement costs will be covered, including the transaction costs and institutional costs. In this case the impact on the national economy would be almost neutral.

If the abatement activities are carried out in a the most efficient manner, aiming to achieve the 2020 targets by the least cost, with more expensive activities deferred until 2020-2030, then the impact on GDP will be minimised, depending upon the price of carbon and the extent to which all activities qualify for carbon financing. Some possible scenarios are set out in Table 16, which assumes that 80% of projects are capable of qualifying for carbon financing. If carbon finance is available at the higher rate of $10 per tCO2e then by 2020 the country will actually have collected more revenue than it has spent, which could then fund the next period of more expensive abatement activities up to 2030. The threshold price for carbon, at which point costs are matched by revenue over the whole period of 2010-2030, is around **$13** per tCO2e, again assuming that 80% of projects are eligible.

Table 16 - Carbon revenue scenarios

	Carbon price	Carbon revenue*	Shortfall
Period	$/tCO2e	$ million	$ million
2010-2020			
	5	3,712	2,565
	10	7,424	*-1,148*
2020-2030			
	5	3,792	9,274
	10	7,584	5,482
*Assumes 80% of projects are certifiable			

Whilst it is legitimate to express the costs of emissions abatement as a percentage of GDP, in order to place it in the context of the size of the total economy, it does not follow that all such costs cause a reduction in GDP.[79] Indeed, projects that attract carbon revenue from outside the country should add to GDP by generating economic output that would not otherwise have occurred. But carbon revenue for some of the most significant activities, such as REDD, will most likely be deferred until results can be verified – which may be far in the future. If interim finance is not forthcoming from the international community then Indonesia will need to cover the costs of the activities, and this may lead to a deferral of consumption and thus a reduction in GDP. The DNPI report does not attempt to quantify the impact of moving to a low carbon economy to GDP at the national level, and it is unlikely that sufficient data exists at this point to make a meaningful comparison.

However, at the provincial level it is more realistic to predict the impact on future GDP. These can be expressed in terms of the opportunity cost of forgone development (e.g. forests not converted to plantations), but also take into account the positive impact on GDP that occurs when certain management of land improves. The reports produced so far include some specific low

carbon growth plans that have some impact on GDP. These are summarised in Table 17 and a detailed breakdown of provincial benefit / cost ratios is in Annex 12.

Table 17 - Provincial low carbon plans - impact on regional GDP

Province	Impact
Papua	Short and medium term reduction in GDP offset by REDD payments, with long term positive impact on GDP, tax revenue and local incomes. Based on improved plantation management practices, agroforestry and sustainable forest management by communities
East Kalimantan	GDP per capita will be a third higher by 2030, through improved timber and oil palm plantation productivity, and investments in downstream processing
Central Kalimantan	Per capita income will be 29-33% higher than business as usual. Investment in economic development in parallel to abatement has Benefit / Cost ratio of up to 1.52
Jambi	Per capita income will be 8-16% higher than business as usual. Investment in economic development in parallel to abatement has Benefit / Cost ratio of 1.5

6. Implications of moving to a low carbon economy

Based on the data presented by the mitigation options on offer (discussed in previous section), the cost of meeting the government's target of 41% reduction in emissions by 2020 is approximately 1% of GDP. This would go so some way to moving the country to a low carbon economy.

Some of the mitigation options involve a shift from the business as usual pathway towards a new economic paradigm. If policy-makers have until now considered the current trajectory of economic policy to be the best method of achieving development, then they may fear that an alternative path will involve *slower* development. The international community (that wishes to see emissions reduced) would therefore need to compensate Indonesia for this 'deferred' development. On the other hand, there may be evidence that the current trajectory has not in fact been wholly successful in promoting development, and that a new approach may have the advantage of both lowering emissions and boosting long-term jobs and growth.

Understandably, questions have been raised in public discourse about the risks of moving to a low carbon economy in Indonesia, particularly if it leads to a radical change in the way forests are managed and exploited. A few of the common questions and concerns are discussed below:

6.1. What does the low carbon economy mean for the palm oil industry?

Palm oil is a valuable crop that, when properly managed, can yield high rates of return. It has great potential to lift rural incomes and has thus been vigorously promoted in Indonesia. There are fears in the industry that a low carbon economy may constrain the future growth of this important industry. However, high returns to capital invested are not the same as good returns to labour (compared to alternative crops or livelihoods) or efficient use of land. Evidence shows that many smallholders are not earning a good income from palm oil, and real returns per hectare are low. From a development perspective, intensification and improved management practices would bring about better outcomes for farmers and rural communities. This should be part of the process of innovation that leads to higher productivity, and it is hard to see why this would be resisted by the industry.

A range of studies have calculated that Indonesia has a large stock of 'degraded land' that may be suitable for plantation development (for either oil palm, rubber or timber). There is no agreed definition for degraded land as it depends on a number of variables and whether the object of the exercise is to minimise carbon emissions, preserve biodiversity or maximise livelihoods. Most studies seem to agree that there is the range of 8.5 - 21 million hectares[80]. The Forestry Ministry recently suggested there may be as much as 35.4 million hectares[81], but this is likely to include secondary forest that may still have high carbon values and so may not be suitable for a land swap aimed at reducing carbon emissions.

Some provinces have already started the process of identifying degraded land, as shown Table 18. It is not clear what criteria they have each used, as in some cases (e.g. Central Kalimantan) the figure may include secondary forest or other land unsuitable for agriculture. The amount of degraded land available from just these four provinces is sufficient to fulfill most of the demand for land identified for all forms of development, not just palm oil. When detailed studies are made of other provinces, it is likely that that more viable tracts of degraded land will be identified.

Table 18 - Degraded land available in four provinces

	Million hectares
Central Kalimantan	6.4
East Kalimantan	1.5
Jambi	1.8
Papua	0.83
Total	**10.53**

This indicates that in just four provinces there is already sufficient suitable degraded land that can absorb the projected increase in the palm oil estate.

A recent report supported by the industry[82] calculated that 3.5 million hectares of degraded land, if managed properly, would produce 18.5 million tons of CPO, which would bring production up to the industry's target of 40 million tons without using any further forest or peatland. Thus the low carbon economy should not constrain the growth of the palm oil industry, on the contrary, it can actually facilitate faster and more profitable growth.

6.2. Will land swaps place a burden on private companies?

The DNPI plan suggests that the REDD budget includes compensation to landowners to not commence activities that may emit more carbon than they sequester, e.g. conversion of natural forest (and especially peat) for oil palm. They suggest this could be quite expensive, perhaps as high as $30/tCO2e. However, compensation of this type will not benefit the local area (the bulk of it will go to the developer, not the farmers) so it is an inefficient way to distribute resources if rural development is the goal.

Some studies on the opportunity cost of shifting palm oil onto degraded land have included the revenue from timber felling as an incentive to convert forest rather than use degraded land, and have assumed that shifting a development from primary forest to grassland represents a loss to the developer that needs to be compensated. However, palm oil companies themselves suggest they are not interested in accessing forest for the standing timber, as the administrative burden of obtaining felling permits is too high for a one-off felling.[83]

There is a difference in Net Present Value between forest and non-forest, but compared to the 25 year cashflow from a plantation it is not significant. Calculations show the difference in NPV to

be $674 per hectare, so this may be a starting point for compensation. This would cost around $3.6 per tCO2e, which is very much lower than the DNPI estimate of $28/tCO2e.

Furthermore, if the forest land is more valuable than grassland (because of the standing timber), then in a normal market this would be reflected in the price. The developer would have been prepared to pay up to $674 extra per hectare for this land (compared to grassland), but no more. So in a macro-economic analysis, there is no loss to the developer if the state raises the barrier to access forests for development, either through regulation or price, and compensation to private firms cannot be appropriate. However, there may be a case for the state to receive compensation for the lost opportunity to convert forest and harvest trees, and the REDD scheme is to some extent designed with this in mind.

According to the palm oil companies themselves, in a recent survey,[84] no subsidies or compensation should be necessary if suitable land can be found as an alternative. This requires good spatial planning and a methodology for identifying suitable land for development. Companies indicate that they would be willing to see the cost of this exercise included in the fee for the concession.

6.3. Will REDD schemes mean 'locking up the forest'?

Forests are a mainstay of livelihoods for a large number of Indonesians. Old growth natural forests provide a complex package of goods to local people such as fuel, non-timber forest products, fodder and shelter which could in certain circumstance be worth as much as $642 per hectare per annum,[85] as shown in Table 19, which is based on values found in Papua. But other forest landscapes and mosaics are also important as areas for agroforestry, shade crops such as coffee and cocoa and for supplying a range of products, aside from their ecosystem benefits. From a REDD perspective, any activities that do not significantly alter the carbon balance of the forest would continue as before.

Table 19 - Direct use value of the forest

Type of Value	Forest Value
Fuel wood	40.00
Other non-timber forest products	109.45
Water regulation	146.00
Food production	32.00
Raw materials	315.00
Total direct use value (excl. logging)	**642.45**

Source: World Bank (2009)

The objective of REDD is not to 'lock up' all remaining forest in a country such as Indonesia in order to act as a global carbon store to benefit other countries. As currently conceived, it should be a means of finding the most appropriate price for determining if forest is best conserved or best converted. The marginal income from REDD increases the more of a country's forest is in the scheme, as it reduces the risks of leakage and non-permanence of emissions reductions.

The REDD+ scheme is a variation on REDD that acknowledges the importance of forest restoration and the role of local communities in managing forests in a sustainable manner for economic gain. If REDD payments are just for conservation, law enforcement and non-productive activities then the rural economy will stagnate and demand for food and commodities will not be met. Therefore REDD projects must take an investment approach to forests, rather than a purely compensation or preventative approach. This could have the effect of opening up economic opportunities in the forest rather than locking them up.

6.4. Forests are already protected in conservation areas – isn't that enough?

Conservation areas may go some way to protecting forests, but in Indonesia many such areas are under pressure. For instance, from 1985 to 2001, Kalimantan's protected lowland forests were reduced by over 56 per cent,[86] and there is illegal logging, often with forest clearance, in 37 of the 41 national parks in Indonesia.[87] Regardless of the threat level, conservation areas have less relevance to REDD because avoiding deforestation in such areas should be a matter of enforcing existing regulations.

In any case, research has shown that conservation can be a crude way to manage forests, as it often excludes local people from decision-making and cuts them off from economic opportunities.[88] REDD projects acknowledge that in the absence of alternative livelihoods, forest degradation (e.g. slash and burn) will continue regardless of the rules and regulations in place – the forest is just too large and remote for effective monitoring. Thus to be successful conservation must be in partnership with local communities.

Although Indonesia has significant areas of conservation and protection forest, if all other areas of forest continue to be degraded then protected forests will come under increasing pressure for conversion. A balanced approach to forest zoning would have a mix of conservation forest (usually national parks), preservation forest (to protect ecosystem services, for instance on riverbanks), sustainable production forest and industrial plantation forest. If the production forest is over-exploited, and the plantation forest unproductive, then eventually the preserved forest will be eroded.

6.5. How will areas dominated by peat or primary forests be developed in future?

The Ministry of Finance observes that '...the conversion of forests to plantations is often accompanied by local development benefits such as new roads, better communications, and improved health infrastructure, all of which are valued highly by local communities. To make forest conservation attractive to local communities, additional compensation may be required'.[89] However, this argument seems to assume that only palm oil companies provide such infrastructure to rural areas, presumably as part of a Corporate Social Responsibility (CSR) project - and that local governments cannot supply these services without subsidy from some external party. However, CSR should not be relied upon to build infrastructure and deliver social services[90]. Improving health services is already part of the mandate of all district governments, and budget allocations are made available for it. Furthermore, it is not proven that forest conversion necessarily leads to development. This is discussed further in Annex 8.

Some areas are going to be restricted in terms of economic activities because of the low carbon economy, however there have always been areas of Indonesia that are in remote or marginalised areas and struggle to become part of the mainstream economy. Therefore any REDD revenue that is accrued to marginal high risk areas that are relatively rich needs to allow for redistribution to those poor areas that have more limited opportunities, such as lowland districts with a high percentage of peatland.

Some reports[91] point out that REDD income can never compete with the Net Present Value from palm oil, quoting an NPV of 3,835 per hectare for palm oil compared to $614 for carbon credits from REDD.[92] However, at the local level it may not be valid to compare these two values. The net present value for palm oil describes the cashflow that accrues to the developer, not the smallholder. The smallholder's net present value may be in the region of $360,[93] and actual net income could be highly variable, from only $80 per annum for low yielding estates up to $456 for more average estates[94].

In sparsely populated areas, the key issue is returns to labour rather than returns to land and capital. So compensating the areas that are not suitable for palm oil (e.g. peatlands and forests) may not be as expensive as the opportunity cost argument would suggest. This is particularly the case if REDD finance is used to invest in building appropriate sustainable enterprises.

However, there are also administrative and political implications to limiting forest conversion. The granting of conversion permits and concessions has been traditionally entwined with the political economy of Indonesia at both the national and district levels. Changes to this institutional landscape, for instance by a moratorium on conversion, will be resisted in some quarters. A fiscal solution is required to even out the revenue opportunities for local administrations, and win the willing co-operation of the districts.

6.6. Will the Low Carbon Economy make the forest industry uncompetitive?

Some parts of the forest industry are already uncompetitive. They survive to some extent through not paying the full cost of raw materials, including the replacement cost of the forests they exploit. Industrial capacity has been expanded on the assumption that there will always be more natural forest to fell and this paradigm is now running up against natural limits. A restructuring is overdue, but the eventual outcome will be positive as it will lead to a more productive and internationally competitive sector, engaged in higher added-value production.

REDD could provide stimulus for timber plantations, which until now have failed to take root. The incentive should be market-based rather than driven by subsidy. The Dana Reboisasi made inefficient investments by granting soft loans for plantations that failed. However, there are financing challenges to planting trees, particularly for slower growing hardwoods such as teak and mahogany. Using carbon finance to guarantee loans or take an equity stake may be the answer. Linking community plantations to downstream processors, such as furniture manufacturers, helps small and medium sized enterprises solve a raw material problem while helping community forest enterprises find discerning markets for quality timber.

But for pulpwood subsidies are not necessary. The large capital investment in installed capacity means the companies must eventually face up to and solve their raw material problem. Clear-cutting natural forests, as they have been permitted to do for a long time, should cease under the moratorium agreed by the Norway-Indonesia Letter of Intent, or as a result of the national and provincial low carbon development programs that follow. In any case, eventually the industry would run out of trees that can be profitably extracted, as the distance limit for a pulp mill is around 200 km. The industry needs to make plans sooner rather than later on the assumption that supply from natural forests will cease, as it was supposed to cease in 2009 according to the 2007 Road Map. International customers are already questioning the sustainability of the pulp and paper industry[95], and eventually investors will also question it. The very survival of the industry relies on it investing in plantations, to bring them up to international standards. Although the transition may be painful (there may be short term contraction in the industry), the eventual outcome will be a more competitive and sustainable pulp and paper sector.

6.7. Opportunity cost should include the full cost to the economy of reducing carbon intensity

The opportunity cost calculations often fail to take into account the full cost to the economy of shifting to a low carbon development pathway. For instance, land use tends to measure direct outputs from land use, but do not always include the economic value of activities in downstream processing industries.

However, the difference is that if land is removed from valuable economic use, it cannot be re-deployed elsewhere as it is fixed. But other factors of production - labour and capital – are more

flexible. The opportunity cost therefore only needs to cover the delay until these factors are reallocated to other activities.[96] It is therefore not really valid to suggest that a contraction in downstream industries would be a permanent reduction in GDP that merits compensation. Economic sectors wax and wane all the time in a complex economy, as comparative advantage changes between countries and innovation causes industries to re-tool and consolidate.

However, it is valid to find ways in which companies can be assisted in this process of restructuring. Investment funds from REDD could be deployed as co-investment with the private sector in ventures that wish to use new clean technology, increase productivity, or have ways to improve efficient use of raw materials and energy. This would direct investment towards the future, rather than using the opportunity cost argument to justify subsidies that support outdated practices.

6.8. Will the low carbon economy compromise the ability to adapt to climate change?

Climate change will hit the poorest hardest and therefore, as the Stern Review points out, the best way to improve the capacity to adapt to climate change is not be a poor country.[97]. This may be interpreted as an injunction for poorer countries to aim for prosperity at all costs. This is the basis to the proposal that developed countries should be bearing the burden of reducing emissions while developing countries continue on their current trajectories for a while longer. However, if development requires more forest and peatland conversion and thus more emissions, then it greatly contributes to the problem of climate change. Also, land use change that depletes forest cover increases vulnerability to natural disasters. Furthermore, the causal link between land use change and improved economic is far from proven.

On the other hand, if improving land use management leads to better economic conditions, as this analysis suggests it will, then mitigation and adaptation are not mutually exclusive. On the contrary, a reform of the land use sector can broaden and deepen development, improving the livelihoods of the rural poor; it will in fact enhance the capacity of communities to be resilient to the possible effects climate change.

6.9. Will the economy become vulnerable to carbon price risk?

The abatement options are based on prices per ton of CO2e, on the assumption that a carbon market (either based on international compliance or a voluntary system backed by bilateral deals) will set an appropriate price for carbon. This has often been estimated at $5-$10 for terrestrial carbon and $15-$30 for industrial carbon.[98]

Risks to this price could arise if technical solutions such as Carbon Capture and Storage (CCS) are made operational and cost effective earlier than predicted. It will make the marginal cost of abatement through land use change more expensive. Where action is wholly reliant on long term carbon revenue to offset opportunity cost this may be risky. Therefore any abatement plan should have a horizon beyond which it becomes self-sustaining and no further carbon subsidy if required. The low carbon economy is designed to create precisely these conditions. Emission reductions in the context of a business as usual economy will always require subsidy, whereas a managed transition to a low carbon economy reduces the risk of future falls in carbon price. Arguably, such falls are inevitable in the long term once the majority of the world's economies have decarbonized.

6.10. What are the institutional constraints to the low carbon economy?

The transition to the low carbon economy calls for a reform of the current political economy of land use, in particular in relevant ministries such as forestry, agriculture and plantations, and at

local government offices where the Bupati holds so much power over disposition of land. Indonesia's capacity to raise revenue from schemes such as REDD will to a large extent rely on evidence that a reform process is underway. It is therefore essential that this process is successful, but the challenges will be significant. For example, the Ministry of Forestry granted 2.9m hectares of forest land for plantations at the end of 2010, before the planned moratorium stemming from the Norway-Indonesia Letter of Intent has been finalised. 883,500 hectares in Papua will be granted to 3 companies for the development of plantations to supply the pulp industry, although there is currently no pulp industry in that province. Furthermore, Papua has previously submitted a spatial plan to Jakarta that includes re-zoning of the forest estate to better reflect local realities, which includes a moratorium on clearance of primary forest. The mismatch between local government autonomy and the ability of the Ministry of Forestry to override local spatial plans indicates that there is a significant risk in the future that provincial-level low carbon development plans could be undermined by the Ministry of Forestry. This risk will deter investors and bilateral donors, thus greatly increasing the cost of capital.

There will be costs involved in reforming the bureaucracy, but the costs of not reforming the system is very much higher, as carbon revenues will either be reduced or withheld, putting the government's emission reduction target in serious jeopardy.

7. Summary of costs and benefits

Indonesia is especially vulnerable to climate change as much of its population, industries, infrastructure, and most fertile agricultural lands are concentrated in low-lying coastal areas. The UN estimated[99] that 'a delay in the wet season and a temperature increase beyond 2.5°C is projected to substantially drop rice yields and incur a loss in farm-level net revenue of 9 to 25%'. This would disproportionately affect rural communities.

Climate change will have significant impact on economy and development in Indonesia, which is one of the most potentially vulnerable countries. The Asia Development Bank predicted the combined economic losses caused by climate change to be in the range of 5.7% to 6.7% of Indonesia's annual GDP by 2100.[100] This would have a negative effect on human welfare.

Thus climate change is a threat to development in Indonesia, but the costs are in the future, when the country will be better equipped to meet them. Mitigation, on the other hand, incurs costs today that may use funds that would otherwise have been invested in human development. In some cases the international community will meet these costs in the form of carbon payments (or various forms of conditional payments). In many cases, the benefits of taking action may outweigh the costs regardless of any additional financing that may be available.

Table 20 summarises the likely costs and benefits of addressing the current conditions of the land use sector.

Table 20 - Summary of costs and benefits

	Current situation	Situation under Low Carbon Economy	Costs of change	Benefits (excluding GHG emissions)	Benefit / Cost threshold
1	Forests and peatlands converted to croplands and plantations	Spatial planning identifies suitable degraded land for development and facilitates 'land swaps'	$500 - $700 per hectare	Companies prepared to pay full cost of spatial planning and land swap, so exercise should be cost neutral. Higher yields available on mineral soils compared to peatlands, combined with better management this is worth $2.5bn of additional GDP	Swaps are cost neutral, and brings other benefits that outweigh costs.
2	Up to 39 million hectares of forest estate lacks tree cover	Seriously degraded land taken out of forest estate through re-zoning. Partially degraded land prioritised for reforestation.	$664m per annum[101]	Revitalisation of Industrial plantations, allocation of secondary forest to communities for agro-forestry and restoration. Some areas of HCV managed by private sector (e.g. Harapan in Jambi, New Forests in Papua)	Restores value to forests, including ecosystem services. Costs <$20/ha, benefits >$300/ha
3	Industrial forestry sector in decline; 70% of plantations not yet operational.	Non-active concessions reallocated; investment stimulated in plantations, using outgrower schemes and community plantations. Improved silvicultural methods.	$780m per annum	Processing industry (e.g. pulp and paper) able to fulfil capacity and even expand to meet growing demand. Able to meet sustainable criteria by avoiding fibre from natural forest. Indonesia builds new economic advantage in plantation R&D and management. Communities attract investment & build long-term assets in growing plantations	Protects $16bn per annum industry. Further growth could double size of industry by 2030
4	Palm oil productivity is lower than other countries. More land is required to meet target production, leading to conversion of forests and peatland.	Increase productivity to reduce need for forest conversion	Up to $1500 per hectare	Improved smallholder income, by 100%-355%. More efficient use of land, labour and capital. Indonesia becomes more competitive. Adds $4bn to GDP.	Upgrading has positive IRR, very quick payback to investor, farmer and economy
5	At least 16m ha production forest currently idle; forest management is unsustainable and inefficient	Comprehensive re-zoning organises and focuses forest usage; Sustainable Forest Management (SFM) and Reduced Impact logging (RIL) become the norm. More management handed to local communities. Forest licensing based incentivising long-term outcomes, not short-term extraction.	$474m per annum	SFM and RIL leads to higher productivity, healthier forest with better growth rates, more skilled an better paid workforce. Community involvement in KPH and small-scale enterprises improves rural incomes	Reverses decline in $5bn sector, and increases high value production, especially for SME sector.

	Current situation	Situation under Low Carbon Economy	Costs of change	Benefits (excluding GHG emissions)	Benefit / Cost threshold
6	Fires destroy timber and cause pollution	Fires under control	$327m per annum	Annual fires probably cost at least $860m per annum, averaged over 9 years. Reducing these costs has direct financial benefit.	Costs of mitigation outweighed by benefits by at least 2:1
7	Peat-rich districts allocate peatland for conversion to plantations to boost economic growth	Most peatland not available for conversion. Such districts need to find alternative growth opportunities, and may require cross-subsidy from wealthier districts	$3bn per annum	Alternative livelihood opportunities may be more appropriate to local context and wishes of local people. Areas with HCV forests will be candidates for eco-tourism and funds for conservation.	At local level subsidy required to meet costs. But at national level the benefits outweigh costs because of improved land allocation and efficiency.
8	Degraded land has unclear tenure, is not productive, and has no incentive for investment	Land identified, re-zoned (e.g. as APL), local farmers able to secure tenure and finance, or partnership with investor (e.g. plantation)	$160m per annum	Expansion of productive cropland estate and plantations. Improved livelihoods for 5m farmers, perhaps as many as 20 million people. Reduced poverty and enhanced rural economy.	Depending on crops, benefit outweighs costs by at least 2:1.
9	Environmental degradation reduces ecosystem services and increases vulnerability to natural disasters	Reforestation and local management (by KPH) of watersheds, river banks and hills. Water management in peatland areas.	$90m - $164m per annum[102]	Reliable water sources, reduced landslides, less flooding from peatland in rainy season and less drought in dry season, supporting fish stocks and local economy.	Disasters may cost $0.5bn per annum. Benefits outweigh costs by as much as 3:1

In summary, the benefits outweigh the costs in each aspect of the transition to the low carbon economy. The only exception is in cases where certain districts are constrained from taking advantage of economic growth opportunities (this will be in the few cases where a district comprises 80% peatland or more). However, the excess of benefits over costs in other areas means there is, at a macroeconomic level, sufficient capital available for redistribution.

The table above considers the benefits and costs of moving to a low carbon economy and finds it advantageous for Indonesia even if no income from carbon financing or other climate change initiatives were available. However, in reality other funds will be available (e.g. Norway's $1bn contribution signaled in the Letter of Intent). Therefore in many cases the abatement and implementation costs will be directly offset up carbon income, and often with co-benefits. Institutional and transaction costs (what DNPI calls 'critical enablers') add significant costs to the total, but these also carry significant co-benefits. For instance, improved spatial planning and land titling will bring many benefits to the economy in terms of increased investment (bankability) and efficient use of land.

8. Conclusion and recommendations

Mitigation is an investment to avoid future risks - most of which occur in over fifty years time. However, the benefits listed above do not include the potential costs of climate change to Indonesia as these could still arise. Indonesia is a significant carbon emitter, but even if the country takes unilateral action to reduce emissions, it will not have sufficient effect on global

emissions to mitigate the effects of climate change unless other countries also take action to reduce their emissions. It is probably the case that Indonesia's leadership on the issue enhances the likelihood of other countries taking action, but it is not guaranteed.

The commitment of other countries to reducing global emissions is expressed in terms of their willingness to pay for every ton of carbon that Indonesia does not emit (compared to the agreed baseline). This may be exercised through a market mechanism that distributes the burden of reducing emissions towards those countries and sectors where the cost of abatement is lowest. This is the means by which carbon can be priced, and this is the backbone to most of the abatement plans that are being prepared for Indonesia.

However, Indonesia is not in a position to incur up-front costs through mitigation activities while running the risk that a future carbon price may be lower than estimated. Initial financing is needed to cover the institutional and transaction costs, and go some way towards cover the cost of implementation. However, the evidence shows that as Indonesia moves on to a low carbon development track certain economic benefits will emerge, offsetting the costs of the abatement actions.

8.1. Recommendations

It is not the purpose of this report to provide a specific road map for reducing emissions that picks the best path in terms of institutional capacity and efficient use of resources. It seems that allowing each province to develop a plan (similar to the plans reviewed in this report) is the most sensible solution. Land use needs to be considered in a local context, but has cross-boundary implications. It is possible that the provincial government is the ideal level at which these matters can be planned, rather than the kabupaten which usually lacks the capacity to develop such plans and may encounter local conflicts of interest that are difficult for local political leaders to transcend. At the national level, a framework of incentives, enabling factors and technical support needs to be developed, so as to give the provinces the best chance of making good long term decisions. This would include:

- Political leadership on the importance and benefits of the Low Carbon Economy
- Support provinces to build capacity of kabupaten-level administration
- Devise an incentive structure (perhaps through Dana Alokasi Khusus) that channels interim funds for implementation, and then rewards performance and outcomes as listed in Table 21.

Table 21 - Indicators for funding of local abatement plans

Activities	Institutional preparedness Implementation (e.g. land rehabilitation, fire control) Setting up a financial model (e.g. Green Investment Fund)
Performance	Outputs from activities, e.g. evidence of reduced fire outbreaks, number of hectares allocated to rehabilitation projects
Outcomes	Reduction in emissions, measured by proxy indicators or more sophisticated MRV tools as they come on-line

Creating the enabling conditions for a low carbon economy will enhance the opportunities for capturing international finance, as well as improving the economic outcomes of the abatement activities. Policy-makers should direct their attention to the following areas:

a) Tenure, land rights and licensing

- Reform community tenure in natural forests and secondary forests in order to promote community logging, boost agroforestry and local management of ecosystem services.

- Reform the way concessions are granted and managed. For instance, use 'restoration bonds' (similar to those used in the mining sector) rather than levying a reforestation tax (DR) on production. Companies with a good track record will have no difficulty financing this bond, particularly those that have FSC certification.[103] The REDD financing mechanism could underwrite this bond for smaller enterprises and include measurements of carbon value biodiversity. The bond could also be used by the Ministry of Finance to offset future risks lower carbon revenue from leakage and non-permanence.
- Improve governance of permits and impose stiff penalties on districts that allow conversion of forest land without subsequent development.
- Revoke leases of non-active concessions and make process of application for licenses more transparent, and open to a wider group of companies, cooperatives and foundations.

b) Spatial planning

- Spatial planning, including community involvement and Environmental Impact Assessment (EIA) can have the benefit of both improving land titling (and therefore economic security) while also rationalizing the often anachronistic zonation of land.
- Rezoning the forest estate involves identifying degraded land for development. This could be swapped for forested land currently outside the forest estate (APL), however it may be better to leave this managed as part of Forest Management Unit (KPH), unless a reversion to the national forest estate (kawasan hutan) has a good development or economic advantage.
- Conversion of primary forest should carry a higher price than using degraded land or secondary forest, as it involves the loss of the future utility of the asset. The Ministry of Finance should include these losses in national accounting, and impose penalties on those districts that fail to protect such assets.

c) Community Engagement

- Involve local people in forest management in a meaningful way, both at forest management (KPH) unit level and through community forest enterprises. This will improve livelihoods, give local people a stake in the long-term health of the forest and thus maintain carbon value.
- Develop a long-term plan for building capacity at the community level, with a view to eventually devolving most forest management away from the state and towards local rights holders.

d) Raise standards

- Encourage districts to allocate land for oil palm plantations only to RSPO members,[104] or smallholders affiliated to the RSPO smallholder certification scheme.
- Poorly performing palm oil or timber plantation companies, especially state-owned enterprises, should be encouraged by district governments to enter into joint venture partnerships with more skilled operators, or to sell out entirely. Engage private sector and co-invest in best practice management, processing industry, training and education.
- In order to improve management there is a need for a new generation of skilled managers. Universities should be incentivized to produce high quality graduates with relevant skills. The palm oil industry indicates it needs 500 well-educated and properly trained managers per annum to meet its goals of raising productivity.[105]

e) Financing

From a financing point of view, carbon abatement will be paid for after proven reductions have been made, which may be far in the future. However the costs of making these reductions need to be incurred up front, in particular the cost of institutional reforms. Therefore interim finance is required to fill this gap, which may arise from various international funding mechanisms. The quantity and conditionality of this finance flow will depend on how Indonesia can demonstrate its commitment to reforming institutions and ensuring transparency. This will require some political leadership to ensure Indonesia is seen as an appropriate candidate for such funding.

Reforming institutions and improving enabling factors will have widespread benefits for the economy. It will mean capital is cheaper (as risk is lower) and it will become easier to attract long term Foreign Direct Investment and technical transfer into the country. Much of this investment will find its way into the land use sector, and will stimulate the process of revitalization that the sector needs to make it internationally competitive and a driver of low carbon growth.

Some of this reform needs to take place at the fiscal and regulatory level, for instance:

- In Brazil, the largest state bank issued an instruction that soy farmers will get credit only if they can prove their land was not previously cleared forest.[106] This could be replicated in Indonesia for palm oil development as it shifts the economics of land clearance towards using degraded land, where the cost of capital is cheaper. Other banks are likely to follow suit, and this creates an ambience of better governance, eventually forming the basis for new norms to establish themselves. And it makes both good business sense for the farmer and economic sense for the country.
- The Ministry of Finance should design a fiscal instrument that ensures concession companies have a financial interest in protecting the long term value of forest asset. This could be in the form of a restoration bond, similar to that used in the mining sector.
- Regulations should permit forest concessions to be purchased by investment companies, such as Real Estate Investment Trusts (REITs), that can demonstrate a financial interest in long-term value of the forest (including carbon). These trusts can appoint local managers to operate the concession, determined by key performance indicators. This provides an additional layer of monitoring of the forest, aligns the investor's interests with the state's long term goals, and separates management from ownership.

8.2. Conclusion

Indonesia still has a substantial forest estate and extensive peatlands. Sensible management of these landscapes in the context of global carbon markets has great potential to release some of the 'utility' value that reflects the true economic, social and environmental value of the forest, not just the short term extraction value. This would improve the welfare of millions of rural Indonesians and would be a great improvement on the existing growth model, which relies too heavily on over-exploitation of natural resources, does not invest sufficiently in people and fails to make the most of the opportunities presented by globalization.[107]

The key point is that the low carbon economy happens to largely coincide with good land use policy. Indonesia has to make important reforms in the land use sector, but has been shielded from doing so for years because of the sheer size of the forest. Now is the perfect opportunity for policy-makers with an interest in rural development and economic performance, to shape a land use strategy that moves away from the top-down primary resource extraction. A sustainable development path need not be traumatic, carries few risks and may yield significant benefits.

The DNPI suggests that 'better management of Indonesia's land holds the key to cutting emissions and improving economic planning. It offers the possibility of reducing emissions by 1.9 Gt CO2e by 2030.' The bulk of the emissions are in the land use sector, which is more amenable to mitigation than emissions from other sectors. The focus on Indonesia by other countries is not borne out of moral disapproval, but out of hope. Indonesia has an admirable blend of quickly reversible emissions, good economic potential, resourceful and energetic people and a modern political system. This is a great opportunity for Indonesia to demonstrate leadership and innovation as it moves towards a low carbon economy.

Annexes

Annex 1: Definition of 'low carbon economy'

A 'low carbon economy' may not be the same thing as a 'zero carbon', or 'carbon neutral' economy. Removing all carbon from the economy is exceedingly difficult and perhaps even impossible with current technology, or certainly ruinously expensive. Therefore a 'low carbon' economy describes a state whereby all feasible steps are being taken to abate GHG emissions, within the constraints of cost effectiveness. This could be measured by emissions intensity, that is to say the amount of carbon a country emits per dollar of GDP. From a global point of view it is assumed that if all countries were equally committed to keeping carbon emissions to less than 450ppm and thus reduce the likelihood of warming above 2 degrees, then carbon intensity would need to decrease to 300tCO2e per million dollars of GDP by 2020 and 200tCO2e by 2030.[108]

However, every country is starting from a different baseline. For instance, the UK emits almost 9 times less GHG per million dollars of GDP than Indonesia, but on a per capita basis UK emits slightly more, and at 10.7tCO2e/capita could not be said to be anywhere close to a low carbon economy. Indeed, the UK government is committed to reducing this per capita figure by 85% by 2050.

Therefore a 'low carbon economy' is a rather subjective term, as it depends upon the basis for comparison. For instance, if Australia were to reduce its per capita emissions by 60% from year 2000 levels (which it tentatively plans to do by 2050)[109] then although this may be described as a 'low carbon strategy' it would actually place it at the same per capita emission level that Indonesia was at in 2005.

As every national economy has a different composition and development status, making changes that decarbonise the economy can vary widely. However, all economies will eventually need to converge at a similar low emission intensity level at some point in the future, but some countries will get there quicker than others. An economy that did not make attempts to aim for this goal, by continuing to emit carbon at 'business as usual levels, would be effectively 'free riding' on the efforts of all other countries who have made investments in reducing total global emissions. The tolerance levels of compliant countries towards non-compliant ones will reduce significantly as the costs of decarbonising economies increases. This will be even more the case if any country were perceived to be obtaining a competitive advantage by remaining on a high carbon track. Thus for most countries, especially emerging economies such as Indonesia, working towards becoming a low carbon economy may become the only rational economic and political choice, providing if it can be achieved without sacrificing development goals.

Annex 2: LULUCF and climate change

Land use patterns may have positive or negative implications for carbon emissions. For instance, Pasture for cattle leads to methane emissions (CH4) and fertilizer use, tilling and rice cultivation emits nitrous oxide (N20). Oil palm plantations and rubber agroforestry systems, on the other hand, may store carbon as they grow. Current agricultural land practices, regardless of any emissions created upon the change from previous usage (which may be many centuries ago), are responsible for 14% of all anthropogenic GHG emissions globally.[110]

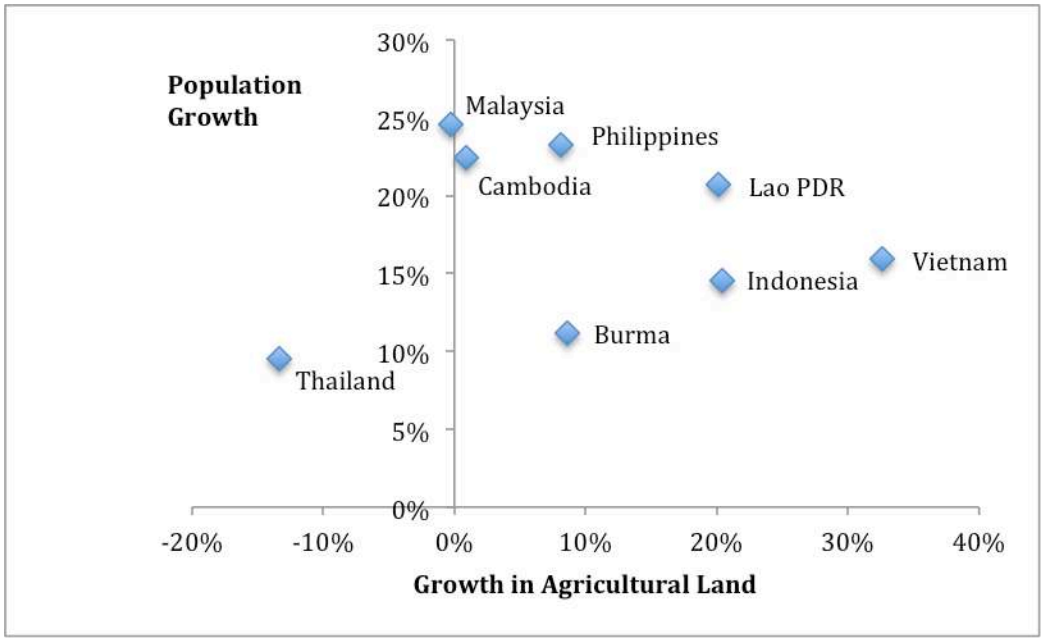
'Land use change' usually refers to the conversion of a long-term landscape, such as a forest, into a new form of use, such as pasture or plantation. Such changes to land use can lead to emissions of greenhouse gas (GHG), principally carbon dioxide (C02) released by the trees, soil and other biomass when the material is removed, burned or disturbed. Even small changes to land use can

impact carbon stocks, such as logging when it disturbs areas around the target trees, or involves altering the area's hydrology. It is estimated that approximately one third of global carbon emissions since 1850 have been the result of land use change.[111]

Deforestation involves the rapid removal of stored carbon from land - the trees are literally shipped away from the site - and this is the most visible form of land use change, particularly as it is often accompanied by the use of fire. Other land use changes, for instance the draining of peatland,[112] can commence a long-term process of oxidisation that leads to large stocks of carbon being emitted over very long periods of time. Also, as peatlands dry out they become more susceptible to fire, which accelerates carbon emissions.

Annex 3: The link between population growth and deforestation

Agriculture is usually identified as a driver of deforestation, as a rising population demands more food that in turn requires more cropland. However, although this connection may seem self-evident, the evidence points to a more complex relationship. For instance, the amount of agricultural land in India remained static from 1995 to 2005 despite a 19% increase in population, as did Malaysia's despite population increasing by a quarter.[113] For most countries in Southeast Asia, there appears to be no linear correlation between population growth and demand for more cropland, as the chart shows. Only Indonesia and Vietnam experienced an expansion of agricultural land that was in excess of their population growth.



The reason for this weak correlation probably lies in the way agricultural productivity increases over time, not only per unit of labour but also per hectare of land. All countries in the region seem to have experienced such increases in the period 1995-2005 (by 42% on average), except for Indonesia were productivity grew by only 3%.[114] It is possible that the other countries face more scarcity of land than Indonesia, leading to higher land prices and thus stronger economic incentives to raise productivity.

It may also be the case that farmers in Indonesia use insufficient inputs, or use them inappropriately. There may also be a lack of access to mechanisation. Indonesia has half as many tractors per hectare as Malaysia, and even less compared to Thailand and Vietnam. Also, Indonesia tends to use land for lower value crops (with the exception of palm oil), and under-produces horticulture and fruits. Indonesia imports $200m of fruit, vegetables and processed food

from China - which shows that there must be obstacles to competitive production of such goods in Indonesia.[115]

Weak and uncertain tenure, incomplete cadastral systems and legal contradictions regarding customary land rights combine to keep land prices low in Indonesia. Timber concessions and plantation companies are granted leases at values that may fail to reflect the true value of the land. The amounts paid in compensation to local people by companies developing oil palm plantations has in general been very low ($1- $4 per hectare in the case of Papua).[116] The presence of a large amount of degraded land (estimates vary from 7Mha to over 30Mha) is a sign that the forest frontier is undervalued.[117] It means forest land is either very cheap or open-access, so economically it makes more sense to continue to plunder the frontier rather than develop existing open land.

Estimating deforestation

The relationship between population growth and conversion to croplands may not be wholly proportional. The growth in agricultural land since 1995 (approximately 6 million hectares) has been accompanied by very slow growth in yields and productivity, and it is unlikely that such a condition could continue for the next 20 years. Current population growth is 1.49% per annum,[118] so the next 20 years will see population expand by 81 million. If the past correlation between land and population is valid, then an additional 11 million hectares of agricultural land will be required (which is consistent with the DNPI estimate), but the extent to which all of this will come from the forest estate is uncertain. Investing in raising agricultural yields could thus have a direct effect on avoiding deforestation.

Annex 4: Macroeconomic Trends

A study by Harvard calculated the Revealed Comparative Advantage (RCA) of Indonesia and Malaysia in relation to China, which is a formula that identifies the competitiveness and productivity of a particular activity.[119] It shows that the two countries, both major exporters of edible oils to China, have a similar competitive profile. In short, Malaysia has higher yields and more efficient plantations, but Indonesia has lower wages. However, for higher value processing into foodstuffs and cosmetics, Indonesia has an RCA that is a fraction of Malaysia's.

Revealed Comparative Advantage	Veg oils and fats, refined	Animal and vegetable fats and oils, processed
Indonesia	14.2	4.2
Malaysia	13.1	17.0

This problem is replicated across Indonesia's economy. It is too reliant on extraction of resources and primary low-value processing, but is unable to complete in higher value-added activities (with the exception of specialist sectors such as furniture), neither is it growing a market in 'income elastic' goods.

This means as incomes rise in Asia (including the domestic market in Indonesia), growth opportunities will be limited. Income elastic goods are the higher-value manufactures that consumers demand as they have more disposable income. The demand for low value commodities is inelastic - that is to say people do not consume much more of them as they get richer.

Indonesia has benefited from rising demand for vegetable oils, particularly from China, but this sector has limited scope for forming upstream and downstream linkages in the economy that may spur innovation and thus further employment and value added. It is a dead end, developmentally.

Indonesia's manufactured exports have grown very slowly since 1997 (compared to other emerging economies), reflecting increasing reliance on unprocessed or part-processed raw material exports. 6.4% pa ave 03-07, compared to 21% pa in Vietnam, and 16.3% in Brazil. (Harvard 2010)

Growth of manufactured exports, selected countries

	1997-2002	2003-2007	1997-2007
Indonesia	3.40%	6.40%	5%
Brazil	2.40%	16.30%	9%
China	13.30%	27.60%	20%
India	5.80%	17.30%	12%
Korea	3.20%	14.30%	9%
Malaysia	2.70%	7.90%	5%
Philippines	10.70%	3.40%	7%
Thailand	2.70%	14.60%	9%
Vietnam	13.60%	21.30%	17%
Source: Harvard (2010)			

The realisation that there is a link between over-reliance on natural resources and under-development has led economists to seek a more accurate measure of the state of a country's capital stock than merely assuming that the annual increase in GDP is automatically added to national wealth. This measure is called 'Adjusted Net Saving' - ANS (also known as 'genuine saving' or 'net positive saving'). Negative ANS indicates the country is running down assets, and will thus have less assets for future generations and a declining capacity to generate economic growth. Over the past two decades, Indonesia's Adjusted Net Savings rate has dropped from more than 18% to a negative rate of minus 2%.[120] This negative trend is also reflected in other statistics that show that most people are trapped in low-income jobs in the agricultural sectors. There is no significant transfer from these sectors to manufacturing, as Indonesia's economy largely sells raw materials, not products. Hence, the jobs and the value-added are captured by other countries.

This evidence shows that Indonesia not only squanders its natural riches, it squanders its finest resource: its people. Educated and skilled Indonesian workers receive lower salaries than their counterparts in other Asian countries. At the same time, the global manufacturing and service industry does not move into Indonesia to exploit these low labour rates, as barriers to entry outweigh the benefits of low input costs. Labour rates are lower than India, Malaysia, Philippines and Thailand, and less than a fifth of those in China, yet this does not lead to more jobs. This is because wages are just one component of competitiveness. You also need a skilled workforce, good infrastructure, low cost of capital and an enabling environment for doing business.

Job growth in Indonesia is slower than in other large middle incomes countries. A recent study estimates that of the 22 million workers who entered the labor force between 1997 and 2008, only 5.6 million found real jobs.[121] The rest were unemployed, left the country in search of employment or took up low or zero productivity jobs as family laborers or in low return, largely informal occupations like petty trade and services. This trend drives down labour rates on plantations, as migrants are always available. This may be beneficial to plantation companies in the short term, but it does little to alleviate rural poverty.

Annex 5: Calculating institutional costs

Institutional costs (readiness and enablers) according to the DNPI reports for Central Kalimantan and Jambi are as follows:

	Central Kalimantan				Jambi			
	$ million		$/CO2e		$ million		$/CO2e	
Year One	**low**	**high**	**low**	**high**	**low**	**high**	**low**	**high**
Institutional Readiness	28	55	0.10	0.20	19	39	0.35	0.71
Critical enablers	115	181	0.42	0.67	63	111	1.15	2.02
Total	143	236	0.53	0.87	82	150	1.49	2.73
2011-2030								
Institutional Readiness	14	27	0.05	0.10	9	19	0.16	0.35
Critical enablers	420	788	1.54	2.90	277	545	5.04	9.91
Abatement costs	343	502	1.26	1.85	86	112	1.56	2.04
Total	777	1317	2.86	4.84	372	676	6.76	12.29
Non-abatement costs	434	815	1.60	3.00	286	564	5.20	10.25
	56%	**62%**			**77%**	**83%**		

Annex 6: Forecasting palm oil demand and prices

Future demand will continue to come from the edible oil sector (currently 75% of demand) but may also be increasingly influenced by the biofuel market. Demand for edible oils could account for an additional 5 Mha of Indonesian plantations (depending upon yield performance) by 2030, which is lower than current trend growth.[122] However, biofuel demand is hard to predict, as it is so dependent on subsidies, regulations and technical advances. If alternatives that do not displace food crops (e.g. second generation biomass fuels) become more efficient, then palm oil may become less attractive. For instance, using perennial grasses as biofuel feedstock could meet up to 56 percent of global current liquid fuel consumption, which would greatly reduce demand for palm oil as a biofuel.[123] Furthermore, there is a complex interaction between different types of oils (soy, rapeseed etc.), so that if more palm oil is demanded for biofuels, this may drive edible oil demand towards these alternatives and away from palm oil, so the increase in demand for palm oil as a biofuel is offset by a reduction in demand for it as an edible oil.

There has been an assumption that the only way is up for palm oil prices, and that demand will keep growing *ad infinitum*. However, this ignores certain economic realities about commodities. The current price (as for many commodities) is to a large extent driven by speculation on the futures market. Indeed, some argue that this is driving up the prices of most grains, oils and cereals at the present time. The price therefore does not necessarily reflect the current equilibrium between supply and demand, but is a signal of the future, higher equilibrium. It acts as a signal to increase production now and thus reduce prices in future (although how quickly the market reacts to these signals depends upon fiscal conditions, type of crop etc.).

Furthermore, it is likely that palm oil may become a more widespread crop within the tropical zone. Brazil has plans to plant 5m hectares[124] of land that was deforested so long ago that it will not be accused of deliberate forest conversion. The oil will be certified sustainable and will thus be eagerly absorbed by EU and North American markets, where the demand for sustainable oil exceeds supply.

Sustainable oil (for instance certified by RSPO, or the new Indonesia standard ISPO) is in any event likely to become a more influential factor in the market. The additional marginal cost for consumers in developed countries to switch to certified oil is quite low - $0.40 per annum in the case of a US consumer.[125] Palm oil that is produced on land that was converted at the expense of forest or peatland is always going to struggle to find a foothold in such a market, which could eventually consign Indonesia to selling to the cheaper, less discerning market which has higher demand elasticity (consumers reduce consumption or switch to cheaper products if prices rise too much). This is the wrong market segment for Indonesia to be in, if the goal is long term rising and sustainable profits.

Palm oil has inelastic supply - if CPO prices fall then you cannot turn off the tap - the CPO keeps flowing, as plantations are 25-year cycle investments. This would tend to lead to overshoots of price falls in times of glut, as well as the other way (excessive bubble prices that then drive over-investment in palm oil) in the case of a shortfall in supply. As it takes 3-6 years from securing the land until first harvest, there can be a time lag between prices rises indicating undersupply and market response in terms of higher production. Thus the chances of over-production are high, and prices could be volatile.

Annex 7: Cost of land swaps

The BAPPENAS Peatland Strategy (2009) included a sensitivity test to ask how high the cost of a land swap needs to be (including the cost of surveys, FPIC, compensation, central and local government costs etc.) for the NPV of mineral soils to dip below the NPV on peat land. It appears that the cost of securing degraded mineral land would need to be $2,500 or more per hectare for unpopulated degraded peat land to be more attractive financially, and $1,800 per hectare if the peat land was forested (as the degraded mineral land would not enjoy the income of the timber harvest on clearance).[126] It is most unlikely that costs of negotiating and acquiring degraded mineral land would reach these kinds of levels. Indeed, Conservation International considers a 'fair' price of land to be $300,[127] and the WRI POTICO project assesses transaction costs to be $24 per hectare.[128]

The costs of the process, based on a land swap for a 12,000 ha plantation, are in the region of:

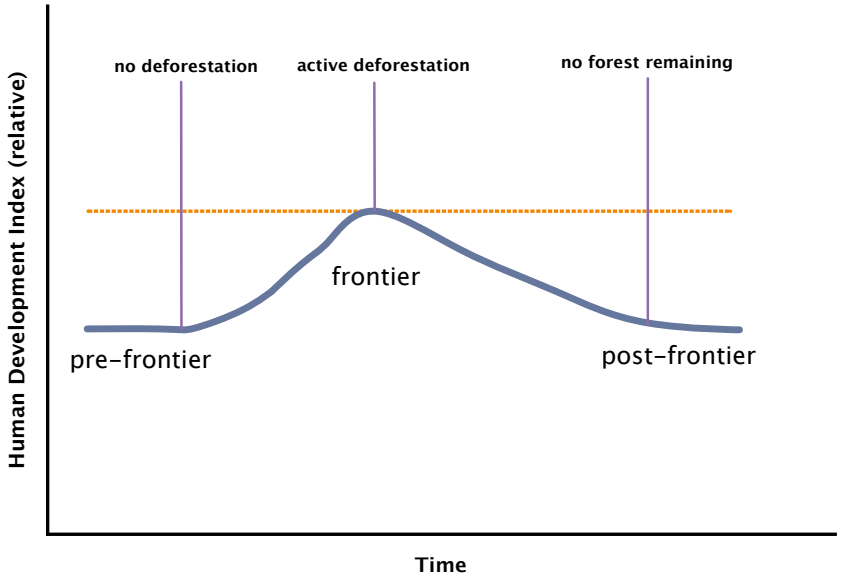
Facilitation costs	$50 000
MoF (Baplan) technical assistance	$26 000
MoF (Baplan) Boundary orientation, reconstruction, inauguration and settlement	$208 000
Total:	**$284,000 ($24 / hectare)**
Companies willing to pay:	$700 per hectare
Compensation to locals:	$300
Payment to Forestry Ministry:	$19.5
Income for local government:	$380.50
Assume 5m hectares for swaps:	
Local people receive:	$1.5bn
Local Government receives:	$1.9bn
Ministry of Forestry receives:	$98m

Annex 8: The role of LULUCF in human development

It could be said that land use change is an inevitable consequence of development. This has certainly been the experience in most parts of Europe and North America. But there is not necessarily a causal link (e.g. deforestation causes development), and over time a transition tends to take place where the rate of deforestation slows down, and eventually reverses, as it has in USA and particularly China. This process of classic forest transition is also sometimes referred to as a 'Kuznets' curve, which models how an improved standard of living causes environmental degradation until a tipping point is reached, where the trend changes to better stewardship of the environment

Studies of forest transition[129] show that there is no direct path from conversion towards higher incomes (from either agriculture or forestry). The value of forest conversion to society depends largely on the local context, such as population density and proximity to cities, as well as the policies and incentives. Therefore it is unwise to assume that good economic outcomes from conversion in one area can be replicated in other areas. Indeed, in many cases deforestation may actually exacerbate poverty.

Recent evidence from Brazil shows that the relationship between tropical deforestation and poverty needs to be better understood at the local level, in terms of how it affects communities proximate to a moving frontier of deforestation. As the land use changes, there is a short-term boost to the livelihoods of local people caused by the work available for clearance and other associated economic activities. Thus the human development index (HDI), relative to the district, rises. However, the evidence shows that after the forest is cleared, the economic opportunities diminish, even if the land is now in agricultural use. Thus there is a boom / bust cycle over time, leaving local people more impoverished at the end of the cycle than before the forest was disturbed.



Deforestation also has impacts on health, for instance a recent study showed that incidence of malaria increased by almost half in areas where forest cover had been degraded.[130] This is caused by opening up canopy cover, changing the moisture uptake dynamics and the formation of pools of standing water, creating an ideal habitat for the malarial mosquitos.

Research has found that most deforestation generates relatively small economic benefits in proportion to the damage caused to ecosystems and the future carrying capacity of the land. Thus the current pattern of land use, where large amounts of forest are allocated to concessions or

converted into plantations may not automatically be leading to the sort of development that will improve the lives of people living in remote rural areas.

Furthermore, in many cases deforestation does not actually lead to future development, for instance for oil palm, but instead lies unused, eventually becoming grassland or scrubby heath. More than 28 million hectares of forest have been cleared in Indonesia since 1985, but much of this land has not been put to productive alternative uses, leaving large areas of degraded land that contributes less to local economies than the forest it displaced.

Annex 9: Papua Low Carbon Development Plan

Papua Province is in the process of developing a low carbon growth strategy, the broad principles of which are set out in 'Building a low-carbon economy for Papua Province'.[131]

The main insight of the plan is that the Business as Usual case for forest conversion (approximately 6 million hectares) implies very high emissions by 2030, particularly as the conversion estate includes 1.3 million hectres of peatland. However, once adjusted for soil suitablity, slope, distance from population centres etc., the actual amount of land that could be converted to commercially viable plantations reduces. In other parts of Indonesia (especially Kalimantan), forests have been converted without any plantation being successfully developed, often because the company obtaining the license to clear the forest (IPK) has not been obliged to demonstrate commercial viability of its long term plans, and local district governments have not had the capacity to make a proper Strategic Environmental Assessment (SEA) in their spatial planning process.

The Papua plan envisages sets out a number of scenarios, as shown in the table below:

Scenario	% Deforestation	Description	Area of oil palm Mha	GtCO2e 'saved'	Value (US$ m)
I	87%	All areas useable for oil palm converted	5.2	n/a	0
II	60%	Excluding peat and other land of only marginal suitability for oil palm	3.6	0.377	1884.6
III	25%	Degraded forest/land only, excluding primary forest, peat and other land of only marginal suitability for oil palm	1.5	0.871	4357.2
IIIa	16%	Degraded forest/land only, excluding primary forest, indigenous savannah, peat and other land of only marginal suitability for oil palm	0.83	0.948	4740
'Zero'	0%	No new oil palm development, optimise existing oil palm only	0.044	1.084	5422.30

Following the agreed best path solution of 'Scenario IIIa', up to 830,000ha of HPK and APL will be allocated for 'best practice' oil palm and 3 million ha retained for of sustainable community forest management and agro-forestry (with a further 1.3 million ha of peatland conserved), Papua will save about 38 million tonnes of C02e a year by 2030 (compared to 'business as usual'). Approximately 1.3 million hectares of peatland will be conserved in this scenario.

The methodology used to calculate the Papua emission reductions seems to be more conservative than those used by DNPI.

Annex 10: BAPPENAS peatland strategy

The BAPPENAS peatland strategy identifies total mitigation target of 1281 MtCO2e (this is higher than the DNPI target and is currently being revised in the light of the latest research) and groups the mitigation options under three headings:

I. Improvement of peat land management practices to reduce emissions in peat land currently under forestry and agricultural land use; Legal compliance and best management practices in existing land under production could yield 338 Mt CO2 emission reductions by 2025 (24 percent of potential reductions)

II. Rehabilitation of degraded peat land to reduce emissions through fire prevention and the rehabilitation and management of unproductive peat land; Peat land rehabilitation and prevention of uncontrolled fires potentially may add a further 430 Mt CO2 emission reductions (31 percent of potential reductions)

III. Consolidation and revision of spatial plans and land use permits to reduce emissions through redirecting economic land use away from peat land to mineral soils. Revision of land allocation, forest conservation and land swaps that direct future development away from peat land could create an additional 513 Mt CO2 emission reductions (37 percent of potential reductions).

Annex 11: The pitfalls of using the opportunity cost method

Part of the process of establishing the mitigation cost per ton of C02 is determining the opportunity cost of switching land use. From a landowner's point of view, this could be the income forgone from not converting forests to palm oil plantations. For society, it could be the lower GDP that results from a smaller economy because less forest is converted. In each case, the opportunity cost is expressed as the 'net present value' (NPV), which is the value of future income in today's terms, net of costs.

Many opportunity cost calculations are based on a study that formed part of the Stern Review, or more recent studies. The range of values for opportunity cost can be quite wide, and care needs to be taken when using them for cost benefit analysis, as they depend on a large array of variable and sensitivities. For instance, many models assume a CPO price of $700 per ton, yet it has recently risen to over $1000 per ton. In future it may fall back to $500 per ton, and a 20 year projection needs to predict a long-term average.

The Stern Review calculated the opportunity cost of forest protection for the top 8 deforesting countries is $5bn per annum. Expressed in terms of carbon emissions avoided by such action, the opportunity cost of avoided deforestation was calculated as less than $5 per ton CO2e, and in many case even less than $1. However The DNPI calculates the opportunity cost as much higher - up to $28 per ton CO2e.

When considering the economics of oil palm plantations at the expense of forests (or peatland) versus degraded land, the opportunity cost argument, which might be valid at a local case-to-case basis, appears to be weak against a macro-economic context. Adopting a macro-economic perspective on this issue, it appears to be more reasonable to talk about the actual technical and transaction costs of shifting oil palm plantations from carbon-rich land to degraded land, rather than considering the opportunity cost of not converting forests or peatland. If the argument is based on opportunity cost only, then the rational conclusion would be to convert every square inch of Indonesian land into oil palm plantations. Even if labour and capital were available for

such an expansion, it ignores the interaction of supply and demand in the market. If Indonesia over-produces palm oil then the price will fall, eventually to below the opportunity cost of alternative land uses.

Furthermore, it is difficult to see how a compensation payment system for not developing oil palm plantations on forests or peatland would be integrated into an Indonesian low-carbon growth strategy or become sustainable in the long run. Such a system is likely to generate perverse economic incentives, such as encouraging large palm oil companies to engage in land-banking.

Annex 12: Provincial cost/benefit ratio

The provincial plans include costs that will lead to improved livelihoods and enhanced GDP by 2030, compared to the business as usual case. All four plans show a positive benefit/cost ratio for moving to a low carbon economy, and Central Kalimantan and Jambi are shown in the table. Also, East Kalimantan claims the GDP growth could increase from 3% to 5%, which by 2030 will have increased GDP per capita by a third. With additional investment this sum could increase even further.

Comparison of costs and benefits: Jambi and Central Kalimantan

	Central Kalimantan		Jambi	
Total abatement (MtCO2e)	**282**		**55**	
Costs ($m)	**lower**	**higher**	**lower**	**higher**
Year 1	143	236	19	39
by 2030	770	1320	373	676
$ /tC02e	2.4	3.9	6.8	12.3
Benefits				
extra GDP over baseline ($m)	1,170	1,342	505	1,011
Benefit/Cost ratio	**1.52**	**1.02**	**1.36**	**1.50**

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[4] Ranked 15th highest emissions per $1m of GDP (WRI-CAIT)
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[8] BPS (2010)
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[17] This decree was later revoked, giving pulp companies more time to access natural forests. It is not yet clear how the Norway Letter of Intent will affect this policy as the moratorium has not yet been signed at the time of writing this report.
[18] Barr *et al* (2010)
[19] World Bank (2007)
[20] DNPI Kaltim (2010)
[21] Yields vary according to dataset. BPS export data combined with Deptan plantation data implies productivity of only 2.14 per hectare, but Deptan data may include juvenile estates.
[22] Long term average 1975-2006 -- Jalani et al (2002)
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[41] Extractive Industries Transparency Initiative – www.eiti.org
[42] Fairhurst *et al* (2010)
[43] e.g. Kulim (2007)
[44] In addition to these reports there are also various private sector initiatives, most of them involved in REDD projects of some sort. These have not been reviewed for this paper
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[50] developed by McKinsey & Co
[51] This is higher than the DNPI target and is currently being revised in the light of the latest research.

[52] DNPI (2010) p.21
[53] Fairhurst et al, 2010
[54] Fairhurst and McLaughlin (2009)
[55] BAPPENAS, 2009
[56] However only districts with good governance and professional spatial planning will be able to attract the new plantations brought by land swaps
[57] Dyer and Counsell, 2010
[58] Note: table has made the assumptions about the proportion of non-LULUCF abatement activities that will take place before 2020.
[59] This is a lower REDD compensation cost than assumed by DNPI, as explained in text.
[60] MoF Green Paper, 2009, p.4
[61] Harvard, 2010
[62] e.g. World Bank 2007 Road Map
[63] Van Beukering et al., 2003
[64] Priess et al., 2007
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[66] Putz et al
[67] Commissioned by Oxfam Novib and The Prince's Rainforests Project in collaboration with AAK, Asian Agri, Musim Mas, Sime Darby, Sinar Mas, SIPEF and Wilmar
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[73] Fairhurst et al, 2010
[74] Based on data from WRI-POTICO. See Annex 7 for a detailed breakdown.
[75] Elson, 2009. This excluded the cost of FPIC, AMDAL etc.
[76] Economist – family farms
[77] Jakarta Post, 2009
[78] Compensation for lost /damaged homes based on government announcements on compensation for victims of Mt Merapi disaster in October 2010 (Jakarta Globe, 2010)
[79] It should also be acknowledged that as GDP is growing in real terms, the future cost of abatement will be a smaller proportion of GDP than that quoted in this report (which uses 2009 GDP as the baseline).
[80] Fairhurst et al 2010 p.16
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[82] Fairhurst et al 2010
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[85] World Bank 2009
[86] Curran et al. 2004
[87] Ministry of Forestry 2006 cited in Nellemann et al. 2007
[88] Cernea, 2006
[89] Ministry of Finance Green Paper, p.102
[90] The criticism of CSR is that local people become 'clients' of a private company over which they have no control, rather than citizens of a society than can exercise control over local government through the democratic process.
[91] e.g. Butler et al 2009, Fairhurst et al 2010
[92] Ibid.
[93] Agus *et al*, 2007
[94] Molenaar *et al,* 2010
[95] e.g. Major buyer Staples cut ties with APP in 2008 - Wall Street Journal (2008)
[96] Stern, 2006, p.217
[97] Stern, 2006
[98] Informal Working Group on Interim Finance for REDD
[99] UN, 2009
[100] ADB, 2009
[101] Gross figure calculated by DNPI is $738, it is assumed 10% of this is for watersheds etc. and is counted in separate item
[102] Assuming $90m for water restoration (DNPI data) and 10% of reforestation is on watersheds and river banks (10% of $738m total reforestation cost identified by DNPI)
[103] Forest Stewardship Council – www.fsc.org
[104] Roundtable on Sustainable Palm Oil (www.rspo.org)
[105] Molenaar et al. 2010
[106] Government of Brazil, 2010

[107] Harvard, 2010
[108] PWC, 2009
[109] Australian Government, 2010
[110] USEPA, 2006
[111] Houghton, 2003
[112] In some reports, emissions from peat lands are listed separately from LULUCF, partly reflecting the ongoing debate on definitions occurring in international forums. However, in this paper it is assumed that the conversion, draining or disturbance of peat land is a component of the broader land use change sector.
[113] FAOSTAT 2010
[114] FAOSTAT 2010. Note that Indonesia may have been at a higher level of relative productivity on 1995, and thus some other countries experienced higher productivity growth in order to catch up. However other data on current yields and productivity does not seem to support this explanation.
[115] Harvard 2010
[116] EIA, 2010
[117] Mcleish & Hanson, 2011
[118] BPS Sensus 2010
[119] Harvard, 2010
[120] World Bank, 2010
[121] Papanek and Chatib Basri (2010)
[122] Corley, 2008
[123] Cai et al, 2011
[124] According to the Brazilian agricultural research agency Embrapa, the estimated amount of land suitable for such cultivation is actually closer to 30 million hectares
[125] Butler & Koh, 2010
[126] BAPPENAS, 2009
[127] EIA, 2009
[128] Personal Correspondence with WRI
[129] e.g. Chomitz, 2006
[130] Olson et al, 2010
[131] Suebu, 2009