DNPI Green REVIEW

ON REDD+

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LULUCF and REDD+

Agus Purnomo and Doddy S. Sukadri

Introduction

Nicolas Stern, a well-known economist from UK, stated in his 2006' report review that about 17 to 20 percent of the world GHG emission is a result of deforestation and forest degradation. Of this number, about 75 percent of the deforestation and forest degradation is originated from tropical forest countries. Three countries, i.e. Brazil, Indonesia, and DRC are the three largest tropical countries in the world. Indonesia, which, by law has approximately 132 million of forest land, has therefore been expected by international community to play a significant role in stabilizing the climate, and that keeping the forest in sustainable practices.

A study undertaken by DNPI (2010) concludes that in 2005, Indonesia accounted to contribute about 5% of global GHG emissions, and has been projected to increase quite significantly in 2020 and 2030. The following figure shows detail of the analysis.

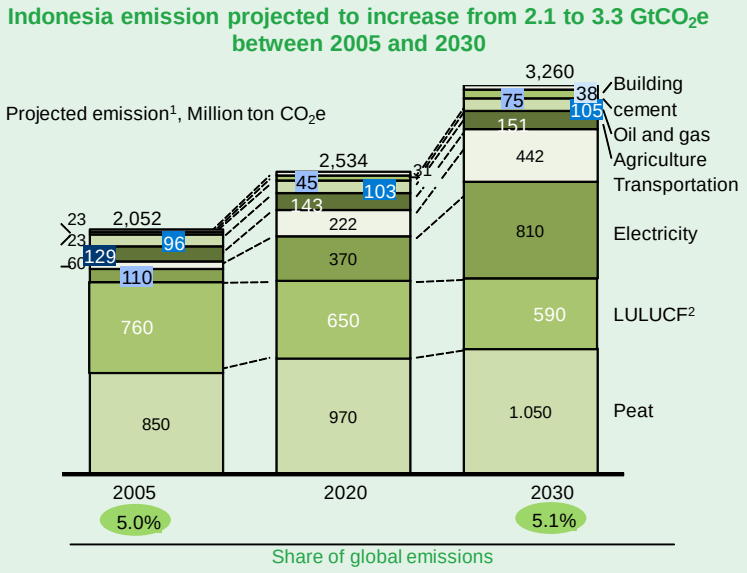

Figure 1 : Indonesia's emission projected profile: 2005 - 2030

From the figure it is clear that Land-use, Land-use Change and Forestry (LULUCF) and peat are the most significant emission by sources, and at the same time could potentially be a carbon removal by sink if appropriate measures are well undertaken. The DNPI study furthermore shows that Indonesia has a potential mitigation to reduce its GHG emissions by 2.3 Giga-ton by2030, representing a reduction of 46% from 2005 levels. Such a reduction would equal to neatly 7% of the total global reduction needed to prevent global warming to increase more than two degrees centigrade, according to the United Nation's Intergovernmental Panel on Climate Change (IPCC). However, with the Business as Usual (BAU) practices, LULUCF and peat would still be the "champion" of the country's emission sources. It would still contribute more than 50 percent in 2020 and approximately 50 percent in 2030. This means that about 2.5 percent of the world GHG emission could be emitted from LULUCF and peat areas in Indonesia.

From the global perspective, LULUCF also contributes significantly to global emission. The following figure explains the situation:

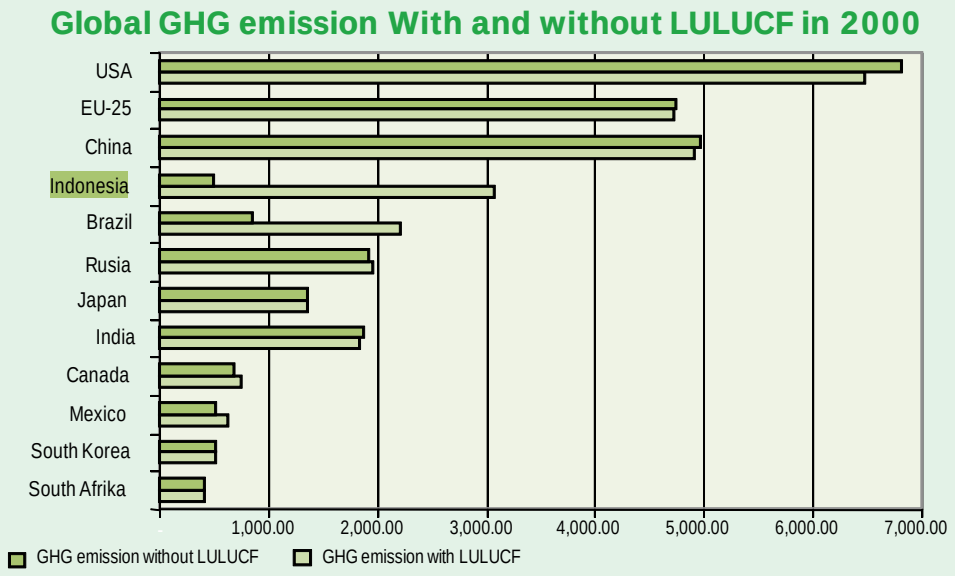

Figure 2 : Global GHG with and without LULUCF

Looking at Figure 2 apparently LULUCF contribution to GHC emission is more than double compared to non-LULUCF emission sources. This is particularly true for forest developing countries like Indonesia and Brazil. The main reason among other is due to development needs, which require forest land is unavoidably converted into agricultural and estate crops, mining, settlement extension, and other development activities.

LULUCF has been heavily discussed by the Ad-hoc Working Group on further commitment of Annex-1 Party under the Kyoto Protocol (AWG-KP) throughout the Climate talk debates, but little progress has been made so far. The discussion of LULUCF mainly on issues relating to rules and modalities, including definitions of forest, deforestation, reforestation, natural disturbances, harvested wood products, and force majeure. All of the definitions reflect intentions of Annex-1 parties leading to accounting of emission reduction. Complexity of methodology of the accounting such as determination of REL, consistency, and transparency, are of concerns of Non-Annex-1 parties.

Unlike developing countries, developed nations receive more advantages of LULUCF activities compared to Non-Annex-1 parties. For Annex-1, LULUCF is just like a “low hanging fruits” if emission reduction target is of their main attention and responsibility. As LULUCF activities are included in carbon accounting, part of their responsibility becomes reduce. This is reasonable since land use change, particularly forest lands in Annex-1 party have generally been managed intensively for much longer time compared to Non Annex-1 countries, resulted in significant carbon removal by sink, rather than emission by source. According to CAN (2010), developed countries who are promoting forest management accounting, would result in a loophole equivalent to 5% of the total emission reduction mandatory in the first commitment period, which is about approximately 400 CO2e per year.

For Non Annex-1 parties, LULUCF however provides a greater opportunity for developing countries to reduce their-own emission. Three major areas, according to Aston (2010) have potential in reducing emission, i.e. avoiding deforestation, low-carbon agriculture practicing, and enhancing carbon sequestration. The following figure describes these activities:

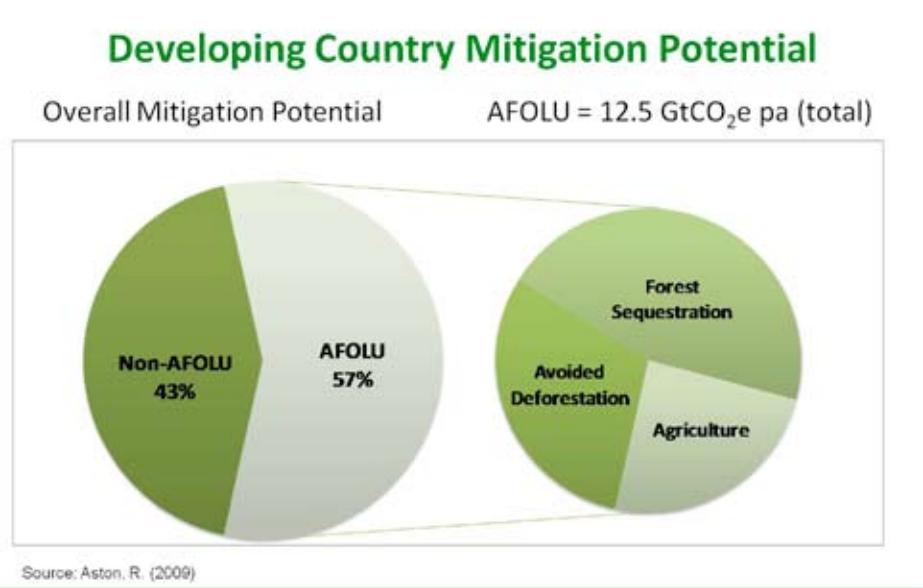

Figure 3 : Mitigation potential in developing countries (Aston, 2010)

Over half of developing world mitigation potential lies within AFOLU-related activities. Therefore, it needs a comprehensive framework that includes REDD Plus and inclusion of AFOLU into the overall mitigation efforts in developing countries, including Indonesia.

The status and role of Indonesia' forest and peat in emission reduction

In the context of climate change, forest generally has three main functions, i.e. as carbon sequester or carbon removal, carbon reservoir, storage or sink, and carbon emitter releasing CO2 into the atmosphere. The capacity of forest in absorbing CO2 would largely depend on bio-geophysical of the forest, such as variability of tree species, density, and soil and organic matter content. But in general, forest dominated by young plantation has generally higher capacity in absorbing the carbon. On the contrary, over mature forest could release carbon when decaying process is taken place due negative growth of the trees or abandon tree felling on the ground. In the form of biomass, tree stands could restore carbon more if there is no human intervention. But when the forest is cleared up and converted into other uses of lands, it would result in reduction capacity in absorbing the carbon. Such activities would bring about a significant amount of emission when forest fire takes place.

It would be much more significant if this occurrence is happening in peat forest areas. According to a long standing research undertaken by Hokaido University in Central Kalimantan, the amount of carbon restored in this area consist of approximately 15 to 20 times compared to the amount of carbon in mineral soil (Osaki et al, 2011). The Indonesia National Council on Climate Change reports that of the 21 million hectares total area of peatland in the country, 18 million hectares is located in designated forest area, and the rest of three million hectares is spreading outside of the designated forest area, and usually under auspices of local communities or maybe privately-owned land.

Box: Indonesia's peatland story line

- Globally, peat covers only 2,7% of land area, but it stores approximately 30% of terrestrial carbon. Indonesia's tropical peatland occupies only 5% of the global peatland area, but it contributes more than 50% of global emission originated from tropical peatland.
- Peatlands are threatened all over the world by drainage and fires, but most dramatically in Indonesia, more than 300,000 hectares are being degraded annually, resulting in a total area of approximately 10 million hectares of already degraded peat.
- Emission from Indonesia peat is mainly caused by decomposition following drainage and peat fires. The emission caused by the decomposition is about 600 million ton of CO2, and from the fire about 650million ton of CO2 per year. Deforestation for conversion to other land uses and degradation through timber extraction has resulted in emission of about 240 and 45 million ton of CO2, respectively.
- Drivers of peat conversion and degradation are many, ranging from the needs for development and land use change to improper policies such as the mega-rice project, and a lack of knowledge and awareness.
- Stopping conversion of peatland for agricultural use would result in a quick win for the government, and would draw a lot of attention and recognition by other countries, but it would cause protests by business sector such as palm oil and pulpwood, and would not be of interest of small scale farmers.
- Water management has a high feasibility because it would not only result in the emission reduction, but also a lower risk plantation and concession owners due to smaller number of fire occurrence in the dry season and less flooding in the reany season.

The designated forest land, according to the Ministry of Forestry (2010) occupies about 71% of total land mass of Indonesia, and the rest of 29% is of non forest area, which is called the APL (Areal Penggunaan Lain) or KBNK (Kawasan Budidaya Non-Kehutanan). Such information and its current status are detailed in the following table:

Current status of forest coverage

FOREST COVERAGE	FOREST AREA		NON-FOREST AREA		TOTAL	
	Extend (ha)	%	Extentd (ha)	%	Area (ha)	%
FORESTED	92.328 (Virgin=43.801; LOA=48.526)	49%	8.412	4%	100.740	54%
UNFORESTED	40.071	21%	46.976	25%	87.047	46%
TOTAL	132.399	71%	55.388	29%	187.787	100%

Source: Landsat imagery 7 ETM+ 2005/2006 (217 scenes)

Table 1 : The status of forest coverage in Indonesia

Table 1 explains that out of approximately 132 million or 71% of designated forest area in Indonesia, about 40 million hectares is not forested. The rest of the designated forest area is of virgin and secondary or logged over forest areas (LOA). The LOA which is accounted for 48.5 million hectares is presently under the forest concession permits. There is so far no reliable information yet, however, on the quality status of the LOA. How much of the LOA is in a good condition, and how much is in a poor and medium quality conditions. This information is actually required to estimates and projects the capacity of LOA in terms of carbon removal, carbon sink, as well as carbon emission.

Forest cover, in fact is not only located within designated forest area, but also inside non-designated forest area, which is mostly privately-owned lands. About 8 million of forest cover can be found within this category of lands. If this number is added to the

forested lands within the designated forest area, and assuming 25% of LOA is in a good shape, Indonesia would have approximately 65 million of forest cover. This figure becomes important component when carbon removal and sink are of the core point for keeping the forest to be a significant role in maintaining the net carbon sink.

As discussed earlier, forestry and peat are presently the two major sources of Indonesian emission. With 26% emission reduction targeted in 2020, forestry in particular, would take the largest portion of remission reduction activities compared to other sectors. It is estimated that 54% of the total reduction should come from forestry-related activities. These could be materialized in the forms of mitigation and adaptation efforts. Improvement of sylvicultural practices, such as reduce impact logging, intensive sylviculture, and fire protection are of the most realistic and pragmatic actions the government can do. Other than that, law enforcement for forest criminals such as illegal logging prevention, and good governance are fundamental and would be part of the important policy measures.

REDD and REDD Plus

The Intergovernmental Panel on Climate Change (IPCC) divides the world land uses into six categories, in which each of its function keeps changing overtime. Because of the dynamic changes, it is called as Land-use, Land Use Change and Forestry (LULUCF). The six categories of LULUCF are forest land, cropland, grassland, wetland, settlement, and other land. Pedroni (2007) explained the theory of REDD and REDD Plus, which hypothetically describes that when the forest is no longer meet its function as carbon removal at a certain point in time, than the land use function will change to be one of the five remaining categories.

An incentive mechanism, called REDD (Reducing Emision from Deforestation and Forest Degradation) is perceived to be a realistic way to reduce global carbon emission, and thus increase carbon removal. REDD, which is believed by many parties could potentially reduce forest degradation in many developing countries, was then supported by both developed and developing nations. The reason is simple, because it is viewed as the easiest and cheapest way in reducing the global emission.

REDD scheme, which was initially one "D" (Reducing Emission from Deforestation) only, firstly proposed by Papua New Guinea and Costa Rica in 2005. The proposal was then supported by many countries. REDD scheme basically grants opportunities to forested developing countries to reduce the emission through various forestry activities. REDD with the two "D"s became officially accepted in the 13th Conference of Parties UNFCCC in 2007 in Bali. And even became the REDD Plus, with the three additional areas, i.e., avoiding deforestation and forest degradation, increasing the role and function of forest conservation in increasing the capacity of carbon storage/sink, sustainable management of forest and enhancing the forest carbon stock. Pedroni (2007) than pictured the REDD Plus in the following figure:

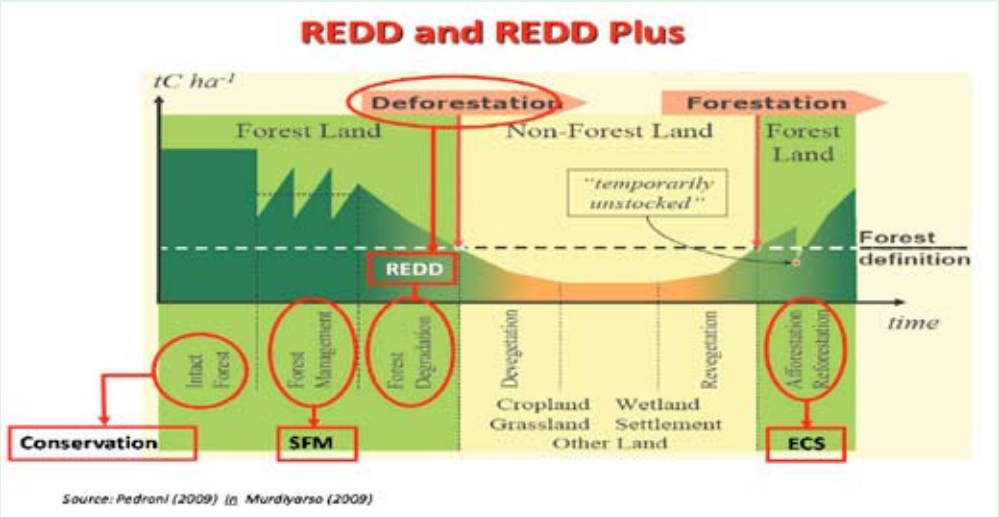

Figure 4 : REDD and REDD PLUS

Pedroni furthermore clarified that when forest is no longer capable in removing the carbon at a certain point in time, based on forest definition, then the land function will change to be one of the five remaining land categories. Looking at the figure, the ECS (Enhanchement of Carbon Stock) in particular, seems to link with the "one billion trees plantation" program launched by the Indonesian President in 2010. Similar activities have long been experienced in Indonesia, including among other the GERHAN (Land Rehabilitation Program), One-man, one-tree program, Community forest plantation (the

HTR), and the privately-owned forest development (the HR). In the global context, these activities are very important especially in stabilizing micro climate, and helping the forest industry sustainable.

MRV for REDD

IPCC guidelines require the measurement and estimation of two variables to calculate total forest carbon: forest area change and carbon stock change estimation or emission factors (carbon density). These should be based on a common methodology, such as use of remote sensing and ground-based methods. Reference Emissions or Reference Emission Levels (RE/REL) need therefore to be established and verified, taking national circumstances into account. MRV should be based on robust national forest inventories (existing or developed) and subject to periodic external review.

DNPI, in cooperation with Hokaido University, Japan, is now developing a comprehensive MRV system for Indonesia. The system is intended to cover three layers of the measurements, i.e. ground-based, air-bone, and satellite approaches. It would also involve a robust measurement for peatland emission. The selection of Hokaido University, among other things, is because its scientific experience for more than 13 years working in emission measurement for the peatland area in Central Kalimantan. As discussed earlier, peatland MRV would be very critical for Indonesia in the next coming year, considering its huge potential carbon stock, as well as emission from such an area. There are a lot of MRV-related things that Indonesia should pay attention. For instance, how to address forest degradation and MRV for forest conversion? The level of accuracy to comply with UNFCCC requirements, could a set of simple indicators or verifiable proxies, be used to assess the performance of REDD action in early stages? And the most critical one is involving local stakeholders in MRV for REDD. In that sense, the involvement of local stakeholders could significantly help to verify the permanence.

REDD can have land-use impacts that go beyond forests, and the drivers of deforestation will impact national policies. Seventy percent of deforestation in Indonesia is taking place in designated forest area, while thirty percent is occurring in privately owned lands. The development of REDD processes needs to account for and make provisions for an eventual move to broader land use frameworks. Measuring additionallity, leakage, and permanence

from REDD activities, therefore, should be carried out from landscape perspective. Not only in designated forest area, but it should cover privately-owned forest lands. The International Center for Research in Agro-forestry (ICRAF) introduces the concept of REALU (Reducing Emission from All Land Uses). According to this concept, REDD is only a part of the mitigation accounted for from land-based emission reduction activity. Besides REDD, there are three other mitigation efforts that should be taken into account, i.e. RE-PEAT (Reducing Emission from peat area), RESTOCK (Restocking the emission through various land-based utilization), and REAGG (Reducing Emission from Agriculture GHG Gases). All of these mitigation efforts are of the four main pillars in building-up emission reduction from land-based activities, as can be shown in the following figure:

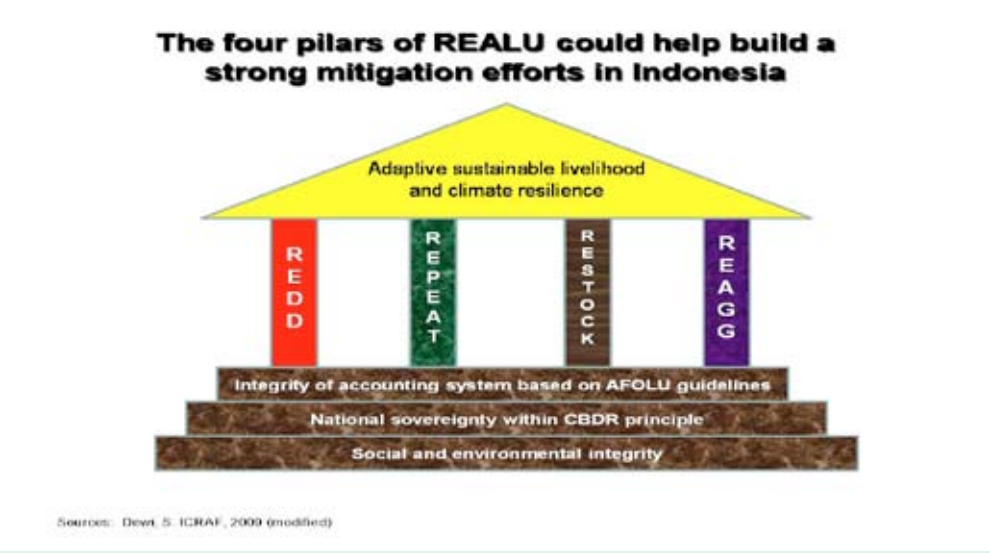

Figure 5 : Reducing Emission from All Land Uses (REALU)

Indonesia subscribes to national accounting and sub-national implementation for its MRV system. Frameworks for the MRV are being developed at the national level, and will require some form of international oversight. A great deal of technical expertise has been developed around the various elements of MRV, but much more is needed. Existing MRV regimes provide opportunities for lessons learned, but also present a streamlining and coordination issue. Considering the complexities of MRV for REDD, as part of the

partnership with Norway government, Indonesia is now in the process of establishing the MRV Agency. It is expected that the agency will be a clearing house for REDD data-based system in the future. Existing line Ministries and Agencies will be in charge for accomplishing this task force. It is expected that the agency would be one of the "one door service" for REDD-MRV-related matters in the future.

The LoI on REDD Plus with Norway

On May 26 2010 in Oslo, Norwegia, an important agreement on REDD Plus, known as the Letter of Intent (LoI) was signed by Indonesia's Foreign Minister, Marty Natalegawa and Norwegia's Minister of Environment and International Development, Erik Solheim. The signing of LoI was witnessed by the Indonesia's President, Susilo Bambang Yudoyono, and the Norwegia's Prime Minister, Hon. Hubert Ingraham. In brief, the LoI reflects high commitment willingness and of the two governments to participate in reducing GHG emission, particularly from sources caused by deforestation and forest degradation which are taking place in Indonesia's tropical forest.

The partnership with Norway pledges a total funding assistance amounted to US$ one billion, and this would be implemented in three phases starting from 2010 to 2014. The first phase, called the preparation stage was set up from June to December 2010 (it is now extended to June 2011); the transformation stage is from 2011 to 2013; and the contribution stage from 2014 on.

The first stage basically covers five main critical activities, i.e. 1) Completion of the REDD Plus National Strategy (Stranas); 2) The establishment of REDD Plus Agency, i.e. the special agency directly report to the President for implementation of the REDD Plus; 3) The MRV agency establishment and suspension of new licenses for natural forest and peatland; 4) Arrangement of financial architecture for REDD Plus; and 5) Selection of a pilot province for REDD Plus demonstration activities. These five main activities have been controlled directly by the president, which assigns the Special Delivery Unit under the office of the President (called UKP4) to coordinate with line Ministries and or undertake these tasks. On September 20, 2010, the Presidential instruction decree on REDD Plus Special Task Force was issued underlining the tasks. The task force is chaired by Dr Kuntoro, who is also the chairman of UKP4, involving high level decision makers from line Ministries as the task

force members, including Forestry, Environment, Finance, National Development Planning Agency, National Land Agency, Office of Cabinet Secretariat, and the Indonesia National Council on Forestry.

The signing of LoI reflects a high commitment of the government of Indonesia to seriously take care of deforestation and forest degradation in Indonesia. Throughout the history of Indonesia's forestry, this is for the first time that forestry is under direct auspices of the President. This demonstrates an ultimate commitment of the government to recover the forest degradation and its environment. In addition, this shows a concrete action and Indonesia's contribution toward global climate change mitigation efforts. Active participation of and coordination amongst key stakeholders including the government, NGOs, private sector, and scientists is aimed at achieving the better future for Indonesia. This effort has been undertaken carefully to anticipate social, economy and political risks that might be happening in the next ten to 20 years from now.

REDD, however, is not a 'silver bullet' solution. REDD implementation must be supported by broader sustainable development strategies at the national level. While a number of challenges must be addressed moving forward, REDD remains an innovative and constructive element of the international climate change negotiations and is translating into real action on the ground.

REDD has the potential to accrue economic, environmental and social benefits. Governance and capacity building challenges must both be addressed to ensure that REDD activities result in the 'Development Dividend'. Lessons learned at the national level can provide useful guidance in this regard, and help identify where gaps between policy and action persist. There is a need to establish minimum standards for ensuring safeguards and co-benefits at the national level. The scope for safeguards and co-benefits, and institutional structures needed to support them must be further explored, while being mindful of the need not to layer so many things on REDD that implementation becomes overly difficult. There is a role for international guidance in this regard, but the 'pressure point' for addressing co-benefits and safeguards should be at the country level.

REDD financing plays into the conversation in two key ways; financial benefits from REDD activities will need to be managed and distributed, and financial support is needed to ensure robust implementation of REDD and the realization of benefits. The role of markets remains a contentious issue that is not likely to see resolution in the near term, though a

mixed approach including both market and non-market elements is considered optimal for Indonesia.

For Indonesia, REDD Plus is now becoming the banner for forestry-related issues after the signing of LoI. It invites pros and cons from all levels of stakeholders. Some cons argue that LoI is nothing more than a new version of ecological colonialism. Their primary reason is because Indonesia is no longer free to utilize their-own natural forest resource, and that means breaking up national sovereignty. The pros are of the view that this is in-timely manner to reform forestry institutional structure, cleaning up the forest governance, and simplify the red-tape procedure. Neither cons nor pros are now able to prove each of their arguments. As time goes by, everyone would see the different that might be happening in the near future.

Linking REDD Plus with NAMAs

Nationally Appropriate Mitigation Actions (NAMAs) firstly introduced in 2007 in Bali. Paragraph 1 (b) (ii) of the Bali Action Plan COP 13 says: "calls for 'nationally appropriate mitigation actions' by developing country Parties in the context of sustainable development, supported and enabled by technology, financing and capacity building, in a measurable, reportable and verifiable manner". And than not too long after Bali, COP 15 in Copenhagen "took notes" about responsibility of parties in reducing emission in each country, no matter whether they are developed or developing countries. Non-Annex-1 Parties agrees to devote all mitigation effort into one concerted effort, i.e. NAMAs, while Annex-1 Parties put their effort into the so-called NAMAC (Nationally Appropriate Mitigation Commitment or Actions), including quantified emission limitation and reduction objectives or QELROs.

Under the NAMAs, Indonesia pledged up to 26-41% of emission reduction by 2020. This commitment was reflected in an official letter from DNPI sent to Secretariat of UNFCCC on 30 January 2010. The Indonesia Planning Agency (the Bappenas) accordingly started to set up policies and mitigation actions from existing sectoral activities leading-up to the emission reduction targets of 26-41%. According to Bappenas, there are about 70 activities is now under the NAMAS category, and all of them are framed into the national action plan of GHG reduction target, or locally called the "RAN-GRK". The RAN-GRK has been part of mid and long term national development plan, and therefore, should be

steam-lined with the national plans, and this is the reason why Bappenas has been in charge for this matter.

NAMAs basically consist of compilation of existing programs and activities of all national development sectors, including forestry, agriculture, industry, mining and energy, public works, etc. that potentially lead to emission reduction. It has been planned and agreed by all key stakeholders that the 26% emission reduction activities will be using national budget source (the APBN) or unilateral NAMAs, while the 41% target will utilize the overseas donor assistance (ODA) or financed/supported NAMAs. Beyond these two targets, the activities would be considered as creditable NAMAs. Bappenas decides to categorize activities that easy and cheap into unilateral NAMAs, while activities that are hard to implement and expensive would be categorized as financed NAMAs. Both of unilateral and supported NAMAs should be M-R-Vied, part of the mid and long term national development goals, and economically feasible. The question now is whether REDD would be part of the unilateral, supported, or creditable NAMAs or not? The following figure demonstrates the position of REDD with respect to NAMAs.

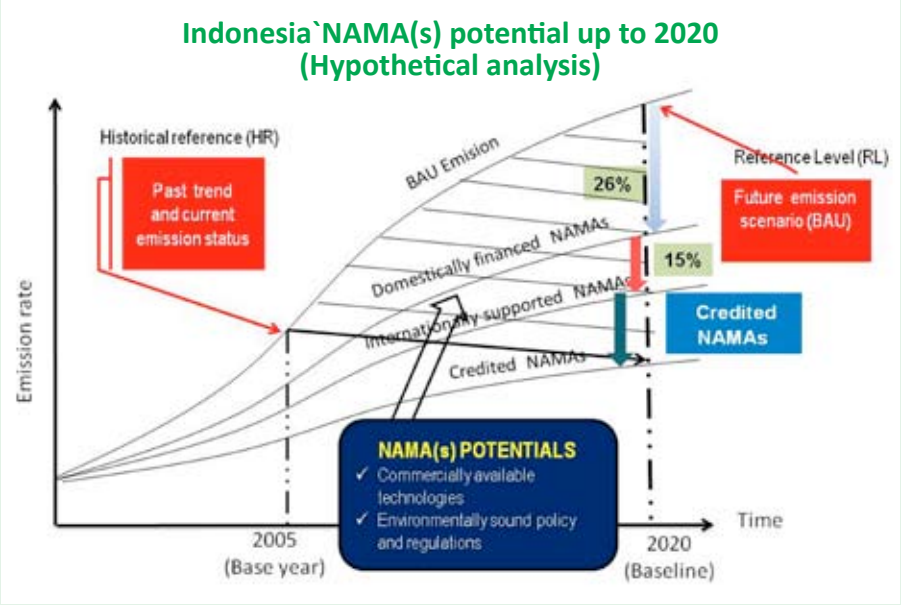

Figure 6 : REDD within NAMAs potential

There are different views on whether Indonesia should put REDD under NAMAs or not. Indonesia's present position says that REDD is not part of NAMAs. The argument is that REDD has been developed far away compared to NAMAs, and it may potentially damage the REDD negotiation progress if REDD is included into NAMAs. However, it is going to be difficult for Indonesia if there is uncertainty on linking REDD to NAMAs in the global climate talks, considering forestry as the major contributor as well as emission reduction potential for the NAMAs. Using the 26% of the Indonesia's emission reduction target and the Indonesia' BAU emission scenario in 2020, forestry and peatland mitigation activities should take the largest portion of the reduction. With the 26% target, the Ministry of Forestry indicates about 54% of the target should come from forestry and peatland sector. This means that about 14% of the 26% reduction would be coming from this sector as well. If all of REDD activities are considered as unilateral NAMA, than Indonesia should account all of the REDD relating cost internally, using the APBN. On the contrary, if Indonesia expects REDD to be the financed NAMA, than 54% of the mitigation should be covered by ODA up until 2020. Credited NAMA for REDD is another think to take into account. Growing initiatives from from overseas investment on REDD, either through G to G and P to P relationships indicates high potential of REDD to be part of credited NAMAs in Indonesia. The government therefore should make a clear policy whether REDD would be included or part of the NAMAs or not.

The Way Forward

The Indonesia National Council on Climate Change pointed out in 2010 that Indonesia should utilize their lands in more efficient manner to reduce carbon emission and increase economic growth. Reducing emission from deforestation and establishing forestry-related business and estate crops within abandon and degraded lands would increase emission reduction capacity up to 30% by 2020. Furthermore, with decreasing fire occurrence and decomposition as well as managing water level on peat-land area, would obtain additional emission reduction about 13%.

Forest and tree plantation for increasing carbon removal at conservation area and other protection purposes would also important for Indonesia. According to Verchot et al. (2010), forest plantation establishment on degraded and abandon lands covered by “alang-alang” could potentially increase carbon removal capacity up to approximately 435 million ton in 50 years period.

Plantation forest development for meeting the need for sustainable wood-based industry in Indonesia is also critical. It would help economic growth of the country and people welfare. One thing that is important to note that it would not directly reduce the emission, but it should be directed to protect thr forest from conversion of the remaining natural forest into other use of lands, such as mining, oil palm, etc. The most efficient way to increase economic growth in one hands, and at the same time to reduce the emission is by establishing plantation forest in degraded lands. Establishment of wood-based industry in Indonesia, including pulp and paper industry, should be supported by wood supply from plantation forest that is developed in such the degraded lands.

From the discussion above, we can summarize that the REDD scheme in Indonesia is part of the low carbon economic path. Therefore, all forestry-related businesses, and other forest land utilization, including oil palm development, agricultural crops, etc should be carefully designed and planned, so that they remain within the low carbon economy corridor. Of course this should be within the framework of increasing the production capacity. It would be naïf if REDD is viewed as a bottle neck for growing economy in Indonesia. It should even be viewed from the other perspective, that REDD will support forestry-related productivity in the near future.

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Emissions Scenarios and Abatement Opportunities Forest, LULUCF and Peat Sectors

DNPI

The DNPI's GHG abatement cost curve study for Indonesia involved in-depth research into eight sectors – LULUCF, peatland, agriculture, power, transportation, petroleum and gas, cement, and buildings – which currently represent the majority of Indonesia's total emissions. The findings described in this section are based on our ongoing analysis, which continues to be refined and updated.

Several challenges to the analysis persist. For example, access and availability to national-level data with regional breakdowns was limited in the LULUCF, peat, and agricultural sector analyses. Furthermore, the science and methodology behind peat emission calculations is still at a relatively early stage. Such challenges are further articulated within each sector description that follows.

For each of the sectors, we have developed both business-as-usual and abatement scenarios. These have taken into account, amongst others, government and industry perspectives on how the sector would develop (a) should no major policy or regulatory changes take place between now and 2030 and (b) should identified abatement opportunities within each sector be taken up fully. This work has involved extensive stakeholder interactions and workshops.

Peat

2030 – emissions: 972 $MtCO_2e$, abatement potential: 566 $MtCO_2e$

While in the past emissions from deforestation and forest degradation have received the vast proportion of climate-focused attention, both domestically and internationally, carbon emissions from Indonesian peat[1] reserves are even more significant.[2] Only very recently has there been a broad recognition of the importance of peatland emissions, and while the science is still at a relatively early stage it has improved significantly in recent years.[3] The importance of peat as a source of carbon emissions has gained greater acceptance globally. Exhibit 6 captures the difference between this DNPI report and various estimates published by other government agencies, multilateral organizations, and non-governmental organizations.

Sectoral emissions

Peatlands store a massive amount of carbon in the form of organic matter accumulated in waterlogged soils.

The release of carbon from tropical peatlands represents a unique and predominantly Indonesian challenge as Indonesia holds approximately 50 percent of the total tropical peat area. Emissions from peatland today represent 38 percent of Indonesia's total emissions and will continue to remain a dominant portion in 2030 (at 30 percent) if no major action is taken.

Under the business-as-usual scenario, emissions from peatland are expected to increase by 20 percent from 772 $MtCO_2e$ in 2005 to 972 $MtCO_2e$ in 2030 (Exhibit 2).

Fires are the main sources of peat related emissions. In 2005, fires accounted for 472 $MtCO_2e$, more than 60 percent of all peatland related emissions. Decomposition of peatland as a consequence of drainage is the second largest source of peat related emissions, accounting for another 300 $MtCO_2e$. As peatland forest are converted to another land

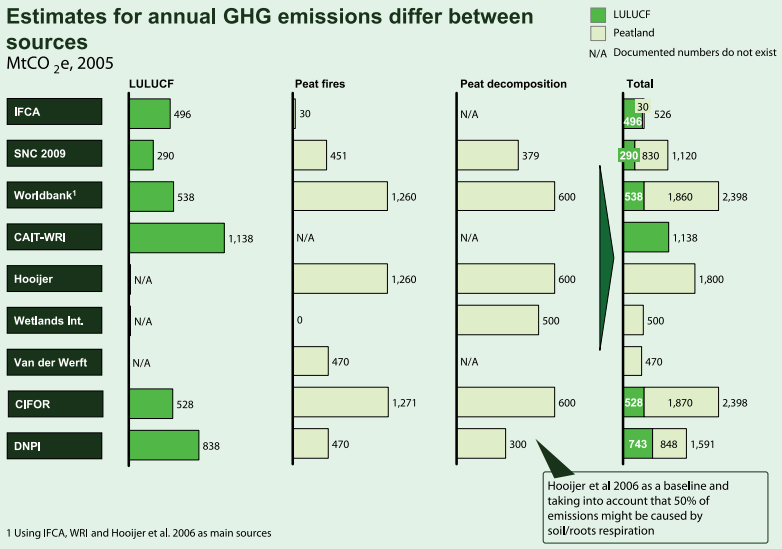
1 A more detailed description of peat and its relevance to carbon emissions is included in the appendix

2 Indonesia's peatland represents 5 percent of global and 50 percent of tropical peat. It is storing 132 $GtCO_2e$ below ground and a further 4.2 GtC above ground, a value comparable to the Amazon rainforest, which is the single largest ecological carbon sink in the world, at 46 GtC (or 168 $GtCO_2e$)

3 A description of the most important scientific uncertainties is included as an appendix

Estimates for annual GHG emissions differ between sources

MtCO $_2$e, 2005

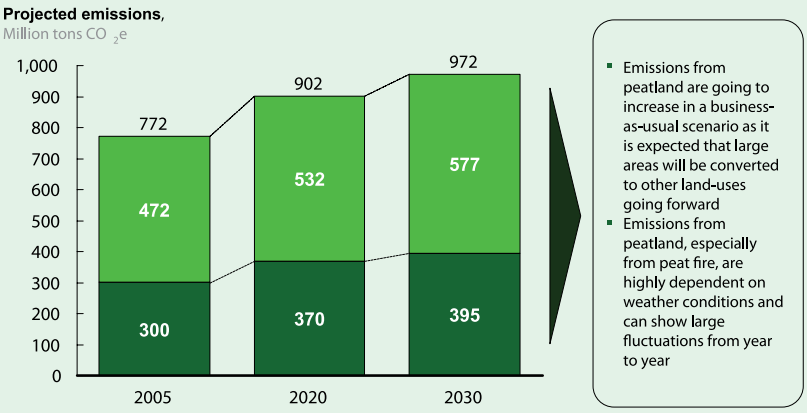


1 Using IFCA, WRI and Hooijer et al. 2006 as main sources

SOURCE: IFCA; Ministry of Forestry Indonesia; Houghton; Worldbank; CAIT – WRI; Hooijer 2006; SNC 2009, Indonesia GHG Emission Cost Curve

Exhibit 1

Emissions from peat fire and peat decomposition are expected to increase by 200 Mt in a business-as-usual scenario



SOURCE: Hooijer et al 2006– PEAT CO2e; Alterra; Wetlands International; Expert interviews; Couwenberg et al 2009; Van der Werft et al 2008

Exhibit 2

use, the removal of the aboveground biomass during land clearing and timber extraction during logging of production forests (HPH) result in further CO_2e emissions; to avoid double counting, these emissions are accounted for in the LULUCF sector.

Peat fires

Emissions related to peat fires will increase from approximately 470 $MtCO_2e$ per year at present to nearly 580 $MtCO_2e$ in 2030, as the total share of degraded peatland at high risk to fire increases if peatland conversions are not stopped and if fire is continued to be used as the main tool for land preparation and fertilization by smallholders. It should be noted that the year-to-year emissions from peat fires tend to fluctuate significantly, as they are heavily correlated with annual rainfall, the groundwater table, and the extent of the dry season.

The estimates for peatland fires are based on an analysis of 2000–2006 emissions from peat fires by Van der Werf et al. (2008) as well as the future projected development of degraded land areas and the share of different land types as described by Hooijer et al. (2006). The estimates are based on the same publication from Van der Werf as used by Indonesia's Ministry of Environment in Indonesia's Second National Communication. When compared to estimates published by other scientists (e.g., Page et al. (2002)), estimates for peat fire based on the Van der Werf data can be considered to be conservative.

There should be no doubt that emissions from fires on degraded peatland will continue to be a major contributor to emissions, pending strong action. Indeed emissions from peat fires could easily range higher than the estimates used here.

Decomposition

Emissions from decomposition will continue to grow by 30 percent from 300 $MtCO_2e$ in 2005 to approximately 395 $MtCO_2e$ in 2030, due to the combination of emissions from already drained peatland and due to the fresh conversion and drainage of peatland for plantations (e.g., pulpwood and oil palm plantations) and smallholder agriculture. Drainage accelerates the rate of soil decomposition, as significantly larger volumes of peat soil are exposed to oxygen and hence made susceptible to further oxidation.

It is only in recent years, as more peatlands have been cleared, that land managers and scientists have come to understand how peat soils behave as they dry out. Peat soils subside dramatically due to compaction, shrinkage, and decomposition, and this can

result in a loss of the fertile surface layers. At the same time, the drying out of the surface layers results in a growing vulnerability to hard-to-manage peat fires.

Our estimates of carbon emissions from peat decomposition are based on an analysis of historically drained peat areas and their expected future conversion into different land uses. Emissions from soil decomposition are assumed to depend on drainage depth. Estimates are derived from measures of decomposition for different levels of drainage (for different land uses) combined with the area of degraded land and the number of years of decomposition after the initial drainage. One key uncertainty is that soil and root respiration make up somewhere between 40 and 60 percent of measured carbon flux between soil and atmospheric carbon, as a result of soil and biomass respiration and carbon uptake during photosynthesis, as recently described in Couwenberg et al. (2009). Measurements of carbon flux from soil decomposition, using changes in soil mass and carbon composition, are not subject to this uncertainty, but few such studies with comparable measurement methods have been published.

The emission levels used here were calculated using Wösten's linear peat drainage emission model (which predicts emission patterns for different drainage depths) and average drainage depths of different land uses provided by Hooijer et al. 2006. Hooijer et al. 2006 synthesizes the direct observations of drained peatlands made by different scientists in different areas of Indonesia, Papua New Guinea, Malaysia, and Brunei. It includes estimates for decomposition of peat soils in secondary forests, palm oil plantations, and agricultural areas planted with other crops affected by drainage.

Estimates of emissions from peat decomposition remain subject to revision, as further scientific work is done. Many potentially useful research efforts to tackle open issues were started only recently. The results of these efforts, expected to be published in the coming two to three years, might change the current view of the extent of peat decomposition. Given this uncertainty, estimates used here are conservative relative to other widely cited estimates.

Abatement potential and cost

The Indonesian government has already begun to address peat emission through a decree that prohibits land conversion of peat which is more than three meters deep. In addition to this, several opportunities exist for reducing emissions at a relatively modest cost. A total of 566 $MtCO_2e$ of abatement opportunity exists in the peat sector across several levers,

including fire prevention, peatland rehabilitation, but also water management in existing timber plantations and oil palm plantations or more generally in areas under agricultural use (Exhibit 3).

Fire prevention

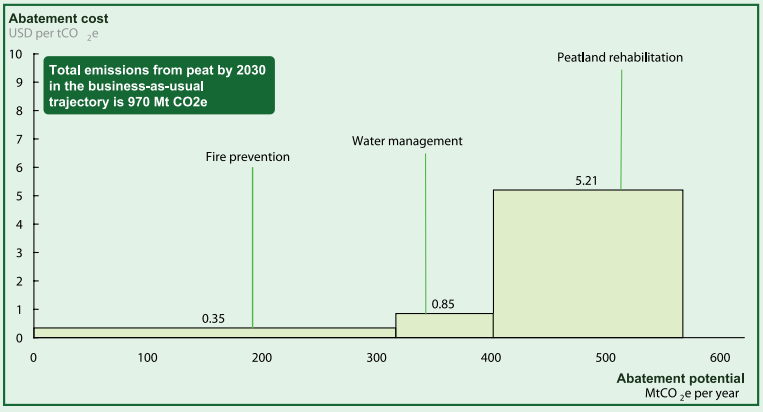
Fire prevention is the largest abatement opportunity and could prevent nearly 320 $MtCO_2e$ in 2030. Necessary actions to reduce emissions from peat fires include prohibiting fire as a tool for land preparation, providing appropriate and practical technologies (and, if appropriate, financial incentives) for manual land clearing, developing appropriate early-warning systems based on fire risk status and field-based fire detection, strengthening fire brigades, ensuring strong enforcement and large penalties for rule violations, and building public awareness of the local economic and social costs of forest fires. Besides the reduction of emissions, fire prevention will have additional positive effects on the health of the local population as well as on the overall economy of Indonesia through, e.g., the avoidance of airport closures and haze-related transportation delays. Fire prevention can be done as discrete activities, however it will be more successful and sustainable if the main source of fires, the degraded peatlands, are rehabilitated in parallel.

Cost for fire prevention is relatively small, averaging at 0.35 USD per tCO_2e if the implemented actions focus primarily on the historical fire hotspots. If the prevention of

Exhibit 3

566 Mt of CO2e could be abated by fire prevention, water management and rehabilitation of degraded peatland

Societal perspective; 2030



SOURCE: Indonesia GHG Abatement Cost Curve

fire-caused economic losses, e.g. haze-related transportation delays, loss of agricultural crops and loss of valuable timber, would be taken into account as well, societal cost for fire prevention could be negative, as these economic losses can be significant. The World Resource Institute estimated the direct economic loss of the 1997/98 fires at more than 5 billion USD.

It should be noted that the technical potential for emissions reductions due to peat fire prevention could be as high as 580 Mt CO_2e. However, it would require massive investments in infrastructure to be able to attack or suppress all fires across the breadth of Indonesia. As a result, we have assumed a more conservative figure in this analysis.

Peatland rehabilitation

The rehabilitation of Indonesia's degraded peatland, e.g., areas within the Ex-Mega Rice Project in Central Kalimantan, is the second largest abatement opportunity of peat emissions. Peatland rehabilitation combines the restoration of the hydrological functions of the peat and the replanting with native species.

While the restoration of the hydrological functions of the peat by blocking drainage channels is relatively cheap at a cost below 1 USD per abated tCO_2e, replanting degraded peatlands is relatively expensive with costs between 500 to 1,100 USD per ha or 3 to 5 USD per t of sequestred CO_2e. Fostering natural regeneration of existing tree cover could reduce the replanting costs significantly and should be applied wherever possible.

Water management

Installing a dam-based water management system in timber and estate crops plantations located on peatland is another powerful tool to reduce emissions. There is a technical abatement potential of 90 $MtCO_2e$ by 2030.

Water management is relatively cheap, with an associated cost below 1 USD per abated tCO_2e. In addition, water management can help to reduce the risk of flooding in the wet season and prevent the risk of drought in the dry season.

Land Use, Land-Use Change, and Forestry (LULUCF)

2030 – Net emissions: 666 $MtCO_2e$, abatement potential: 1,204 $MtCO_2e$

With over 100 million hectares of tropical forest, Indonesia is home to the world's third

largest tropical forest – rich in biodiversity and with total carbon storage of 15 Gt above ground, which is equivalent to 60 $GtCO_2e$ if completely emitted.

Deforestation peaked in Indonesia in the late 1990s, at a rate of more than 1.8 million ha annually, and has significantly decreased since then, averaging roughly 1.1 million ha annually between 2000 and 2005. However, the increasing global demand for pulp and paper and palm oil together with a growing domestic demand for food crops is expected to result in the conversion of an additional 21–28 million ha of currently forested land by 2030 (Exhibit 3) in a business-as-usual scenario. Much of that additional land is likely to be made available through deforestation of conversion forest (Hutan produksi yang dapat di konversi, HPK); the shift of production forests (Hutan produks tetap, HPH) to conversion forests because of high rates of degradation (due to poor logging practices); and from conversion of forests located outside the forest estate (kawasan hutan).

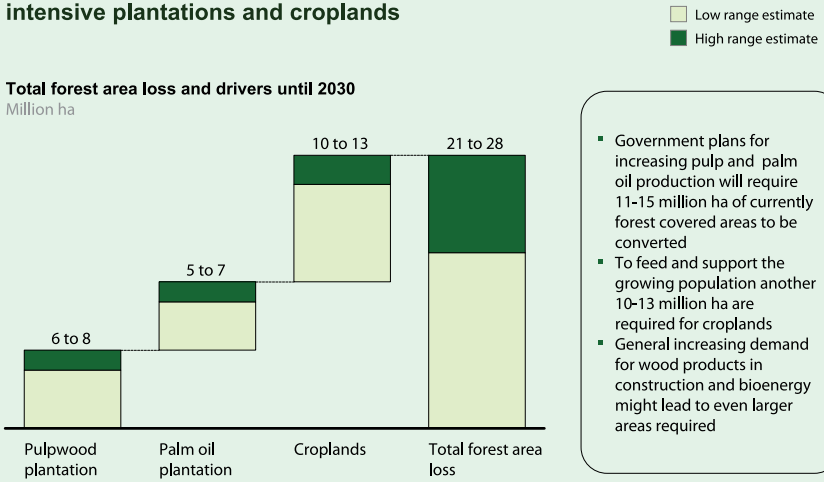
Given that Java and Sumatra have already lost large parts of their original forest areas, it is expected that deforestation will shift to other, still largely forested islands such as parts of Kalimantan and especially Papua.

Sectoral emissions

Net emissions from LULUCF account for over 35 percent of total carbon emissions in Indonesia, at 745 $MtCO_2e$ in 2005, and are expected to remain significant even if LULUCF-related net emissions decrease to 570 $MtCO_2e$; its relative share will sink to 18 percent in 2030 (Exhibit 4). However, annual gross emissions are likely to remain at a high level of more than 1,080 $MtCO_2e$.

Gross emissions from dry-land forests stem primarily from deforestation, forest degradation and forest fires. Deforestation is caused by land conversion for (smallholder) agriculture, oil palm cultivation and pulpwood plantation but also illegal logging. Deforestation is expected to remain constant at the current rate of 1.1 million ha annually resulting in around 750 $MtCO_2e$ of gross emissions. Forest degradation caused by non-sustainable logging activities in Indonesia's production forests could on average account for another 250 $MtCO_2e$ of gross emissions per year if current logging practices are not changed. Forest fires are expected to contribute in average another 78 Mt CO_2e annually going forward.

Deforestation is expected to remain constant driven by conversion to intensive plantations and croplands

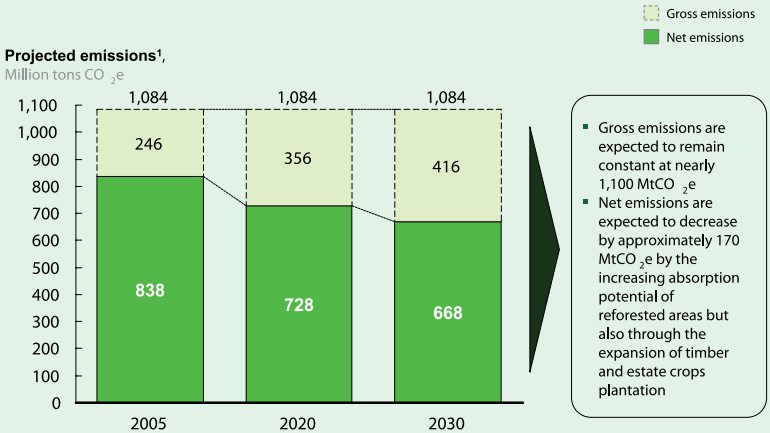


- Government plans for increasing pulp and palm oil production will require 11-15 million ha of currently forest covered areas to be converted
- To feed and support the growing population another 10-13 million ha are required for croplands
- General increasing demand for wood products in construction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

Exhibit 4

SOURCE: RISI; EMGE; Government of Indonesia; A Rante Tondak DG Estate Crops , Min of Agri, Proceedings of the World Conference on Palm and Coconut Oils for the 21st Century, American Oil Chemist Society, Leonard Perkins and Cahn edts, 1999; Indonesia GHG Abatement Cost Curve

Net emissions from the forest sector are expected to constantly decrease throughout the reporting period but gross emissions will remain constant



- Gross emissions are expected to remain constant at nearly 1,100 MtCO $_2$e
- Net emissions are expected to decrease by approximately 170 MtCO $_2$e by the increasing absorption potential of reforested areas but also through the expansion of timber and estate crops plantation

Exhibit 5

1 Net emissions include absorption in secondary forests, timber and estate crops plantations and initiated reforestation programs
SOURCE: DNPI - Indonesia GHG Abatement Cost Curve

Abatement potential and cost

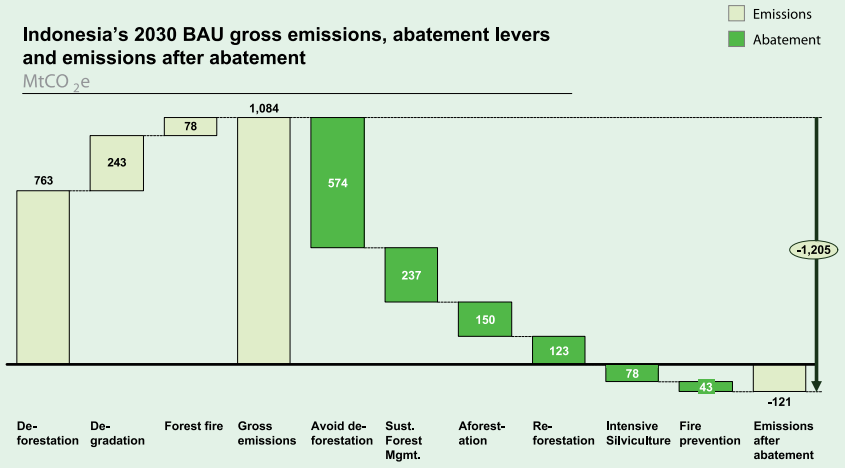
The LULUCF sector's potential to bring about emission reductions by 2030 is unique, in that the potential reductions significantly exceed business-as-usual emissions. This is due to the fact that conservation- dedicated afforestation and reforestation efforts could effectively create a net carbon sink, capturing more carbon (called sequestered carbon) than would otherwise be emitted. Indeed, the total annual abatement potential of the LULUCF sector is 1,204 $MtCO_2e$ by 2030, of which halting deforestation and forest degradation would account for 811 $MtCO_2e$, afforestation and reforestation efforts could account for 280 $MtCO_2e$ (Exhibit 6) and fire prevention for 43 $MtCO_2e$.

Reduced emissions from deforestation and degradation (REDD)

The abatement potential of REDD is by far the largest of the LULUCF levers. We use the term REDD as shorthand for the halting or prevention of emissions-causing activities in forested areas. REDD represents a combined abatement opportunity of more than 570 $MtCO_2e$, of which stopping forest conversion to smallholder agriculture is the single largest opportunity at slightly more than 190 MtCO2e. As with the case of fire prevention, reduced emissions from so-called "REDD smallholder agriculture" could technically be as

Exhibit 6

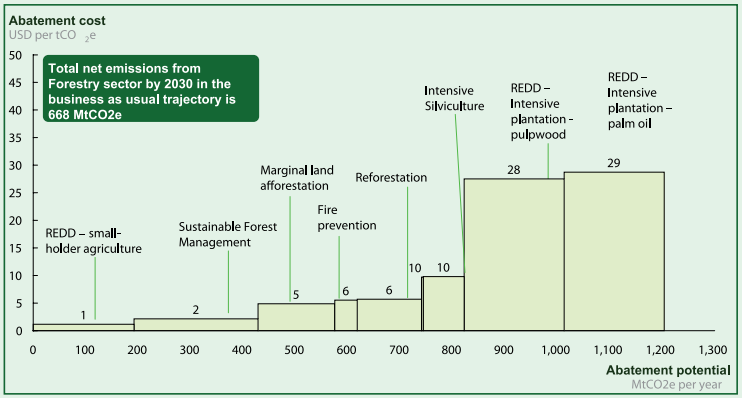
Avoiding deforestation,sustainable forest management, afforestation, and reforestation could turn the LULUCF sector into a net carbon sink by 2030



SOURCE: Indonesia GHG Abatement Cost Curve

1,200 $MtCO_2e$ could be abated in 2030 by implementation of 9 different abatement levers

Societal perspective; 2030



Note: The curve presents an estimate of the maximum potential of all technical GHG abatement measures below EUR 60 per tCO2e if each lever was pursued aggressively. It is not a forecast of what role different abatement measures and technologies will play. Assuming a 4% societal discount rate

SOURCE: Indonesia GHG Abatement Cost Curve

Exhibit 7

high as 300 $MtCO_2e$. Given the large number, fragmentation and remoteness of many smallholder farmers in Indonesia, it seems unrealistic that the full potential could be reached until 2030 and so a discount of 40 percent was applied to the maximum technical potential reduction.

Opportunity costs differ significantly between deforestation drivers, ranging from 1 USD to 29 USD per ton of avoided CO_2e (Exhibit 7). Avoided deforestation and degradation from smallholder agriculture has relatively low opportunity costs, given the limited economic alternatives facing smallholder farmers in Indonesia. However, those costs could significantly increase if transaction costs are included due to the sheer size of Indonesia and the complexity of changing cultivation habits of tens of millions of smallholders. Capturing the abatement potential from "REDD smallholder agriculture" would require massive investments in agricultural extension services to enable rural communities to use already cleared lands more efficiently and with less carbon intensity.

Opportunity costs for avoiding forest conversion into estate crops or timber plantations are high, reaching close to 30 USD per avoided tCO_2e, due to the high economic returns obtainable from crops such as palm oil and pulpwood. These costs can be significantly reduced if those plantations can be established on already degraded or deforested areas,

as the costs then represent only forgone revenue from one-time timber extraction for the initial land clearing and possibly some additional input costs or marginally lower yields. Prospects for this are good as several organizations (e.g., WRI) are trying to develop land swap systems, and the private sector is showing growing interest. However new spatial plans and an appropriate financial incentive system, e.g. carbon-based permit fees for new concessions, would be needed for making the use of degraded land a real opportunity at scale.

Afforestation and reforestation

Afforestation and reforestation represent a sequestration opportunity of 300 $MtCO_2e$ by 2030 at a cost of 5 to 6 USD per avoided tCO_2e. This implies (re-)establishing forests on more than 10 million ha of degraded non-forested and forested land and would be in addition to the already established reforestation program (GERHAN) of the Ministry of Forestry. Realizing large sequestration volumes requires the set aside of these afforested and reforested areas for conservation. Developing commercial timber and estate crop plantations as part of the reforestation program could help to reduce the pressure on remaining forest areas, but at the same time these activities will sharply reduce the abatement potential of reforested areas. This is because large volumes of CO_2e would be emitted at the end of the plantations' rotation period.

Sustainable forest management

Our estimates indicate that reducing emissions from the degradation of production forest (HPH) through a combination of better planning, reduced impact logging, and improved post-harvest management could deliver an emission reduction of more than 200 $MtCO_2e$ at a cost of slightly more than 2 USD per tCO_2e. Current policies on timber extraction and cutting cycles in production forests are already based on sustainability but do not consider nor calculate total biomass removed, which is typically many multiples of the merchantable timber. In addition, further loss of carbon stock can occur for several years after logging if conditions are not conducive for quick forest regeneration.

Activities to reduce emissions from timber extraction include the construction of an adequate network of forest roads and skidding trails to minimize skidding damage, the employment of modern harvesting equipment, and the use of a geographical information system to make harvesting as focused as possible.

The alternative – stopping logging altogether – would have the same effect on emission reduction, but has a much higher opportunity cost and would not allow Indonesia to further develop its forest products industry.

Intensive silviculture

Intensive silviculture should be considered as an additional activity to increase the growth rates (and therefore the sequestration rates) of Indonesia's production forests. Intensive silviculture is based on broadening silvicultural activities from their current limited application. Typical activities include enrichment planting, thinning between the cycles, and also fertilization, improved seedlings, and better breeding techniques. Intensive silviculture is relatively expensive at close to 10 USD per t of additional sequestered CO_2e, but represents an abatement opportunity of nearly 100 $MtCO_2e$ annually. In addition, the application of intensive silviculture represents significant employment opportunities for forest communities, e.g., plant nurseries.

Prevention of forest fire

Fire prevention outside peatland is a significant emission reduction opportunity as well and could prevent 43 $MtCO_2e$ in 2030. Necessary actions to reduce emissions from forest fires include prohibiting fire as a tool for land preparation, providing appropriate and practical technologies (and, if appropriate, financial incentives) for manual land clearing, developing appropriate early-warning systems based on fire risk status and field-based fire detection, strengthening fire brigades, ensuring strong enforcement and large penalties for rule violations, and building public awareness of the local economic and social costs of forest fires.

The cost to reduce emissions from fire prevention in forests outside the peatland is relatively high at more than 5 USD per ton of abated CO_2e. The high costs are caused by the fact the forest fires are scattered across a much larger land area than peat fires.

Methodology

The estimated annual rate of deforestation and gross emissions used in this analysis is 1.1 million ha, which is based on the historical deforestation rate in 2000–2005 provided by the Ministry of Forestry. Approximately 75 percent (or 0.8 million ha) of the total deforested area is expected to occur on dry-land forests and the remaining 25 percent in

peatland forest areas.[4] We assume that the carbon density of Indonesian forests cleared in the future will remain the same as that of forests cleared over the last five years, which is 192 tC/ ha.[5] Land use assumptions were cross-checked with projections for additional land demand for pulpwood and palm oil plantations,[6] and to meet increasing domestic demand for agricultural products.[7] Together the datasets suggest a total need for additional forest land of 21–28 million ha by 2030.

Net emissions from the LULUCF sector are calculated by taking the absorption potential of Indonesia's existing natural forests (with the exception of primary, non-managed forests, as suggested by IPCC[8]) and also man-made forests (e.g., palm oil plantations) into account as long as those meet the forest definition of the Indonesian Government[9] as described in the IFCA report (Exhibit 8).

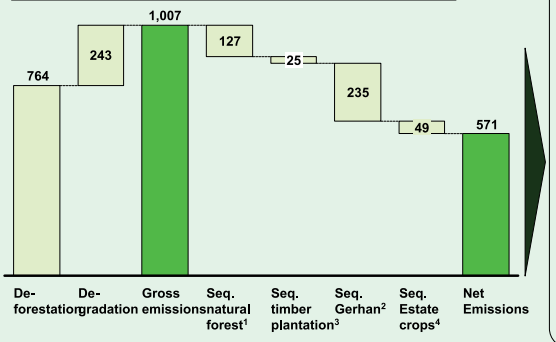
Exhibit 8

Net emissions are calculated by taking absorption of natural forest and plantations into account

PRELIMINARY

Indonesia's emissions from deforestation and forest degradation and absorption 2030

Million tons CO_2e



- Absorption in natural secondary forests is decreasing as a consequence of area reduction and degradation
- Absorption in plantations and reforestation projects are likely to increase steadily until 2030, however as soon as those areas will reach the end of their rotation cycle e.g. oil palm after 25 years the absorption potential will decrease and net emissions increase

1 Annual increment of 4m³ per ha or 4.4 t CO2e/ha per year in Indonesia secondary forest
2 400,000 ha land rehabilitated inside and outside forest annually between 2003 and 2007; sequestrati on of 18.3 t CO2e/ha/year, rotation period 35 years
3 271,000 ha of new established timber plantation, sequestration of 29.3 t CO2e/ha/year; rotation period of 10 years
4 434,000 ha of new established estate crops plantations, sequestration of 5.1 t CO2e/ ha/year; rotation period of 30 years

SOURCE: Min. of Forestry – Rekalkulasi Penutupan Lahan Indonesia Tahun 2008; Forestry Statistics 2007; Sheil et al. 2009; Burschel et al. 2001; Indonesia GHG Emission Cost Curve, Indonesia – 2nd National Communication

4 As described by Hooijer et al. (2006)
5 IFCA 2008
6 IFCA 2008, RISI 2009, NLK 2009
7 Tondak (1999)
8 IPCC – Good Practice Guidance for Land Use, Land-Use Change, and Forestry
9 Forests are described as non-annual plants reaching a height of minimum 5 m and with a crown cover of more than 30 percent of a defined area, normally one hectare

The calculation of the absorption in the forest types described above is based on assumptions for annual growth rates, carbon content per cubic meter of biomass, future area development, and crop rotation period. The rotation period is a critical element of the calculation, as large parts of the sequestered carbon will be released at the end of the rotation period, reducing the annual absorption rate significantly. This is especially true for short-rotation pulpwood plantations, which are therefore not an ideal tool to increase the carbon sink of Indonesian forests in the long term.

Agriculture

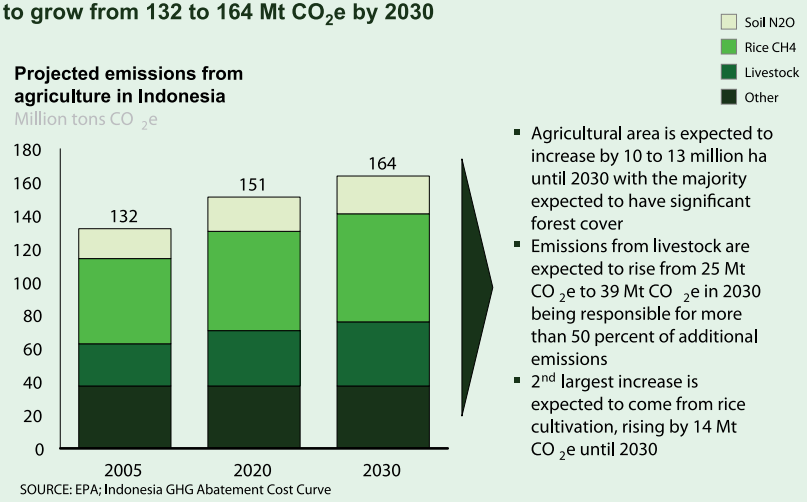
2030 – emissions: 164 MtCO2e, abatement potential: 105 MtCO2e

Agricultural carbon emissions are mostly not carbon dioxide, but other GHGs like methane and nitrogen oxide. Such emissions come from three major sources: water management practices for rice crops, artificial fertilizer application, and the burning of crop residues.

Sectoral emissions

Agriculture is Indonesia's third-highest emitting sector, behind LULUCF and peat, with emissions of 132 MtCO2e in 2005 (based on land use at the time). Emissions from this sector are expected to grow by 25 percent to 164 MtCO2e in 2030 (Exhibit 9).

In a business as usual trajectory emissions from agriculture are expected to grow from 132 to 164 Mt CO_2e by 2030



- Agricultural area is expected to increase by 10 to 13 million ha until 2030 with the majority expected to have significant forest cover
- Emissions from livestock are expected to rise from 25 Mt CO_2e to 39 Mt CO_2e in 2030 being responsible for more than 50 percent of additional emissions
- 2nd largest increase is expected to come from rice cultivation, rising by 14 Mt CO_2e until 2030

SOURCE: EPA; Indonesia GHG Abatement Cost Curve

Exhibit 9

Abatement potential and cost

The abatement potential for this sector is estimated to be approximately 105 $MtCO_2e$ per year or approximately 63 percent of the sector's emissions by 2030 (Exhibit 10).

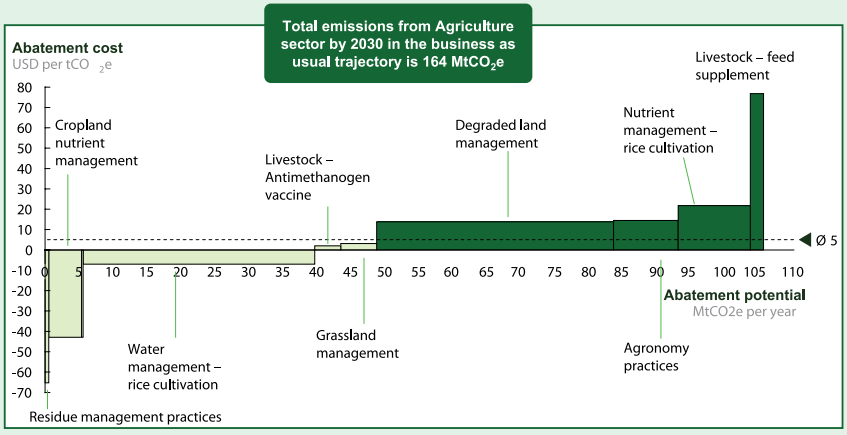
Improving the management of water and nutrients for rice farming offers significant abatement potential of 45 $MtCO_2e$ or 43 percent of the sector's emissions. Rice water management involves mid-season and shallow flooding drainage to avoid anaerobic conditions, which otherwise lead to significant methane emissions. Nutrient management refers to a shift from nitrogen based fertilizers to sulfate fertilizers.

A third of the sector's abatement opportunity comes from the restoration of degraded land (i.e., agricultural land degraded through excessive disturbance, erosion, organic matter loss, salinization or acidification), which would account for emission reductions

Exhibit 10

105 Mt CO_2e could be abated by improving water management in rice cultivation and the restoration of degraded land

Societal perspective; 2030



Note:
The curve presents an estimate of the maximum potential of all technical GHG abatement measures below EUR 60 per tCO2e if each lever was pursued aggressively. It is not a forecast of what role different abatement measures and technologies will play. Assuming a 4% societal discount rate

SOURCE: Indonesia GHG Abatement Cost Curve

of 35 $MtCO_2e$. Typical abatement activities include re-vegetation (e.g., planting grasses), improving fertility by nutrient amendments, applying organic substrates such as manures, biosolids, and composts, reducing tillage and retaining crop residues.

The average abatement cost in the agriculture sector is 5 USD per tCO_2e. The restoration of degraded land through the creation of a carbon sink (building up organic matter within the soil) comes at a cost of 13.8 USD per tCO_2e, while improving rice water management and rice nutrient management has a cost of -7 and 21.7 USD per tCO_2e per year respectively. The improving nutrient management lever is expensive because of the significantly higher prices of non-nitrogen based fertilizers, e.g. phosphor- or sulfate based fertilizers such as Diammonium phosphate, which are up to 30 percent more expensive than nitrogen-based fertilizers.

The greatest implementation challenge in the agricultural sector is geography and the fragmentation of stakeholders, as these abatement programs would have to be implemented across a vast number of Indonesia's mostly smallholder farmers. This would require extensive investment in educational programs to change entrenched farming practices. Transaction costs for these abatement levers are not yet well understood in Indonesia.

National Strategy on REDD+

UN-REDD Indonesia

Executive Summary

Increased emissions or released greenhouse gases (GHG) emissions into the atmosphere, mainly Carbon dioxide (CO_2), nitrogen dioxide (NO_2), and Methane (CH_4) gases, by a variety of human activities have triggered temperature alteration and increased sea water level resulting very extreme climate variability on the earth. Forests turn out to be one of important themes in climate change. Decreased of forest area or deforestation and quality of standing forest or forest degradation in tropical countries, such as Indonesia, Brazil, Congo and others, are suspected having high contribution to globally GHG emissions from forestry sector. According to IPCC (2007) forestry sector contributes to 17.4 percent from the total global emissions[1], which is part of the figure of 30% contribution of the sector of land use change and forestry (land use change and forestry/LUCF). In the Government of Indonesia's report to the United Nations Convention on Climate Change (UNFCCC), stated that Indonesian GHG emissions is 1.4 Gton CO_2e in 2000, of which 821 Mt of CO_2e or 58 percent generated from the forestry sector (MoE, 2009).[2]

1 IPCC (2007), *Climate Change 2007: Synthesis Report, Summary for Policymakers*

2 MoE(2009). *The Second National Communication to the UNFCCC*

Managing deforestation problems has been discussed in 2005 during the Conference of Party 11 (COP-11) UNFCCC in Montreal. Later in the year 2007 UNFCCC COP 13 in Bali, the COP resulted the Bali Action Plan as a follow up of the reduction of emissions from forestry activities through activities of Reducing Emissions from Deforestation and Degradation Forest + (REDD +), it includes components of handling of deforestation, forest degradation, conservation, sustainable forest management and increase carbon stocks. REDD + is policy and incentive schemes for activities to protect and improve a quality of forests.

The Copenhagen Accord resulted from the UNFCCC COP 15 in Copenhagen in 2009 strengthensthe Bali Action Plan and participated countries are expected to establish preparatory activities (REDD readiness), develop infrastructure for REDD +, identify causes of deforestation and forest degradation, and formulate policies that describe in the REDD+ national strategy.

Growing global awareness on REDD is a momentum for the Government of Indonesia to increase and accelerate control on deforestation.

The President of the Republic of Indonesia on the G20 forum meeting in 2009 conveyed Indonesian Government's commitment to reduce national GHG emissions by 26 percent in 2020 with self efforts (unilateral) and 41 percent with supports from other countries. In addition to expecting positive incentives from REDD +, Indonesia keeps maintaining benefit balance between reducing emission efforts from the sector forestry and land through REDD+, and as well as economic growth and welfare of the community through various development efforts in other sectors.

Objective of developing a National Strategy for REDD+ is to provide a basic strategy and guidelines for REDD+ implementation in Indonesia.

Scope of the REDD+ National Strategy includes: i) Identifying problems in REDD + implementation; ii) Identifying opportunities and challenges that exist in the preparation plan for REDD+ implementation; and iii) Basic strategy in supporting REDD+ to achieve target in reducing greenhouse gas emissions from 26 percent to 41 percent.

As one of forestry management strategies, particularly for decreasing emissions from deforestation and forest degradation, therefore, reducing emissions from deforestation and forest degradation is part of efforts to reduce greenhouse gas emissions.

Therefore, developing the REDD+ National Strategy is part of the National Action Plan for Reducing Greenhouse Gas Emissions (RAN-GRK). Furthermore, the REDD+ National Strategy is also part of the National Forestry Planning (RKTN) 2011- 2030.[3] Within the framework of broader development, REDD+ National Strategy and RAN GHG is part of the National Medium Term Development Plan (RPJMN) 2010 - 2014, and the National Long Term Development Plan (RPJPN) 2005 - 2025 for implementing Vision of the 2025 Development.

The national strategy will combine a national target rate of economic growth at 7 percent and Indonesia's commitment to the world to reduce emissions by 26 percent with its own effots and up to 41 percent if there are international supports.

Based on general conditions, opportunities and challenges in forest management and in particular in reducing emissions from deforestation and forest degradation (REDD+), the national strategy are as described below:

VISION. REDD+ implementation in Indonesia has developed a vision that relies on the sustainable and equitable forestry implementation, additionally, to support climate change mitigation efforts.

MISSION. The missions of REDD+ implementation in Indonesia are:

1) Reducing deforestation rate; 2) Reducing forest degradation through applying good and proper Sustainable Forest Management (SFM) practices; 3) Maintaining carbon availability through forest conservation; 4) Increasing forest carbon stock; 5) Improving community's welfare and their life quality; and 6) Increasing investment and land utilization based on green economics principles.

Targets of REDD+. Greenhouse gases (GHG) emissions from forestry sector reduced by a minimum of 14 percent out of the 26 percent of national commitments through self efforts and 41 percent from international support in 2020.

Based on the developed vision, mission and objectives and taking into account of general conditions, exist opportunities and challenges, the national strategy for reducing emissions from deforestation and forest degradation (REDD +) consists of: (i) Improving planning and utilization of balanced spatial with an intention of reducing deforestation

3 RKTN 2011-2030 is being finalized.

while maintaining national economic growth; (ii) Increasing Control and Monitoring); (iii) Improving effectiveness of forest governance; (iv) Involving stakeholders and their participation, especially traditional community and community lives in the surrounding forests, in reducing GHG emissions; (vi) Enhancing and strengthening legal base of forest management (Chart 2).

Strategy 1: Improving planning and utilization of balanced spatial with an intention of reducing deforestation while maintaining national economic growth. The strategy includes: 1) Delaying/ moratorium on new permits for conversion of forests and peat lands, as well as reduction of other emission sources and protecting/maintaining of carbon stocks; integrating development in various sectors, particularly forestry, agriculture and mining, toward green economy that utilizes low-carbon.

Strategy 2: Increasing Control and Monitoring. The strategy, includes: 1) Improving data and spatial information, especially biophysical and socio-economic data, 2) Developing simple, accurate and updated instruments for monitoring and evaluation; 3) Developing national standards for measuring GHG emissions in line with international protocols and good practices; and 4) establishing national independent institutions for measuring and reporting GHG emissions from forestry sector.

Strategy 3: Improving Effectiveness of Forest Governance. There are 3 (three) essential elements in improving effectiveness of forest management namely: (i) Effective forest administration; (ii) Good governance; and (iii) Completeness of legal policy.

Strategy 4: Involving stakeholders and their participation, especially traditional community and community live in the surrounding forests. Involvement of stakeholders may grouped into 3 (three) categories: (i) Involvement in the beginning between the Government and Local Government, (ii) Involvement of non-governmental organizations, (iii) Involvement of private sector fairly, (iv) Involvement of traditional community and community lives close to the forests; and (v) Involvement of international community.

Strategy 5: Strengthening Law Enforcement System. Effective law enforcement requires 3 (three) preconditions in the legal system, namely: (1) Ability to detect; (2) Ability to respond; (3) Ability to punish. Therefore, some measurements that need to be undertaken include: 1. Procurement of facilities and infrastructure and strengthening integrity systems and sufficient public control; 2) Firm and consistent administrative law enforcement;

3). Strengthening criminal law enforcement through the establishment of One Roof Enforcement System (ORES); 4) Increasing capacity of law enforcers (number and quality); and 5) Strengthening public control towards law enforcement.

Supporting System for implementing the REDD+ National Strategy

Implementation of the National Strategy for REDD+ requires infrastructure development that includes: (i) REDD+ institutions; (ii) REDD+ funding institution; (iii) Developing methods required for REDD+, especially determination of Reference Emission Levels / REL /RL at national level and REL at sub-national level, and system for measurement, reporting and verification (MRV); (iv) Strategy in determining priority province, district for implementing REDD+; (v) Developing/capacity building (human resources) and capability (institutions) actors for REDD+ implementation, and communications for stakeholders.

Availability of the 5 (five) elements in supporting infrastructure is very important for implementation of the National Strategy for REDD+, both at central and local levels.

Institution for REDD+. In supporting implementation of the strategy, important steps for establishing REDD+ institutions are: 1) Establishing REDD+ institutions at national and sub national levels that are effective, have legal basis, have sufficient authority to coordinate the ministries/agencies or local agencies, easiness communication, and sufficient technical capability; 2) Accelerating development of Legal Basis and Guidelines for REDD+ implementation at national and sub-national levels. REDD+ National Institution will become decision maker towards the REDD+ local institution, and as well as liaison between Indonesia REDD+ program with REDD+ institutions at global level. Therefore, REDD+ institution function includes accountability of national and international financing instruments, fair distribution benefits of REDD + program, that covers incentive and disincentive mechanisms related to achievement of REDD+ program goals.

Funding Institution for REDD+ Implementation. REDD+ funding institution has to develop funding mechanism that is transparent, accountable, yet dynamic to be able to follow cooperation model with community, both domestically and abroad, and as well as cooperation with foreign institutions. In addition to budget source from APBN (state national budget) and APBD (local budget), it is necessary to establish a join funding

mechanisms with private communities, both domestically and abroad in a form of public-private partnership (public private partnership/PPP) or through corporate social responsibility (CSR). Therefore, in establishing REDD+ funding institution, it is necessary to put consideration on the following issues, such as: 1) Competent in mobilizing funding; 2) Competent in developing criteria and procedures and implementing and allocating fund disbursement transparently and fair; 3) Competent in monitoring fund allocation and its purposes; 4) Ensuring accountability of funds and fiduciary management of REDD+ funds.

Developing Instrument for REDD+ Measuring, Monitoring and Verification. There are two important instruments in REDD+ that should be developed using definite, valid and accurate methodology, namely Reference Emission Level (REL/RL) and Measurement, Reporting and Verification (MRV) system. Determining REL/RL is unique/different in every country and is highly dependent on a condition of each country. Some principles required in determining REL/RL are: 1) Procedure to establish reference emission levels should use similar criteria in every region to prevent opportunistic behavior; 2) Global principle of additionality, REDD+ program should contribute significantly in reducing emissions globally, instead of just at business as-usual level; and 3) Taking into account past levels of emissions as a starting point, then consider national conditions such as forest transition phase (and revenue level/GDP per capita. There are three options in setting the REL/RL, namely: historical emission, adjusted historical emission and forward looking.

Measurement, Reporting and Verification System (MRV). MRV system development should refer to the Intergovernmental Panel on Climate Change (IPCC) requirements and meet with principles of efficient, effective and proper. Measurable implies that used methodology should be credible. Reportable means that the report should be clear, actual and able to be undertaken periodically. Verifiable means that each report associated with decreasing emissions or increasing carbon stock and meet with the criteria of transparent, and it can be verified by any independent parties. Scope of measurable, reportable, and verifiable (MRV) includes: (i) Measurement of changes in forest area based on type and carbon stocks available in the forests and also measurement of benefit distribution over REDD+ implementation; (ii) Contribution of REDD + implementation towards sustainable livelihood and poverty reduction for forest dependent community; (iii) sustainable development and achievement of good governance goals; and (iv) community involvement in REDD+ implementation. MRV implementation is carried out by an MRV institution that

has function for coordination, measurement and monitoring, reporting and verification conducted by any independent institutions. MRV institution also has tasks in undertaking registration system for REDD+ activities in Indonesia.

Determining Priority Provinces, Districts/Cities for REDD+ implementation. Determining provinces or districts/cities for REDD+ implementation is very important to show presence of demonstration activities.

It is also demonstrating a significant of setting priority scale despites of limitations of existing resources. Some issues need to be considered during province and district/city determination process such as: 1) Good will of local government to provide high priority in implementing REDD+ strategies within its administration in accordance with national strategies; 2) Assurance of cooperation between the governor and the regent/mayor if location of REDD+ implementation is under province administration; 3) Assurance of cooperation from every institution of each sector at district/city if a location of REDD+ implementation is under district administration; 4) Commitment to promote moratorium implementation; 5) Good will in undertaking the MRV system within the province and district/city administration; 6) Good will in establishing an institution for REDD+ and MRV implementation at the provincial level; and 7) Assurance of multi-stakeholders involvement, including local communities/traditional communities.

Capacity Building (Human Resources) and Capability (Institution) of REDD+ Actors and Stakeholder Communications

Institutional capacity and capability of human resources play an important role in implementing REDD+. Some institutional facilities and actors that necessary to be available are: 1) Optimizing available institutions to establish and support functions of REDD+ institutions, REDD+ funding institution, MRV institution for the purpose of REDD+ targets accomplishment; 2) Developing transparent and efficient procedures toimplementation of the REDD+ National Strategy + effectively; 3) Developing coordination and communication systems among institutions including their authorities; 4) Providing staffs and personnels needed for relevant technical capability.

As a new approach, particularly related to forest management, and sustainable natural resource management in general, REDD+ approach requires proper understanding and application. Statement of the Government Indonesia in reducing GHG emission as global commitment is a good momentum for emission reduction in order to improve sustainable development quality, and a great opportunity in developing green economics. Accordingly, it is necessary to have special interest on the REDD+ program during the process towards achieving sustainable development at national level, while making benefit from global commitment to accomplish sustainable economic development and maintaining the earth's ecosystems globally.

Some principles of REDD+ program implementation that should be noticed are: 1) Legal basis to be developed should apply efficiency principles and prevent overlapping of laws and regulation; 2) Mechanisms and procedures to be developed should be simple; 3) Dimension for measurement, monitoring and verification should be simple and requires no complicated data to be provided mainly at local level; 4) Reward and punishment system (carrots and sticks) needs to be applied proportionally and fairly; 5) Implementation of the National Strategy will only be effective when it is included in the planning system both at central and local levels, and 6) Implementation of REDD+ National Strategy eventually should demonstrate improved quality of community welfare at all levels, especially who live in and surrounding forests.

Indonesia's Climate Change Commitment and the Critical Role of REDD+: Findings of the OSIRIS-Indonesia Model

Jonah Busch, Farhan Helmy, Ruben Lubowski, Muhammad Farid and Frederick Boltz

Introduction

REDD+ is a promising policy emerging from global climate negotiations under the United Nations Framework Convention on Climate Change (UNFCCC) that aims to provide incentives for developing countries to Reduce Emissions from Deforestation and forest Degradation "plus" conservation, the sustainable management of forests and enhancement of forest carbon stocks. Parties to the UNFCCC agreed on methodological guidance for REDD+ in Copenhagen COP15, December 2009 and are nearing agreement on policy approaches for REDD+. The central goal of REDD+ policies is to provide payments for maintaining standing forests, thereby creating an opportunity for developing countries to grow economically without sacrificing their wealth in natural forest resources and biodiversity. As such, REDD+ provides means of meeting multiple goals of poverty reduction, ecosystem conservation and sustainable development.

The Copenhagen Accord of December 2009 notes the crucial role of REDD+ in meeting global climate mitigation goals. This stimulated a pledge to date of $4.5 billion to catalyze the development of REDD+ activities in developing. The World Bank, the United Nations-REDD program, and government of Australia, Norway, the United States, the UK, France and the EU have pledged support for REDD+ in Indonesia. In May of 2010, Norway pledged $1 billion to support Indonesia's REDD+ readiness and reduction efforts. Under this accord, Indonesia has undertaken a national program of REDD+ implementation, following a national accounting and subnational implementation or "nested" model.

Tropical deforestation is responsible for about 15% of global greenhouse gas emissions. Policies for REDD+ thus offer the opportunity to mitigate a major share of global GHG emissions at low estimated costs, while also protecting biological diversity and providing a wide range of other environmental and social benefits.[1] Investments in REDD+ are also a potentially attractive near-term option for reducing emissions using existing technologies, while buying time to reengineer other sectors of the economy. As a result, there is growing consensus that protecting and managing forests will play a key role in addressing the global climate change problem.

A successful system for REDD+ in Indonesia will be critical for meeting national greenhouse gas (GHG) emission reduction goals and could provide a key contribution to global climate solutions. In 2005, Indonesia was one of the world's top five largest emitters of greenhouse gases, contributing about 2,052 million tons of CO_2e emissions, or about 5% of the global total. Indonesia's National Climate Change Council (DNPI) estimates that by 2030, the country could contribute as much as 7% of the total reductions needed to fulfill the global goal of avoiding warming of more than 2 degree Celsius above pre-industrial levels.[2]

Responding to the urgency of the climate crisis, President Yudhoyono has committed to a national goal of reducing emissions by 26% below projected levels in 2020. He has offered an upper goal of 41% with sufficient international support. Emissions from deforestation--and from peat lands especially--account for the bulk of Indonesia's current and projected emissions. According to Indonesia's National Council on Climate Change (DNPI), net emissions from deforestation, forest degradation, and forest growth on non-peat soils were 763 million tons or 37% of total 2005 emissions, while fires and decomposition of peat soils added another 850 million tons or 41% of total emissions.[2]

Current large public financing for REDD+ favors the payment for greenhouse gas (GHG) emissions reductions accounted for at national scales. At the same time, many land-use decisions occur at the local level and policies and measures at the sub-national scale are necessary to accelerate REDD+ adoption. In this context, the Indonesian government has proposed immediate action on REDD+ under a strategy of "national accounting with sub-national implementation." This strategy nests incentives for local REDD+ efforts within accounting systems that reward performance against GHG emissions baselines at the national, province, and district levels. The overall benefit of this system of rules and incentives will depend on the extent to which it encourages actions across all of Indonesia.

The OSIRIS-Indonesia economic model has been developed to examine REDD+ policies and land-use alternatives.[3,4] In this study, we estimate the deforestation, CO_2 emission reduction, and revenue impacts of payments to reduce deforestation ("RED"), exclusively. in Indonesia. Future research will consider forest management, conservation, enhancement of carbon stocks, and other land-use activities in future versions. Policy recommendations are broadly applicable to REDD+ in Indonesia.

Results

Reducing emissions from deforestation could cost-effectively achieve 21-60% of Indonesia's goal of a 26-41% reduction of GHG emissions, based on projected 2020 emission levels.2 Indonesia could reduce annual emissions from deforestation by 221 million tons of CO_2 at a marginal abatement cost under $10 per ton of CO_2, and by 396 million tons at a cost under $25 per ton of CO_2 (Figure 1 and maps).

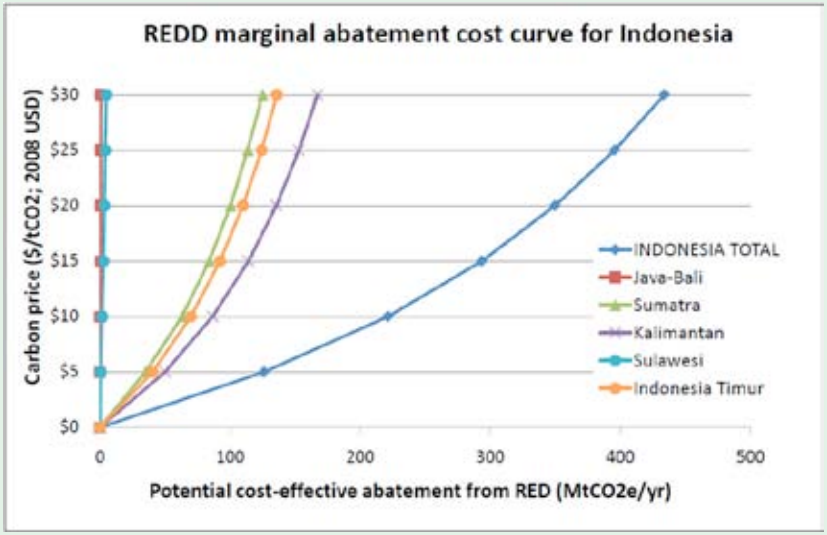
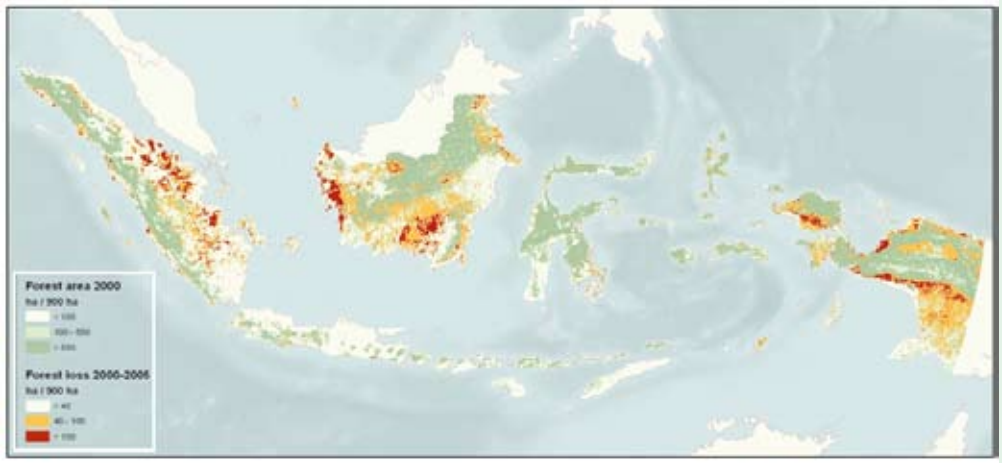


Figure 1 : Potential RED contribution to Indonesia's emissions reduction Assumes no leakage of deforestation, business-as-usual district reference levels, 20% benefit sharing, no cost sharing.



Map 1. Estimated probability of deforestation 2000-2005 without REDD+

Map 2. Estimated probability of deforestation 2000-2005 with RED ($10/tCO2e)

Map 3. Estimated probability of deforestation 2000-2005 with RED ($20/tCO2e)

Deforestation in Indonesia from 2000-2005 was concentrated in provinces with a high carbon density relative to their share of forest area, given the exceptional level of emissions from peatlands. A few provinces representing a relatively small share of the forest land base accounted for a large share of the deforestation emissions. The province

of Riau contained about 4% of national forest area and 6% forest carbon but accounted for around 42% of Indonesia's CO_2 emissions from deforestation emissions. Five provinces with just over half of total forest area accounted for more than two-thirds of Indonesia's deforestation and around 80% of its deforestation emissions (Riau, Papua, Kalimantan Tengah, Kalimantan Barat, and Kalimantan Timur).

These provinces may appear to offer the greatest potential for RED; however, at least cost in terms of foregone land-use, other provinces offer greater gains. We estimate that Papua province has the greatest estimated potential for reducing emissions cost-effectively, with more than twice the potential reductions of the provinces that follow it (Kalimantan Tengah, Kalimantan Barat, Riau). Other provinces, notably Papua Barat, Kalimantan Timur, Jambi, and Aceh, also have significant emissions reduction potential below $30 per ton.

REDD+ policy must provide incentives for broad participation to prevent shifting of deforestation ("leakage") to new regions, particularly provinces with high forest cover and low deforestation rates, such as Aceh and Sumatera Barat. Thus, the greatest emissions reduction and revenue gains are only possible with a comprehensive national program. Broad-scale RED provides meaningful incentives for forest conservation across the country (Figure 2).

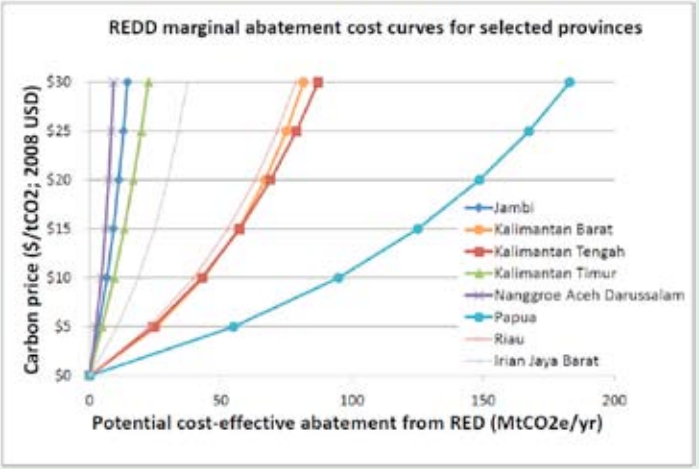


Figure 2 : Provincial investment should be allocated across regions for greatest efficiency and leakage mitigation

Under climate targets of the Major Economies Forum of July 2009, Indonesia's income from the sale of cost-effective RED could be up to $5.1 billion/year in 2012 (estimated to rise 5% annually).[5] If the US fails to act on climate and Europe, Japan, and other nations scale back their climate commitments by 25%, Indonesia's income from the sale of cost-effective RED emission reductions could still achieve up to $1.8 billion/year.

REDD+ offers the opportunity to bridge global and national interests and local development priorities. Indonesian policies for REDD+ offer the potential to attract significant international finance and make a major contribution to national and global efforts to mitigate climate change over the coming decades. Regional data collection and analysis can allow decision makers to integrate national REDD+ income and climate mitigation with local goals of economic growth in harmony with ecosystem conservation, climate resilience and social benefits.

Data and Methods

This study draws from peer-reviewed scientific data on forest cover and forest cover loss for the period 2000-2005,[6] above- and below-ground forest biomass carbon,[7] soil carbon,[8] peatland distribution,[9] emissions from the conversion of forests on peat soils,[10] potential agricultural revenue,[11] slope and elevation,[12] distance from national and regional roads and from provincial capitals,[13] and protected area status.[14] Data was compiled for approximately 200,000 3km x 3km grid cells across all of Indonesia. The statistical relationship between observed forest cover loss (2000-2005) and potential agricultural revenue was used to estimate the level of carbon payment necessary for land-users to voluntarily decide not to deforest (i.e., the "opportunity cost"). Policy incentives (district reference levels; scale of accounting; benefit sharing; cost sharing) were set by the national government in the model. REDD+ participation by Indonesia's 403 districts was estimated, with spatially explicit probabilities of where and how much to deforest. Districts maximized revenue accruing from agriculture and RED. A general equilibrium model of Indonesia's economy[15], permitted our estimation of displacement ("leakage") of deforestation: decreases in one region increasing pressure to deforest in other regions. A unique equilibrium produced estimates of the spatial distribution of deforestation, emissions, and national and district revenue under alternative national policies.

OSIRIS-Indonesia was developed by Conservation International, Environmental Defense Fund, and World Resources Institute, in collaboration with the National Council on Climate Change of Indonesia (DNPI) and Indonesia's Ministry of Forestry, and generous support from the Norwegian Agency for Development Cooperation. The data and economic model are free, transparent, open-source and publicly available at http://www.conservation.org/osiris. A technical document describing the OSIRIS-Indonesia model and present analyses is in preparation for publication.

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The National Forestry Council and UN-REDD Programme Indonesia

Policy Recommendation: Free, Prior and Informed Consent (FPIC) Instrument for Indigenous Communities and/or Local Communities who will be Affected by REDD+ Activities

National Multi Stakeholder Based Process Formulating Team of FPIC Policy Recommendation

Background

1. An FPIC (Free, Prior and Informed Consent) process enables an indigenous/local community to exercise their fundamental right to give or withhold consent to all proposed activities, projects, legislative or administrative measures, and policies that will take place in or impact their lands, territories, resources or livelihoods. FPIC has four elements, namely,- Free, Prior, Informed and Consent. The free element means that the community provides their consent (or decides to withhold it) without coercion from any other parties. The community is free from pressure and threat to express its decision; the community is not under the pressure of time or place to negotiate; the community is also free to choose any person who will represent them. Meanwhile, the prior element means that approval process is undertaken before the policy or activity is performed; the decision-making timeline established by the community must be respected, as it reflects the time needed to understand, analyze, and evaluate the activities under consideration. Finally, the informed element means that before a decision is taken, the community must have genuinely received complete

information in a language and a media which are easily understood by the community. The information should be delivered by culturally appropriate personnel and include capacity building of indigenous or local trainers. The information should be complete and objective (include social, financial, political, cultural, and environmental impacts) and address both the potential benefits and the potential risks associated with the provision of consent.

2. FPIC has become an international mandate requiring REDD+ implementation to fulfill the rights of indigenous community and/or local communities to decide how they will participate in REDD+ activities. Therefore, indigenous communities and local communities who will be impacted by REDD+ implementation are positioned as the main subjects of FPIC, particularly indigenous community and local communities whose lives are dependent on forest resources (forest dependent communities). In the context of FPIC, a local community is a community living in and around a forest and or a forest ecosystem who do not identify themselves as an indigenous community.
3. Nationally, in addition to fulfilling rights, FPIC is one of the instruments to guarantee that REDD+ implementation in Indonesia gives direct benefits to the indigenous community and the local community.
4. Considering the importance of an FPIC instrument for REDD+, the National Forestry Council in collaboration with UN-REDD Indonesia Programme held a National Workshop on Development of FPIC Concept for REDD+ and a series of Focused Group Discussions (FGDs) to formulate a policy recommendation. The workshop and the FGDs were followed by elements of government, business community, academicians, NGOs, indigenous community or local community organisations. The policy recommendation is a crystalisation of various information and ideas presented during the workshop and the FGD. This recommendation is expected to serve as general guidelines for FPIC implementing agencies in Indonesia.

FPIC and REDD+ in Indonesia

5. The main idea of REDD+ is to reduce net green house gas emission by slowing deforestation and forest degradation, maintaining carbon supply and increasing forest carbon stock without disrupting the growth of the local and national economy.
6. REDD+ implementation in Indonesia consists of reducing emission from deforestation and forest degradation, carbon stock enhancement, forest conservation, sustainable

forest management and carbon stock enhancement with project proponent from the government, the private sector, indigenous and local community organizations and institutions, NGO and international development partners. The success of REDD+ will depend on the support of the indigenous and or local communities, particularly those living in and around the forest or forest ecosystem.

Policy Recommendation Analysis

7. There are several main argumentations as to why an FPIC policy in REDD+ is urgently needed in Indonesia. Sociological Consideration. It is estimated that over 25.000 villages in Indonesia are fully or partially located in forests (Ministry of Forestry: 2007, 2009). World Bank (2009) estimated that there were 54 million people whose livelihoods depend on forest resources. This shows that REDD+ will have a direct impact on the livelihoods of millions of people who live in and around the forest. People who live in and around the forest make up one of the largest groups of poor communities in Indonesia. It is important to understand that the indigenous and local communities do not live in the forest solely for economic purpose but also include spiritual and socio-cultural interest, particularly for indigenous people who have been living in and around the forest for generations. This is closely related to customary law/habitual law based ownership and management which have been passed on for generations.
8. In order to develop a democratic public policy in respect of human rights and cultural diversity - as mandated by the 1945 Constitution - the existence, interest and aspiration of the indigenous and or local communities who live in and around the forest must be genuinely taken into consideration. Conflicts on forest utilisation which occur nearly throughout Indonesia and poverty of the people who live in and around the forest, should serve as a material for reflection in planning public policy related to forest and forest ecosystem in general. In this context, FPIC is viewed from two angles: firstly, FPIC as an instrument for human rights and democratisation of development in the forest sector; secondly, this FPIC instrument has actually been living and developing in the community, having various terminologies and social mechanisms in accordance with the local culture.
9. Legal Consideration. Government of Indonesia has the legal obligation to involve the people in accordance with the Constitution of the Republic of Indonesia (Article 18B) to “acknowledge and respect the indigenous/traditional communities in accordance

with their traditional law." This is also in alignment with international principles on human rights such as participation and involvement/inclusiveness including full and effective participation, and contribution to and enjoyment of civil, economic, cultural and political developments. The right to FPIC is supported by the Government of Indonesia's commitment to existing international instruments such as the UN Declaration on the Rights of Indigenous Peoples (UNDRIP), the Convention on Biological Diversity, the International Convention on the Elimination of all Forms of Racial Discrimination (ICERD), the Universal Declaration of Human Rights etc. The UNDRIP reinforces the fundamental right to FPIC that development must not be performed without consent of the indigenous community whose land and environment may be impacted.

10. The agreement reached in COP 16, United Nations Convention on Climate Change (UNFCCC) in Cancun-Mexico called for developing nations to ensure full and effective participations of the relevant stakeholders (among others indigenous community and or local communities) in development and to implement National Strategy for REDD+. Indonesia should look at the development of regulatory scheme and may fulfill it as an access to obtain funding through REDD+ mechanism.
11. At the national level, the law in Indonesia also accommodates the interest and rights of the community in development. It is marked among others by the amendment of the 1945 Constitution which added one separate chapter on human rights. The position of the Government of Indonesia on development and human rights can be found among others in the elucidation of Law No. 11/2005 on Ratification of International Covenant on Economic and Cultural Rights as follows: "Finally, it was realized that the life of a nation and a state that ignores the respect, the enforcement and protection of human rights will always cause injustice to the general public and does not provide a sound foundation for a long term economic, political, social and cultural development."
12. Stipulation of the People's Consultative Assembly number IX/2001 on Agrarian Reform and Management of Natural Resources, states that agrarian reform and management of natural resources must be performed in accordance with principles among others: respecting and upholding human rights; developing democracy, legal compliance, transparency and optimisation of people's participation; ensuring justice in control, ownership, use, utilisation and maintenance of agrarian and natural resources; acknowledging and respecting rights of indigenous community and diverse cultures

on agrarian and natural resources. Policy direction for agrarian and natural resources management reforms must refer to those principles.

13. Law No. 32/2009 on Environmental Protection and Management has included at the minimum 7 articles regulating the recognition and protection of rights and wisdom of the indigenous community related to environmental protection and management which will serve as legal platforms for them and their traditional wisdoms in participating fully and effectively in REDD+ implementation in Indonesia. The law also states that the community has equal and the broadest opportunity to participate actively in environmental protection and management. The roles of the community may take the form of: social supervision; advise, opinion, suggestion, objection, complaint; and/or delivery of information and/or report.
14. Protection of Citizen's Rights for Information is regulated in Law No. 14/2008 on Public Information Disclosure. Aspects regulated in the law include the right of a citizen to be informed of plans for public policy making, public policy programme, public decision making process, the reason of a public decision making, promotion of community participation in public policy making process and sound public agency management. Article 68 [2]b of Law No. 41/1999 on Forestry also regulates rights of citizens in decision making process which will affect them: "Citizens have the right to be informed of forest allocation, utilisation of forest product, and forestry information".
15. Technical Consideration. The local characteristic of FPIC implementation process is highly dependent on the social and cultural aspects of an indigenous community, local community and various forestry stakeholders in a particular forest. The diversity will be a technical challenge in FPIC implementation as it depends on specific cultures of communication, coordination and concensus. With 250 different dialects in Papua for instance, it will take time to find a local facilitator to ensure that the local people understand what REDD+ is all about, in particular what the opportunities and potential risk are as well as the meaning of FPIC can genuinely be understood. However, due to the fact that principles and mechanism of FPIC implementation exist in various local cultures in Indonesia, the application of FPIC in REDD+ implementation is not expected to face obstacles, as long as the FPIC instrument is socialised with contextual language and presentation in accordance with the local socio-cultural conditions and the process is facilitated by trusted figures (having credibility) in the community and accepted by the stakeholders of the forest ecosystem selected for REDD+ location.

Proposed Policy Recommendation

16. Before obtaining approval from a relevant REDD+ agency, responsible proponent intending to implement REDD+ activities have to implement an FPIC process. In other words, the approval will not be given without having been preceded by FPIC. The implementation of FPIC must be preceded by a socialisation of REDD+ and the proposed activities.
17. The main subjects of FPIC are the indigenous community and the local community. The implementation of FPIC will be applied utilising general guidelines and will be adjusted to the local socio-cultural and economic context.
18. Principles that must be followed in the implementation of FPIC in REDD+ Indonesia are: (1) Transparency, namely availability and access of all information related to planning, implementation and the result of FPIC and the issuance of open statement/ opinion of the stakeholders. (2) Accountability, the process and result of FPIC are accountable to the relevant stakeholders. (3) Inclusivity, namely guaranteeing the effective involvement of the stakeholders without discriminating gender, ethnicity, age , religion etc. (4) Integrity, namely consistency of action, values, method, principle of the implementation of FPIC. (5) Participation, namely involving all members of the community who will be affected by REDD+ including women, children, youth, and the elderly. (6) Freedom, namely-physical and mental freedom to express opinions and free from the pressure of a certain interest.
19. The implementation of FPIC at the minimum must pass through four main phases: The first phase is pre-condition. This activity consists of awareness raising of stakeholders through workshops and information dissemination through leaflet, brochure and other relevant media and inventorisation of forest utilization models including inventorisation of forest stakeholders. At the same time, a facilitator (independent and trusted by all parties) needs to be appointed to determine the approach/method of the FPIC implementation. Existing indigenous peoples' or other forest dependent communities' representative organisations and consultation mechanisms should be engaged and partnered with to familiarise the population with REDD+ and the project proponent Programme, undertake consultation, and seek consent where appropriate. Training is essential to ensure that information communicated on REDD+ and climate change is uniform, consistent, complete, and clear.

During this pre-condition phase, institutional mapping needs to be performed at all affected areas in order to obtain information on the types of stakeholders who should be involved and their representatives in all processes. This phase is expected to increase stakeholders' understanding on REDD+ and the importance of FPIC and its process (if necessary by developing a guide book). Other expected result is the availability of data on forest stakeholders and the inventorisation of forest utilization models. This phase is extremely important in determining potential stakeholders and their representatives as well as methods and processes. This phase will be the most time consuming and will answer the Free, Prior and Informed components. All activities will require competent facilitator to cooperate with local parties such as Provincial, District, Sub-district and Village REDD+ Task Forces or other names in accordance with the local custom.

The second phase is Decision Making. This phase will answer the consent component of FPIC. All competent representatives will have a discussion to decide the impact, options for compensation of the impact and other rights if required, involvement in the management of REDD+ initiative and the obligations of the forest dependent communities. This process will be guided by a local facilitator appointed during the pre-condition phase. The time required will depend on the success of stakeholders' awareness raising in the pre-condition phase.

The third phase is verification. A verification team will be appointed by the owner/ implementer of REDD+ project to assess whether all FPIC processes have been performed in accordance with the FPIC principles and phases of implementation.

The fourth phase is socialization of the result of the verification. This phase is to socialize the result of the process and decisions made to all components of the community who will be affected, including to core stakeholders at district, provincial and national levels. Village REDD+ task force, or other name in accordance with the local custom, will conduct a series of meetings at regional, district, provincial and national levels.

20. Institutional arrangement can be performed by strengthening institutional design for safeguards and the resolutions of ongoing conflicts. The success of FPIC implementation in ensuring that communities are empowered and enabled to give or withhold consent on REDD+ activities that may impact them is dependent upon the availability of an adequate institutional arrangement. Institutional arrangement in this case consists of policy related to forest planning and utilization; and an organization with capable

human resources who are able of ensuring the implementation of the entire FPIC mechanism including resolving conflicts which have occurred. Noting the current condition, it is necessary to take the following steps: Implementation of FPIC should be prioritized for indigenous community and local community who have claim rights and group of people who are directly affected by REDD+.

21. In conjunction with the implementation of FPIC, a number of regulations of law need to be revised, among others Law No. 41/1999 on Forestry and Law No. 5/1990 on Conservation of Biodiversity along with their lower legislations because those regulations do not contain adequate FPIC principles.
22. The implementation of FPIC in REDD+ requires grievance or complaint mechanism. The grievance or complaint consists of channels prepared by the implementer of REDD+ project for the community during and post the FPIC implementation. The channels seek to collect inputs, critism, complaint, and suggestions from the community to the project proponent during each phase of FPIC activity in the community. As such, this grievance or complaint mechanism must observe the following principles: accessible by the community, subsidiarity where possible, indepenedent and impartial, transparent, effective and efficient, dedicated budget, the possibility of informing decision-makers directly and offering recommendation on policy and/or procedural reform in dealing with a griavance/complaint.

Closing

23. The development of an FPIC policy for REDD+ is an important component to ensure community rights are upheld, secure community involvement and ensure direct benefits from the REDD+ scheme. As an instrument, this approach needs to be developed and established as one of the components for the preparation of REDD+ infrastructure in Indonesia. This is because one of the success factors of the implementation of REDD+ on the field is highly determined by the extent to which the community is informed, participates freely without any pressure and is finally able to determine whether or not to approve and support the activity.
24. In relation to that, several principles need to be observed in the formulation of FPIC policy: inclusivity, transparency, credibility, accountability, participative, and freedom. It needs to be ensured that the policy will be operational and efficient both in terms of time and cost. The content of the FPIC policy should be simple and easy to understand so as to avoid multi interpretations which will lead to conflicts among stakeholders.

The Katingan Project: Putting Theory into Practice in REDD+ Implementation

Rahmat Herutomo and Sarah Conway

Background

Climate change is an issue of global importance. Around the world, seasons are shifting, temperatures are climbing and sea levels are rising. Some of the consequences of climate change include declining crop yields, increased risk of drought, fire and floods, stronger storms, and more heat-related illness and disease.

Taking into account deforestation, Indonesia is the world's third largest emitter of greenhouse gases (GHG), behind China and the United States. According to the Indonesia GHG Abatement Cost Curve, Indonesia's annual GHG emissions amounted to approximately 2.1 Giga tons (Gt) in 2005. Under a business-as-usual scenario, its total GHG emissions are expected to rise to 3.2 Gt by 2030.

Indonesia has made several groundbreaking commitments to not only reduce its GHG footprint but also to serve as a model nation in the struggle to address this global challenge. At the September 2009 G-20 summit, President Susilo Bambang Yudhoyono voluntarily committed Indonesia to an ambitious roadmap for reducing carbon emissions by 26-41% against a business-as-usual estimate of emissions in 2020, the first large

developing country to do so. In May 2010, Indonesia and Norway announced a Reducing Emissions from Deforestation and Forest Degradation Plus (REDD+) Partnership in which Norway committed USD 1 billion towards REDD+ readiness programs and as contributions in return for verified emission reductions. Indonesia, in return, committed to a two-year suspension of new concessions for forested land and peatland.

Peatland as Carbon Storage

Peat forests have an important storage function for carbon. In fact, with almost 20 times more carbon stored under ground than above[7], peat forests are the richest forest-based carbon sinks in the world. However, decades of forest destruction in which peat fires, often intentionally set to hasten conversion of land to agricultural purposes, has released billions of tons of carbons into the atmosphere. A study by Wetlands International[8] estimates the destruction of Indonesia's extensive peat bogs releases 2 billion tons of carbon dioxide a year – around ten percent of world GHG emissions from human activities. Conserving the integrity of remaining peat forests is crucial as Indonesia sets out to fulfill its commitments in the years ahead.

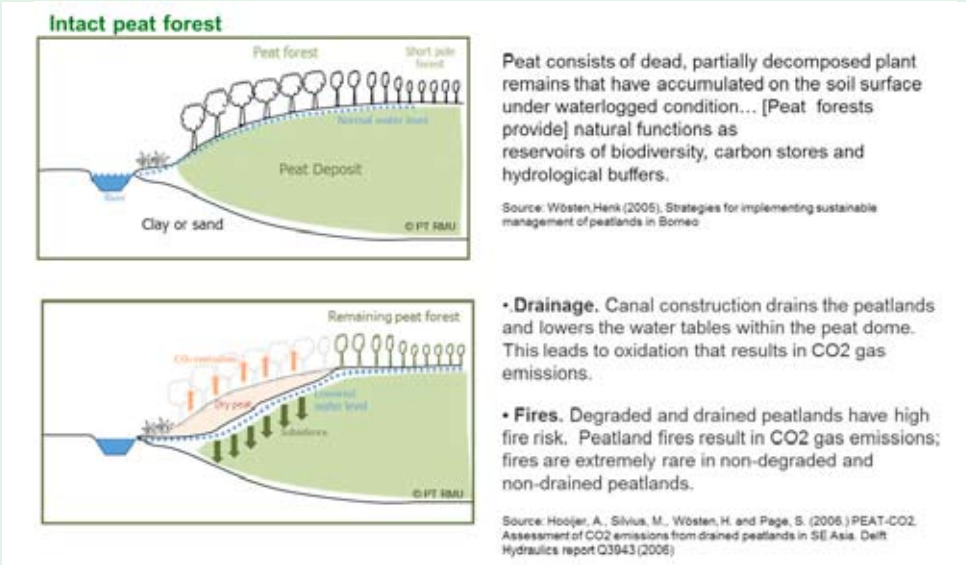

Figure 1 : Emission from Degraded Peatlands

Implementing REDD+

One mechanism to encourage and allow for protection of forests is REDD+. The central purpose of REDD+ projects are to protect primary forest lands in order to inventory and store carbon, mitigate climate change and orient conservation to the marketplace through its creation of salable carbon credits. Studies have shown that avoiding emissions from deforestation would be among the most technically feasible and financially affordable solutions in the short-term, while other technologies are pursued, such as carbon-capture-and-storage and renewable energy. In order to ensure the successful implementation of REDD+, several outstanding issues must be addressed, such as how to work with local communities and indigenous peoples, which type of financial mechanism to rely upon, how to provide accurate measurement of avoided deforestation, how to determine institutional requirements, and so on.

The government of Indonesia had earlier established the Ecosystem Restoration Concession (ERC) policy in 2007. The policy provides opportunities for private companies to secure a concession for conservation and restoration purposes in forest areas designated as production forest. Another important milestone is the stipulation of the Minister of Forestry Regulation (Permenhut) 68/2008 that allows early REDD+ projects to serve as demonstration activities. Demonstration activities refer to pilot projects which possess a clear objective to directly reduce emissions from deforestation and forest degradation.

As a result, there has been a growing interest from the private sector, nongovernment organizations, and donor institutions in investing in REDD+ projects and readiness activities in Indonesia. In fact, a recent survey on emerging REDD+ activities around the world conducted by Wertz-Kanounnikoff and Kongphan-Apirak showed that more than half of all global REDD+ demonstration activities are based in Indonesia. Demonstration activities are essential in order to establish a basic stock of practical experiences related to REDD+. They are necessary for refinement of methodological developments in ongoing REDD+ activities and technologies as well as to develop 'best practices' for future REDD+ projects.

The Katingan Project

The Katingan Peat Forest Conservation Project, led by PT Rimba Makmur Utama (PT RMU) in association with Starling Resources, an Indonesian-based environmental consulting

firm, includes approximately 220,000 hectares of peatland in the Districts of Kotawaringin Timur and Katingan, Central Kalimantan. The key objective of the Katingan Project is to provide a “learning-by-doing” platform for REDD+ project development that is applicable at the village, district, provincial and national levels and that conforms to REDD+ principles and methodology.

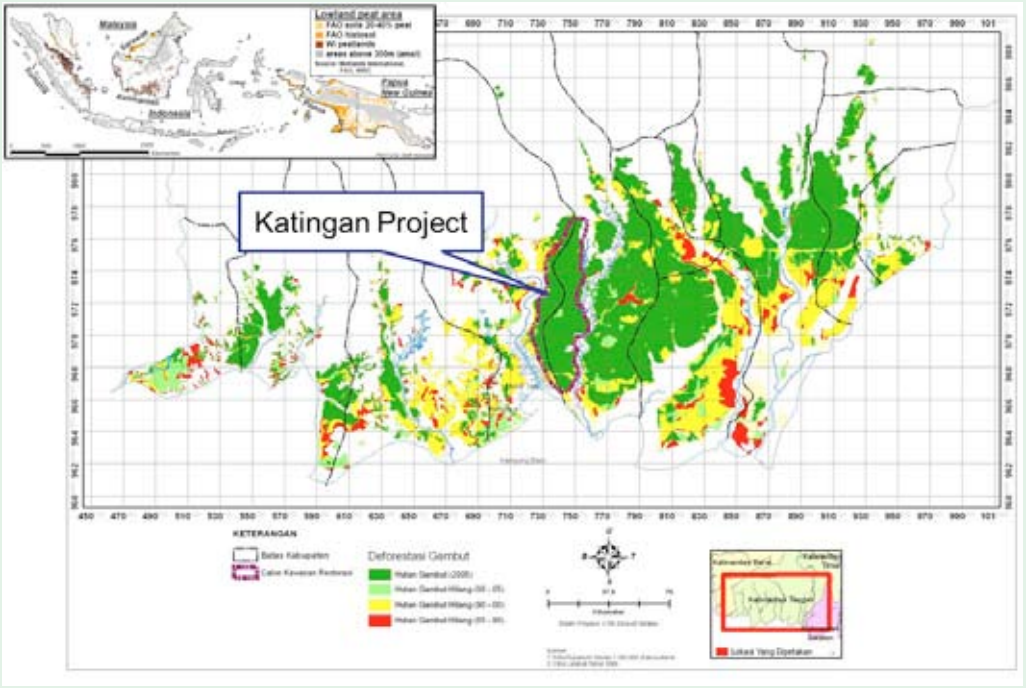

Figure 2 : Peatland in Central Kalimantan (Source Hooijer 2006) and Project Area

The Katingan Project endeavors to transform conservation into a product that might offer strong competition against illegal logging and expansion of industrial agricultural plantations. It also recognizes and cultivates other benefits provided by the conservation site, such as protecting biodiversity and watersheds, availing ancestral non-timber forest products for local use and broader trade, and creating sustainable livelihoods for local communities.

Securing Tenure through ERC Application

The Katingan Project initiated the application process to secure an ERC application process in early November 2008, following the required steps according to Minister of Forestry Regulation no 61 2008 (Permenhut 61/2008).

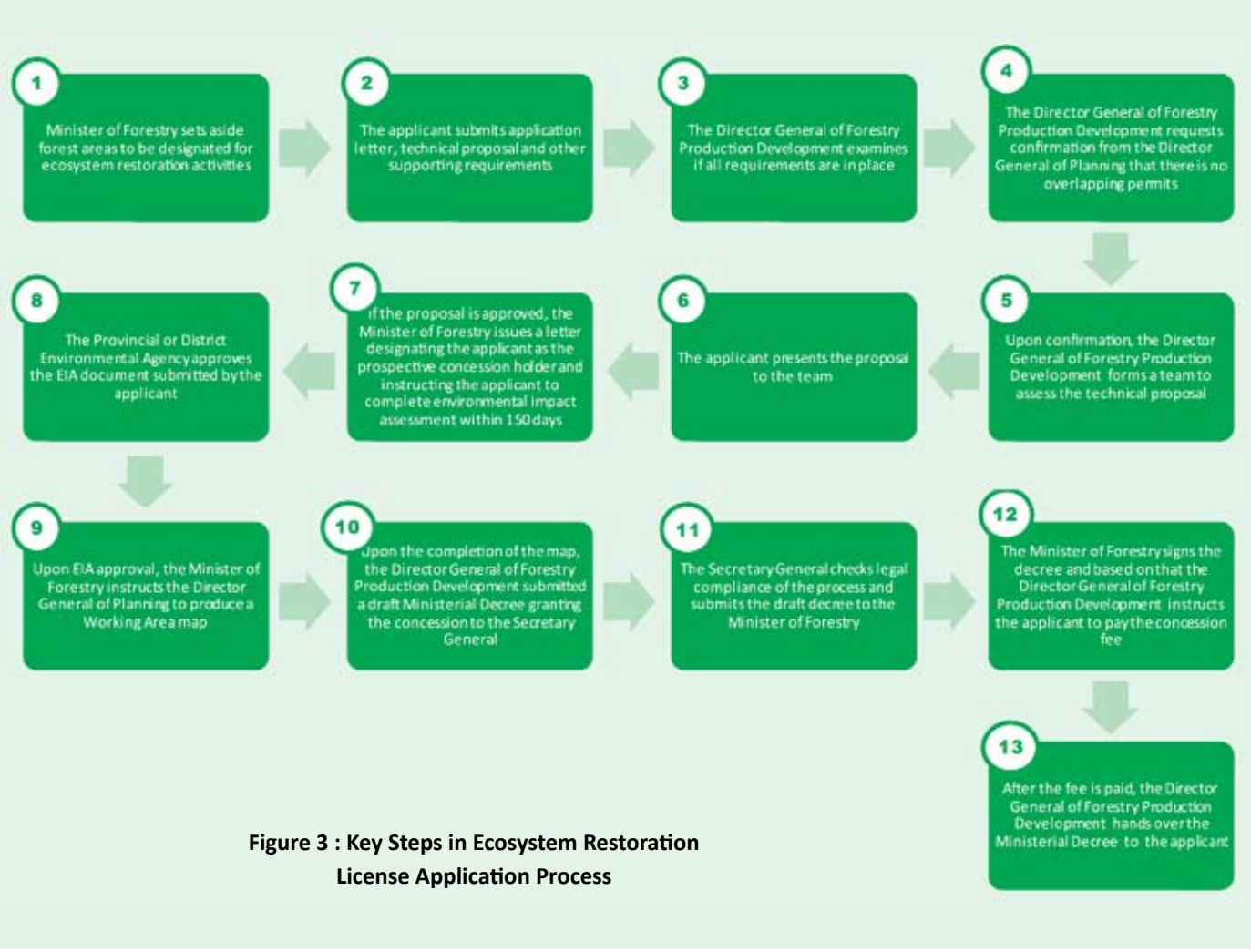

Figure 3 : Key Steps in Ecosystem Restoration License Application Process

The process has been slow and at this stage PT RMU is stuck at the environmental impact assessment (EIA) approval process (Step 8 in the above diagram). The delay can be attributed to three main issues. First, decision makers generally prioritize commodity-based fiscal revenue generation over the long-term economic, social, cultural and ecological benefits generated from ERC holders. Second, there is a lack of understanding on ERC policies among government officials resulting in conflict of opinions between the central and local governments whether the ERC requires a partial or full EIA. Finally, incomplete spatial planning processes in Central Kalimantan adds further uncertainties.

In reality, these issues manifested themselves in an administrative bottleneck. Citing the existence of conflicting permits in the forest areas designated for ecosystem restoration, the district government of Katingan has asked PT RMU to postpone the socialization activities required to complete the partial EIA until those conflicts are resolved. This has effectively put the ERC application process at a standstill.

Project Monitoring, Reporting and Verification

The Katingan Project aims to develop a new REDD+ peat methodology for monitoring, reporting and verification (MRV) of emission reductions. The development of the methodology requires a double approval process required by Voluntary Carbon Standards (VCS). In this case PT. RMU and the Starling Resources field team are working with Terra Global Capital (TGC), a San Francisco-based consulting firm, with support from the Clinton Climate Initiative. This collaboration will produce the peat methodology, sampling design, and a Standard Operating Procedure (SOP). The methodology development is underway and will be peer reviewed by a number of experts, including peat experts from the University of Palangkaraya.

Once the peat methodology is completed, it will be submitted to VCS for approval and upon approval, it will be publicly available. Other project developers can then use the methodology without reinventing the wheel reducing the transaction costs of future REDD+ project development.

A biodiversity assessment actiities, in line with the requirements of the Climate Community and Biodiversity Alliance (CCBA) standards, was completed by the Orangutan Tropical Peatland Project (OuTrop) in collaboration with the University of Palangkaraya. The study documented a total of 68 mammal, 159 bird, 44 reptile, 7 amphibian, and 110 fish species

within the project area. One of species is listed by the IUCN as Critically Endangered (the white-shouldered ibis), 10 as Endangered, and 22 as Vulnerable. Sixty two species are protected under Indonesian law. The project site is also the 6th largest natural habitat of orangutan in the world.

Figure 4 : Peat Swamp Forest and Orangutan

In addition to rigorous scientific surveys, the Katingan project also plans to conduct a community-based biodiversity documentation using methodology developed by PhotoVoices International, an NGO that provides cameras and photography training for people to document important issues in their lives such as the state of the natural environment. The Photovoices process--part documentary, part art, part storytelling--provides a way to hear villagers' unfiltered opinions and to learn from their expertise.

Community Engagement

It will be unlikely for REDD+ projects to succeed without involving local communities whose livelihood depends on the forests. To engage the local communities in the development of the ecosystem restoration plan and the REDD+ project, Starling Resources, in collaboration with Yayasan Puter, a Bogor-based NGO focusing on community development, and supported by a grant received from the David & Lucile Packard Foundation, has developed a community-based forest management plans for forest dependent communities around

the project area. A key step to community engagement in REDD+ activities is to develop a model for a transparent consultation and negotiation process known as the free, prior and informed consent practice (FPIC) between the communities and the REDD+ project developers.

Building on the community consultations that beginning in early 2009, the Yayasan Puter team conducted a systematic FPIC process starting in early 2010. The field team works with local communities by reviewing literature on FPIC and existing legislations, developing the FPIC training module, conducting two-day FPIC trainings in key villages, disseminating information on the FPIC process to additional villages, and finalizing the FPIC module. The final FPIC module incorporated feedback from the communities, such as the need to simplify the module so as to be easily understood by community member with little formal education.

Figure 5 : Community Consultation Meetings in Sub-District Seranau

Addressing Challenges and Moving Forward

Thanks to international commitments, national policies, and demonstration activities, REDD+ development in Indonesia is well underway. That being said, obstacles and challenges remain at all levels.

At the international level there is uncertainty on the REDD+ market (e.g., absence of legally binding agreement in Copenhagen, failure of US climate bill, etc.). However, there

is a movement towards bilateral agreements. In addition to the agreement with Norway, Indonesia has signed bilateral agreement with Australia and plans to do the same with Japan to develop forestry projects to cut emissions. At the global level, there have also been preliminary discussions of having airline surcharge as a source for REDD+ financing.

At the national level, the primary issues are determination of the proper financing mechanism and benefit distribution policies; rectifying the conflicting jurisdiction between national and sub-national level Ministries; and clarifying the jurisdiction between the forestry and mining sectors.

At the sub-national level, the primary issues are finalizing the Regional Spatial Plan and addressing the existence of conflicting permits at the district level. For example, there are currently nine mining permits and six oil palm permits in the area set aside as an ecosystem restoration area in District of Katingan.

At the project level, the primary issues are related to the upfront financial risks as well as the uncertainty around long-term business models and rates of return; the ERC license payment fee is currently required up front while the outlook for return through bilateral or private agreements or market-based mechanisms is unclear. In order for REDD+ projects to reach scale and serve as low-carbon economic transformation programs, investments in REDD+ must translate into reasonable rates of return.

Ensuring that these challenges are overcome, and ultimately that GHG emissions are reduced by 26 to 41% by 2020, will require a great deal of political will and continued collaboration among private sector, nongovernmental organizations, donor institutions and the government. The Indonesia-Norway REDD+ Partnership will help to facilitate progress by establishing a special agency to coordinate the efforts pertaining to the development and implementation of REDD+ and designing and establishing a funding instrument, among other things. Enforcing the moratorium on peatlands while at the same time engaging in peatland restoration, forest preservation, and other community development projects will collectively ensure that Indonesia sets out on a path towards emissions reduction, as well as delivering benefits to the local communities that rely on the forests for their livelihoods and the environmental services provided. The Katingan Project aims to put this theory into practice.

East Kalimantan`s Sector Strategies towards Low Carbon Economy[1]

DNPI

East Kalimantan has significant opportunities to reduce its current emissions and increase its GDP. For East Kalimantan, it is important to look at sustainable development strategies for each major part of the economy and not just for the whole. This is partly because important stakeholders in the province are grouped into different economic sectors (e.g., palm oil companies versus coal mining companies) and partly because our government administration is organized by sector, such as estate crops and forestry, as opposed to physical drivers of emissions such as deforestation. Once each major economic sector has a sustainable development strategy we can engage stakeholders on implementation. We hope that by having initiatives that both reduce the carbon footprint from current activities and also increase GDP through higher value-add activities, the companies and

1 This article was part of DNPI's report: East Kalimantan Environmentally Sustainable Development Strategy (DNPI, 2010). This report evaluates the potential for environmentally sustainable development in East Kalimantan. It first outlines a fact-based assessment of current and likely future GHG emissions for the province and then considers the potential actions to reduce emissions, the relative volume of each of these reduction measures, and an indication of costs (or gains) per measure. Among the most important achievements of the report is to clarify and quantify the central importance of land use, and land use change in East Kalimantan's current emissions picture. The report has also measured the impact of the different efforts which could mitigate these land-use based emissions. Slowing deforestation is an important measure here, but it is by no means the only one.

people working in that sector will support sustainable development as they will directly experience the benefits.

This chapter reviews each of the sectors in order of their current business-as-usual situation, their abatement opportunities, pilot projects, potential GDP improvements, and required policies (or changes to policies) to enable the changes in each sector: palm oil, forestry, agriculture, coal, oil and gas

Palm Oil Sector

This document analyzes palm oil separately from all other agricultural crops, as the palm oil sector[2] is critically important for East Kalimantan's economic growth and is also central to its CO_2e emissions profile and abatement opportunities. Indonesia is the world's largest producer of palm oil, yet East Kalimantan has only recently begun its development of the sector. While palm oil accounts for less than 1 percent of GDP currently, palm oil concessions are expanding rapidly. Palm oil is important beyond its GDP contribution as it is one of the few highly profitable activities in rural areas, thus bringing needed jobs and income to rural people and offsetting rural-urban inequality.

While the oil palm plant is highly efficient compared with other oil crops such as rapeseed, and the actual process of planting, harvesting, and milling palm oil produces relatively few emissions, the sector's expansion into forest and peatlands is creating substantial emissions and has made the palm oil sector the largest emitter in the province. We have identified initiatives to reduce more than 60 percent of palm oil's business-as-usual emissions, through a more efficient use of our land base. Instead of area expansion into forested areas, economic development can be achieved by agricultural intensification, better use of degraded lands, and by moving down the value chain into palm oil refining. However, these changes require supporting policies, training, and financial resources.

Current Context

Palm oil is so profitable in Indonesia that it has earned the nickname of "liquid gold." Oil palm is a highly profitable crop with annual returns[3] ranging from approximately USD

2 Palm oil describes the overall industry sector, while oil palm is used to describe upstream operations within the plantations, such as cultivation of Elaeis guineensis

3 At average crude palm oil (CPO) price of USD 700 per ton

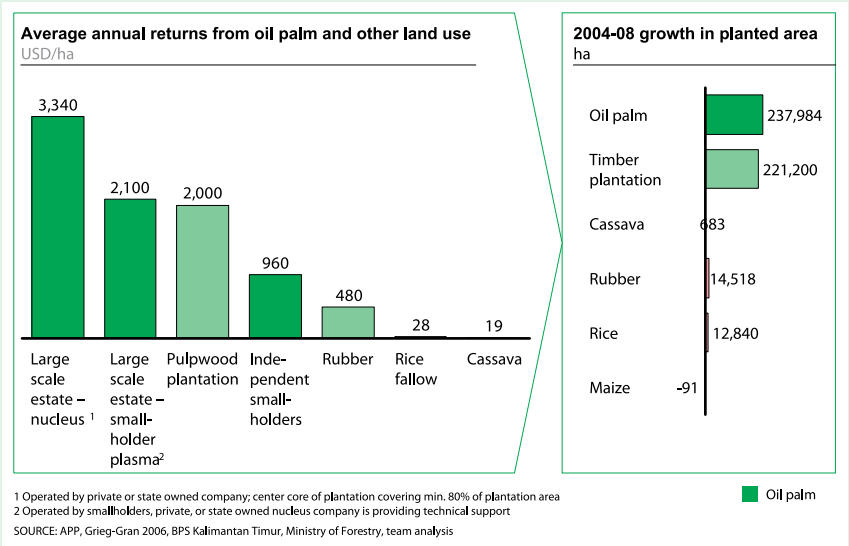

Figure 1 : Significantly higher returns for oil palm than other crops has led to a rapid area expansion

1,000 per ha p.a. in independent smallholder plantations to more than USD 3,000 per ha p.a. in large, privatelyowned estates (Figure 1). These high returns have made oil palm the most important estate crop in East Kalimantan, with a GDP contribution of more than IDR 1 trillion in 2008. Palm oil is especially important for reducing poverty in rural areas of East Kalimantan; more than 40,000 smallholder farmers have planted some 85,000 hectares of oil palm. The sector's future looks bright as global demand is forecasted to increase, driven by growth in large export markets such as China and India.

Palm oil cultivation is expanding rapidly, growing by over 35,000 ha per year. Currently approximately 465,000 ha[4] are planted with oil palm. Our official target, recorded in 2008, is to triple the sector's GDP contribution between 2008 and 2025[5], which will require an additional 790,000 ha of plantings and investments into value-added CPO refining. Thus GDP from palm oil is expected to grow at an annual rate of 7.6 percent until 2020, reaching IDR 1.8 trillion in a business as- usual scenario. Palm oil's growth is rapid in absolute

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terms but even more impressive when compared to other agricultural products, which are forecasted to grow moderately at 3 percent p.a., or to forestry, which is expected to continue its annual 3 percent decline. While palm oil's GDP may be overshadowed by the province's oil, gas, and coal sectors, it remains nonetheless important for its contributions to growth, jobs, and equality.

Palm oil generates substantial emissions, 57 MtCO2e in 2010, and is expected to increase to 67 $MtCO_2e$ in 2030 due to continued rapid expansion of plantations.

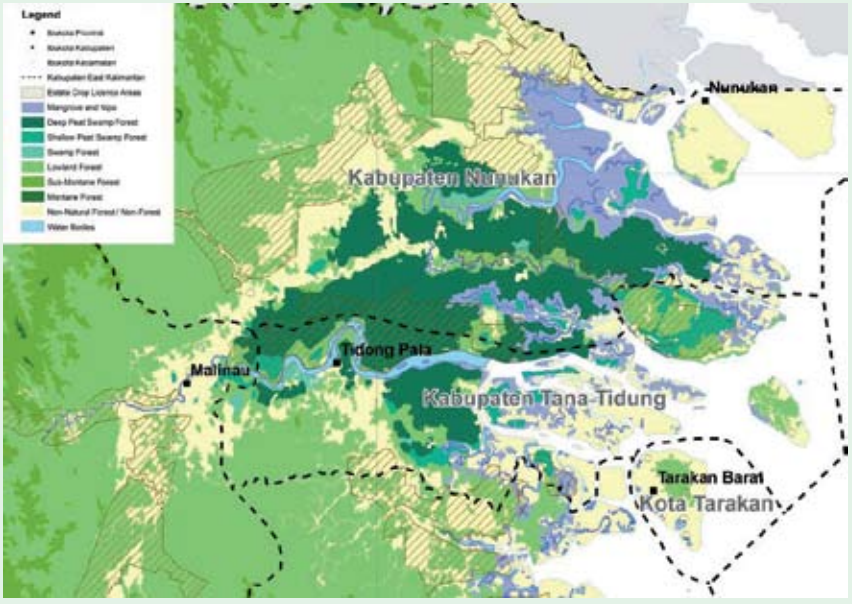

Figure 2 : Palm oil concessions on peatlands in Nunukan and Tana Tidung

The sector's 57 $MtCO_2e$ of net emissions in 2010 make it the province's largest source of greenhouse gas emissions (GHG). Oil palm plantations require large tracks of land; in East Kalimantan this land has largely come from its forests and peatland areas as they provide some additional timber revenue but more importantly offer fewer land-tenure complications. Communicating, negotiating, and accommodating communities on land for palm oil concessions is a long and sometimes costly process. To the contrary, there is far fewer migration into intact forests and peatlands, and thus fewer land rights challenges.

Consequently, palm oil cultivators say that the fastest route to an operating palm oil plantation is get a license to clear forested land. But it is precisely this expansion into forest and peatlands that results in the sector's very high emissions.

The majority of palm oil's emissions come from plantations opened on peatland. Peatlands have acidic water-logged soils, which in a dry state are 60 percent carbon in the form of organic matter that has accumulated over thousands of years. When peat soils are drained for oil palm cultivation, they are aerated and begin to oxidize and decompose. The slow but steady decomposition of peatlands is estimated to result in emissions of 17 $MtCO_2e$ in 2030, while the more rapid oxidation of peat carbon through fires is estimated to account for 26 $MtCO_2e$ per year on average.

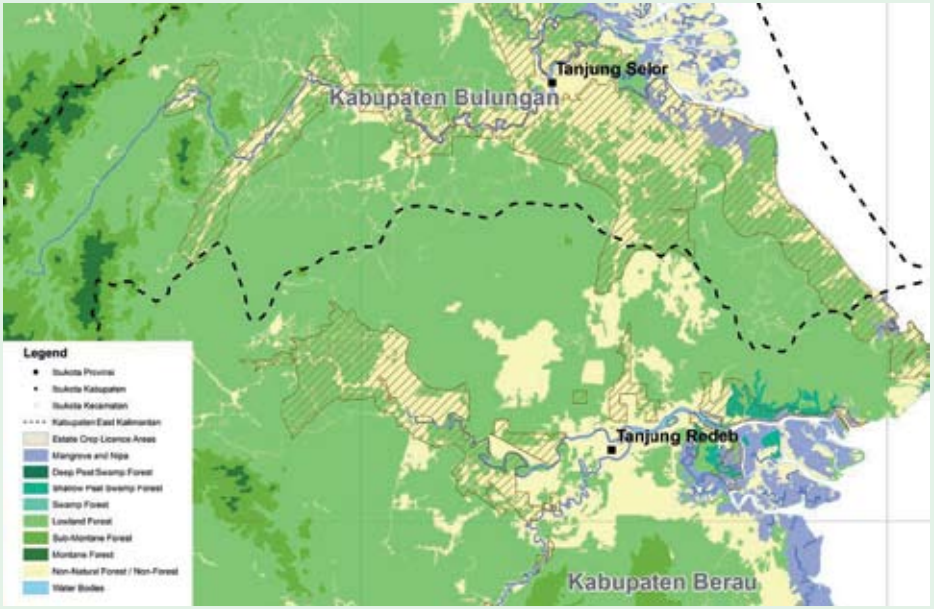

Figure 3 : Palm oil concessions expanding on forest lands in Bulungan and Berau

The second major source of emissions related to the palm oil industry is deforestation that occurs during the conversion of forested areas into plantations. As conversion of (at least partly) forested areas is expected to continue through 2030, annual emissions of 22.4 $MtCO_2e$ from deforestation will likewise remain. Large companies primarily use

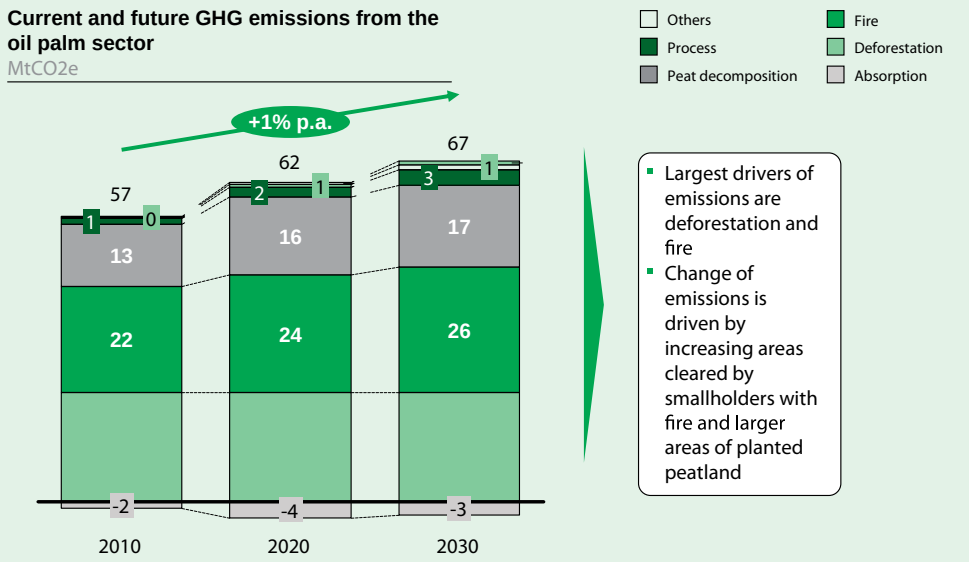

Figure 4 : GHG emissions from the oil palm sector are expected to increase in a business-as-usual scenario

mechanical techniques for land clearing and land preparation; however, many smallholders still use slash and burn techniques, which lead to significant emissions as well.

Outside of the sector's need for land, palm oil's emissions are relatively minor. Emissions from palm oil mill effluent (POME)[6] account for more than 1 $MtCO_2e$ currently. While comprising just one-fiftieth of emissions from land use, these emissions from the harvesting and milling processes are still significant. For example, POME emissions total half of the emissions from the province's entire transportation sector.

Total palm oil emissions are expected to increase at a rate of 1 percent annually and reach 67 $MtCO_2e$ in 2030 under business as usual (Figure 4) Emissions from oil palm-related deforestation are expected to remain constant, but overall emissions are expected to increase as more peatland is opened up for new oil palm plantations. New oil palm plantations on peatland in Nunukan, Kutai Kertanegara, and Kutai Barat districts (indicated

6 Untreated palm oil mill effluent releases large amounts of methane as a result of anaerobic decomposition

by the location permits there) will result in significant additional ongoing emissions from peat decomposition. In addition, emissions from peat fires are expected to increase, as more peatland comes under cultivation and as smallholders continue to use fire as their main means for land preparation and fertilization. Annual emissions from peat fires will fluctuate, as the overall number of fires and the average area burnt during a fire event is correlated with annual rainfall, the groundwater table, and the duration of the dry season.

These estimates are based on the overall assumption that oil palm plantations will cover an area of approximately 1.25 million ha in 2030, which is based on projecting our official Propeda 2025 target to 2030. This plan indicates an additional expansion of 790,000 ha from the already planted 465,000 ha (Figure 6). However, districts have issued over 3.2 million ha of location permits, which would triple the above estimates if all were converted fully to oil palm. We have not used this as our baseline, however, as our Propeda plan has set a clear goal and districts do not have sole authority to issue palm oil concessions; the HGU licenses are issued by the provincial department of estate crops and the national land agency (BPN). In addition, an expansion to 3.2 million ha is unrealistic by 2030 as it would imply oil palm production would grow seven times-fold to 9.9 million tons which represents 50 percent of Indonesia's total CPO production at present. On a practical level, there is currently not enough infrastructure to support this development and this expansion would require 400,000 to 600,000 workers, which is approximately 30 percent of the current working age population.

Abatement Potential

More than 43 $MtCO_2e$ of 67 $MtCO_2e$ of palm oil emissions could be abated annually in 2030 without reducing the GDP growth of the sector. This can be achieved by first setting a clear plan for palm oil in terms of CPO production as opposed to hectares planted and using productivity gains to replace some expansion of concessions. Next, we can reduce carbon loss from deforestation. Our first option is to use our existing degraded lands for new concessions and use land swaps for existing concessions with forest cover. Once those degraded lands are utilized, financial mechanisms (REDD payments) can be used to buy out remaining forest concessions. Finally, we would aim to minimize emissions from productive lands by instituting a zero burningpolicy and improving water management in opened peatlands. These five major initiatives, listed below in order of abatement potential, can

result in a more efficient and productive use of the province's land (Figure 7).

The prevention of peat fires by the implementation of a strict and visibly enforced zero burning policy has the potential to reduce palm oil emissions by 15.6 $MtCO_2e$ at a relatively low cost of below USD 1 per avoided tCO_2e. Capturing the emission reductions from this initiative will require providing technical equipment (and financial incentives) to enable smallholders to shift to manual land clearing, developing appropriate early-warning systems based on fire risk status, install satellite, and field-based fire detection systems, strengthening fire brigades, ensuring strong enforcement and severe penalties for rule violations, and last but not least, building public awareness of the economic and societal costs of forest fires in the province.

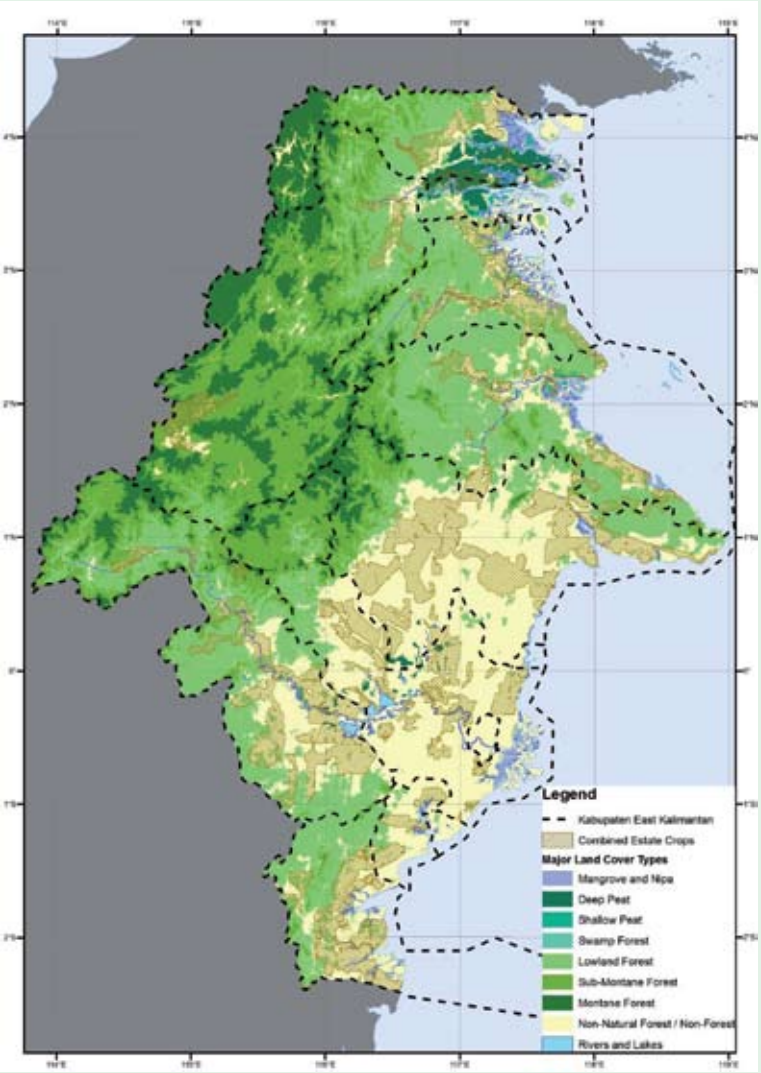

Figure 5 : Oil Palm concessions are expanding into natural forest areas

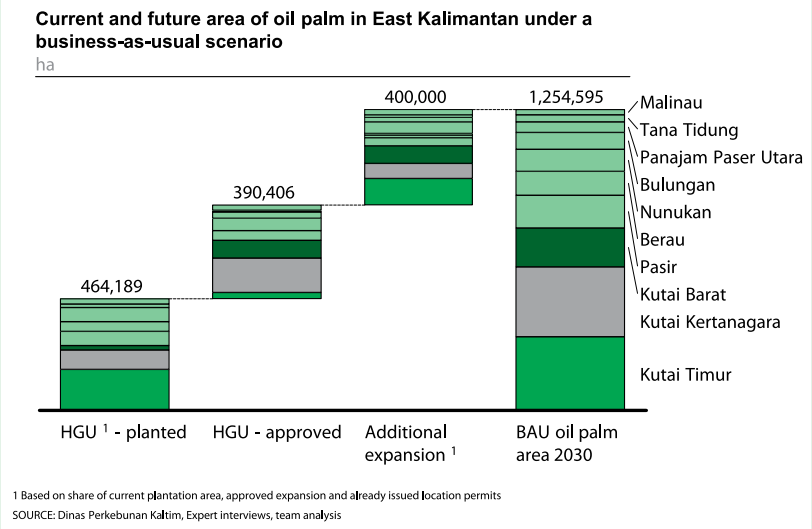

Figure 6 : The greatest expansion is expected to happen in the 3 Kutai districts and Pasir

	Description	Abatement[1]
Zero burning policy	▪ Implement zero burning policy along with strict and visible enforcement ▪ Increase fire fighting capacities within the province by hiring fire rangers and provision of appropriate technology	15.6 Mt CO_2e
Degraded land	▪ Promote use of degraded land (*lahan critis*) for future expansion oil palm ▪ Arrange land swaps of already granted concessions on forested land with equal sized plots of degraded land	11.4 Mt CO_2e
Peatland water management	▪ Implement water management within active oil palm concessions ▪ Protect remaining deep peatland in Nunukan, as the majority of undisturbed deep peatland is located there	7.1 Mt CO_2e
Yield improvements	▪ Initiate and implement extension services in cooperation with supportive private sector players to increase yield of oil palm with activities focusing on smallholder farmers ▪ Higher yields will help to reduce pressure on forest areas	3.3 Mt CO_2e
Concession buyouts	▪ Introduce a REDD payment scheme to compensate concession holders for forgone revenues for not starting an economic activity ▪ Apply REDD when the use of degraded land is no alternative ▪ For the biggest effect on emission abatement, REDD activities should focus on peatland or other areas with high carbon value	3.2 Mt CO_2e

1 Maximum technical annual abatement in 2030
2 Reduced emissions through avoided deforestation, assuming adequate funding from voluntary carbon markets or international bi or multilateral funding
SOURCE: Team analysis

Figure 7 : Emission reduction activities in the oil palm sector should be focused around 5 major initiatives

The technical maximum potential for CO_2e reduction through zero burning could be as high as 26 $MtCO_2e$ annually if all fires set by oil palm growers in East Kalimantan were suppressed. However, we recognize this would require large investments in infrastructure and fire prevention programs across a very large and difficult terrain. Thus, this strategy uses a more conservative abatement estimate of 15.6 $MtCO_2e$, which could be achieved by focusing on the historical fire hot spots within the province.

Using existing degraded lands for the expansion of palm oil plantations could result in 11.4 $MtCO_2e$ of abatement annually by 2030. East Kalimantan has large areas of land that have been heavily degraded through previous deforestation, forest degradation, and the massive fires of the 1980s and 1990s. As many as 1.4 million ha are categorized as very critical (sangat kritis) and critical (kritis), with remaining tree cover of less than 10 percent and less than 30 percent respectively. Large areas of very critical and critical land are covered with Imperata cylindrica (alang-alang) and other weed species or bushes as their main vegetation with low carbon values. These degraded lands require roughly equal amounts of fertilizer (primarily rock phosphate) as forest lands and have approximately the same costs for development excluding any potential oneoff revenues from selling cut timber on forested lands. Using degraded land for oil palm expansion will not only prevent emissions, it could even result in a net sequestration of carbon as long as the initial carbon levels are below 40 tCO_2e per ha.

Only the larger plots of available degraded land are economically interesting for palm oil plantations investments from the private sector. About 40 percent of the land categorized as very critical and critical (approximately 550,500 ha of the total 1.4 million ha) consists of contiguous fields of 500 ha and larger. The rule-of-thumb estimate for the area needed for an economically attractive palm oil concession is 5,000 ha. We have focused on plots of degraded land of 500 ha or greater as we believe that they are typically found close to one another and can be consolidated with proper efforts. Thus, these areas could be used for oil palm cultivation and avoid deforestation of equally sized forests. To enable the use of degraded land, a degraded land database has to be developed that will identify the location, soil type, owner, and current land use. Degraded land must also be included in the spatial planning process, and its use should be prioritized over forested areas in the issuance of oil palm location permits (Izin Lokasi). In addition, financial incentives in the form of subsidies for use of degraded land and/or high carbon taxes on forested land would help to encourage the private sector to use degraded areas. This initiative will need to be

linked to classical REDD payments or reclassifications under the spatial plan to ensure the original forest concession is not converted in the future by other activities.

Using degraded land is a relatively low cost opportunity to reduce emissions, with societal costs[7] of less than USD 10 per abated tCO_2e. The direct costs of cultivating oil palm on degraded land are roughly equal to cultivation on forested land. Forest concessions do offer a one-time revenue from the harvesting of the timber, which can cover the capital to establish the plantation. However, this is not the biggest driver for palm oil companies; in fact, many report that unless there is an associated timber company, they find it difficult to sell the timber or the community will claim it. They report that the biggest cost of degraded land is the indirect time and compensation needed to reach agreement with the larger number of settlers on these lands.

Emissions from decomposing peatland can be reduced through the implementation of a water management system and peat rehabilitation efforts, which can yield 7.1 $MtCO_2e$ in abatement. Water management limits the depth to which the peatlands are drained, from 100 cm to 70 cm for example. While best practices are still being researched, dam and canal systems can better manage water tables in palm plantations. These need to be based on an assessment of the entire hydrological conditions around a peat dome; as peat domes are integrated systems, improving water management in one area, the deep center for example, will not be productive if drainage continues in another, the shallow periphery for example.[8] Such measures are relatively low cost at less than USD 1 per abated tCO_2e. In addition, good water management can help reduce the risks of flooding in the wet season and drought in the dry season and therefore result in higher crop yields.

Yield improvements can act both as an abatement measure (3.3 $MtCO_2e$) as well as a tool to increase the sector's economic contribution. In terms of abatement, yield improvements would allow the use of a smaller plantation area to achieve the same CPO production target, and thus could potentially reduce the area under cultivation, assuming good planning. If East Kalimantan reaches a similar yield level to Indonesia's

7 Societal cost doesn't include transaction costs (e.g., compensation payments for land use rights of communities), which could be significant, especially as a large number of smallholder communities would be involved

8 Peat domes are in the center of a coherent hydrological system and are normally areas with the highest peat thickness, which control the water flow within the peatland

national average, it could reach a production of 3.8 million tons of CPO[9] with 100,000 fewer hectares of plantations than at current yield levels. Yield improvements in isolation are unlikely to cause a decrease in plantation expansions; in fact, they could encourage expansion as palm oil becomes even more profitable. Therefore, yield improvements must be done in conjunction with strict planning on the use of lands for palm oil, targets set on production and not planted lands, and classical REDD payments to protect forests that would have otherwise been needed for palm oil expansion.

Avoiding emissions from deforestation and forest degradation through a concession buyout scheme could provide 3.2 MtCO_2e of abatement annually. The idea behind concession buyouts is that local communities and concession holders would be paid for not starting or continuing economic activities that result in deforestation or forest degradation. While REDD+ payments could be part of the above initiatives, concession buyout payments would focus only on buying out a palm oil concession when there are no other options to relocate the palm oil plantation, Concession buyouts can be extremely expensive if concession holders and local communities insist on being compensated for the full opportunity cost of the lost palm oil plantation. Such an approach would cost approximately USD 16,000 to 21,000 per ha or USD 19 to 28 per avoided tCO_2e depending of oil palm yields and avoided emissions. It should therefore only be applied in areas where few alternative opportunities for economic development exist, or to prevent the conversion of areas with high carbon and conservation value, such as primary forests and peatland or areas of cultural heritage for the province's indigenous peoples.

Costs for reducing carbon emissions within the palm oil sector are, with the exception of a plantation concession buyout, relatively cheap if calculated on a per ton of abated CO_2e basis. However, given the sheer seize of the overall abatement captured, total costs reach considerable levels of up to USD 200 million per year (Figure 8).

Pilot Projects

Pilot projects will help to identify and overcome existing challenges and showcase the potent combination of emission reduction and economic growth. Pilot projects should be developed to achieve quick and significant emission reduction as well as further economic

9 East Kalimantan's business-as-usual production level at current yield rates is 3.8 million tons of CPO with 1.25 million ha under production

development. Pilot projects need to be selected with local stakeholders and be based on several criteria, including the potential abatement as well as the level of support of stakeholders with land tenure and land-use rights. We have identified preliminary pilots by using the first criteria of abatement potential. Three recommended pilot project are as follows: work with the 10 largest holders of oil palm location permits (izin lokasi) in the province to relocate onto degraded land; implement a zero burning policy in areas historically prone to fire; and improve water management standards on peatland with the five largest active oil palm concession holders.

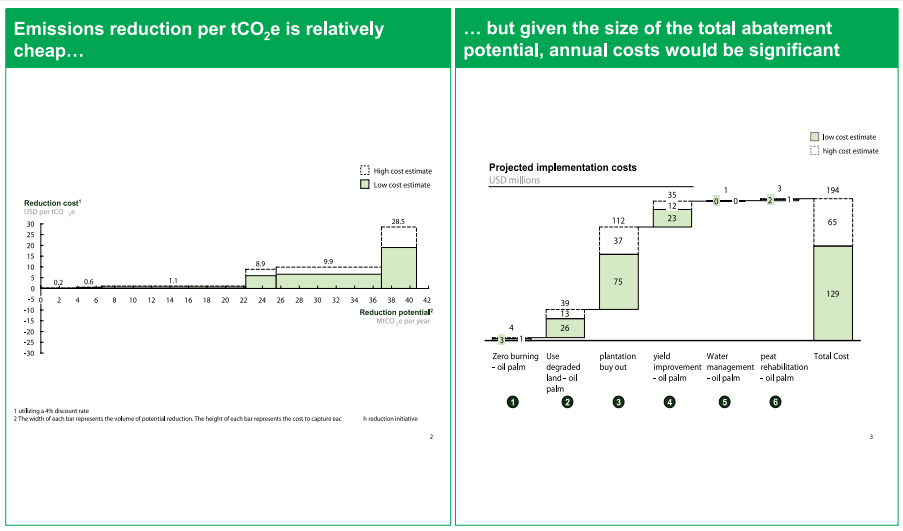

Figure 8 : Significant financial resources are re quired to reduce emissions from the palm oil sector

The proposed pilot projects could yield as much as 375 MtCO2e of avoided emissions by 2030. The increased use of degraded land could alone result in an avoided deforestation of 250,000 ha. The immediate emission reduction resulting from zero burning and water management will be relatively small with annual avoided emissions of 14 MtCO2e and 2 MtCO2e respectively however, the accumulated avoided emissions will become significant at 280 MtCO2e and 40 MtCO2e respectively by 2030. A moratorium on new licenses on

forested areas and peatland is a proposed national policy[10] and could accelerate the above pilots.

GDP Potential

The GDP contribution from palm oil is growing from the expansion of concessions, yet there is potential to increase growth above business-as-usual from raising productivity and capturing more downstream activities. The expansion of oil palm plantations will result in a tripling of current GDP contribution under a business-as-usual scenario. Improving yields and developing downstream manufacturing could provide an IDR 1.1 trillion of GDP in 2030, equal to 60 percent of the business-as-usual forecast for palm oil GDP (Figure 9).

Current palm oil yields can be improved by 9 percent. Average CPO yields in East Kalimantan's plantations are 3.1 tons per ha at present, which is below Indonesia's average of 3.5 tons of CPO per ha.[11] Lower yield rates are partly a result of lower natural soil fertility than other in provinces, e.g. the volcanic soils in Sumatra, but also a result of better inputs, such as fertilizers, and practices in those plantations. There are substantial productivity differences within East Kalimantan whose independent smallholders have much lower yields regardless of location. Raising yields in East Kalimantan up to Indonesia's average would result in 9 percent higher production from a given hectare of oil palm plantation, which would represent a significant additional contribution to GDP. Yield improvements might also be seen as a way to decrease the demand for converting land into oil palm plantations, which could result in lower emissions from the conversion process. However, yield improvements will not result in additional employment , as the number of employees needed within the labor-intensive palm oil sector is more directly related to area planted than output.

Box 1 discusses a 10-step approach to palm oil productivity improvements in Harapan Sawit Lestari Estate in West Kalimantan.

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10 On May 28, 2010, a REDD+ partnership between Indonesia and Norway was announced, in which Norway pledged USD 1 billion towards REDD+ readiness programs and as a contribution in return for verified emissions reductions. At the same time, Indonesia committed to a two-year suspension of new concessions on forested land and peatland

11 BPS – Indonesian palm oil statistics 2009

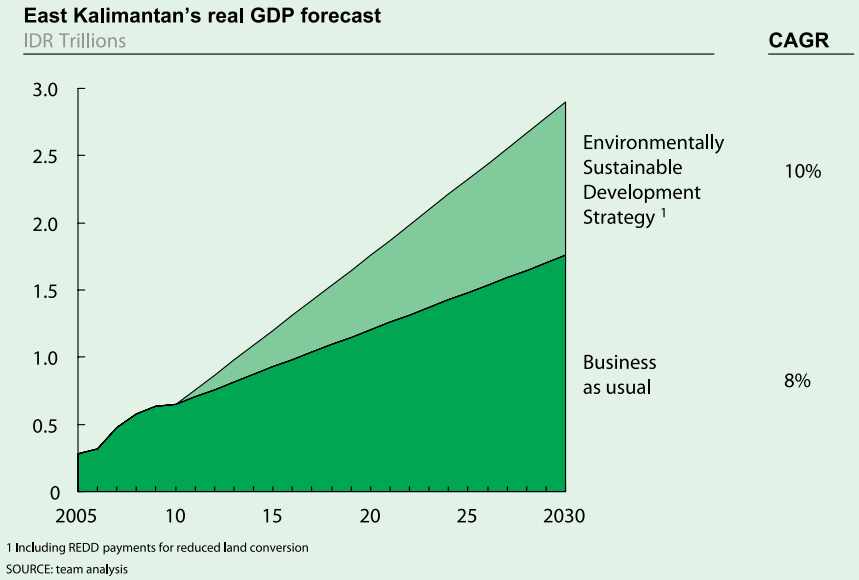


Figure 9 : Including financial transfers for REDD, GDP from palm oil could increase to IDR2.8 trillion by 2030

Several opportunities exist for investing in the downstream manufacturing of CPO-derived products, which range from food oils and biofuels to oleochemicals.[12] Our conversations with potential investors have largely ruled out downstream manufacturing in food oils as companies prefer to process these near their consumer markets. We have focused on increasing the production of oleochemicals but, according to investors, a number of regulatory and fiscal obstacles discourage new investments in this area. Whereas Malaysia uses differing export duties to promote refined palm oil products over crude palm oil, Indonesia does not. In addition, good transportation is important for downstream processing. The lack of seaports with refined palm oil handling capacities and sufficient roads to enable fast transportation to centrally located refineries, also act as a disincentive to downstream manufacturing (Figure 10). We have identified improved infrastructure as a requirement to attract further investments in downstream refining. Biofuels might be a sizeable opportunity as demand is rising fast, especially in Europe.

12 Oleochemicals are used in soap products such as detergent, toothpaste, shampoo, and face soap

The European Union has recently released new criteria that oil palm plantations have to meet if they have the intention to export CPO or biofuels to Europe. Those criteria are in line with our current thinking related to a better utilization of our degraded land. The consequent implementation of those criteria could therefore open markets and provide a competitive advantage compared with other Indonesian provinces.

Box 1.

Palm oil Productivity Improvements in Harapan Sawit Lestari Estate in West Kalimantan

Palm oil yields in Kalimantan lag behind their potential considering that the region's soil, climate conditions, and available planting materials. The Best Practice Management project implemented in Harapan Sawit Estate illustrates that impressive yield improvements in oil palm can be achieved by a targeted 10-step approach:

- Complete crop recovery by strict control of harvesting activities to eliminate crop loss in the field
- Harvest intervals controlled at seven-day intervals
- Proper access for harvesting (infield paths, foot bridges, road access)
- Continuous maintenance of correct canopy conditions by removing fronds at harvest and implementing two rounds of pruning per year
- Ground cover management to provide adequate soil cover but provide harvesters and other field workers with unimpeded access
- Adequate in-field drainage and outlets
- Recapitalization of soil phosphorus with one-time application of 1 t per hectare of reactive tock phosphate
- Timely application of standard fertilizer programs
- Application of empty fruit bunch mulch (40 t per hectare)
- Relentless drive by management to maximize yield by eliminating field constraints

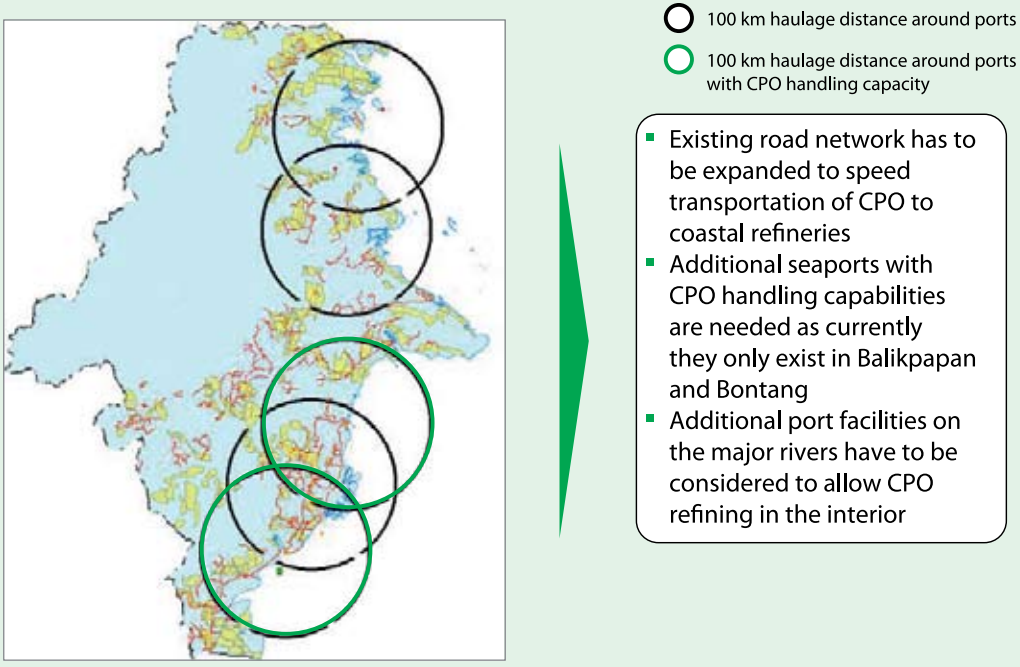
Following the approach, fresh fruit bunch yields in trial blocks increased rapidly after implementation of best practice guidelines by 4 t per hectare due to complete crop recovery. Additional FFB increases of 2 t per hectare can be explained by better agronomic management and reached 35 t per hectare in 2007.

(Fairhurst, McLaughlin (2009) Sustainable Oil Palm Development on Degraded Land in Kalimantan)

Box 2.

Roundtable of Sustainable Palm Oil (RSPO)

Palm oil yields in Kalimantan The Roundtable of Sustainable Palm Oil consists of oil palm growers, downstream manufacturers but also financing institutions and non-governmental organizations. In 2007, the RSPO has, after a long period of consultations, published more than hundred principles and criteria which ensure sustainable production of oil palm. While the majority of large Indonesian oil palm growers and palm oil producers are members of RSPO only a couple of companies, e.g. WILMAR and Cargill, have received formal RSPO cerification for selected plantations.



SOURCE: ICF, team analysis

Figure 10 : East Kalimantan needs to improve its infrastructure to attract downstream investment

It is important that we implement safeguards to ensure that greater downstream processing does not lead to increased demand for palm oil that leads to increased deforestation for new concessions. This can be avoided partly by timing the development of downstream facilities only after the identified abatement measures and policies are implemented. Locating any processing unit near palm oil concessions on degraded lands will also help as transportation costs will favor the closest concessions as sources. Finally, requiring the downstream processing facilities to use only certified sustainable palm oil (RSPO) can mitigate these risks (Box 2).

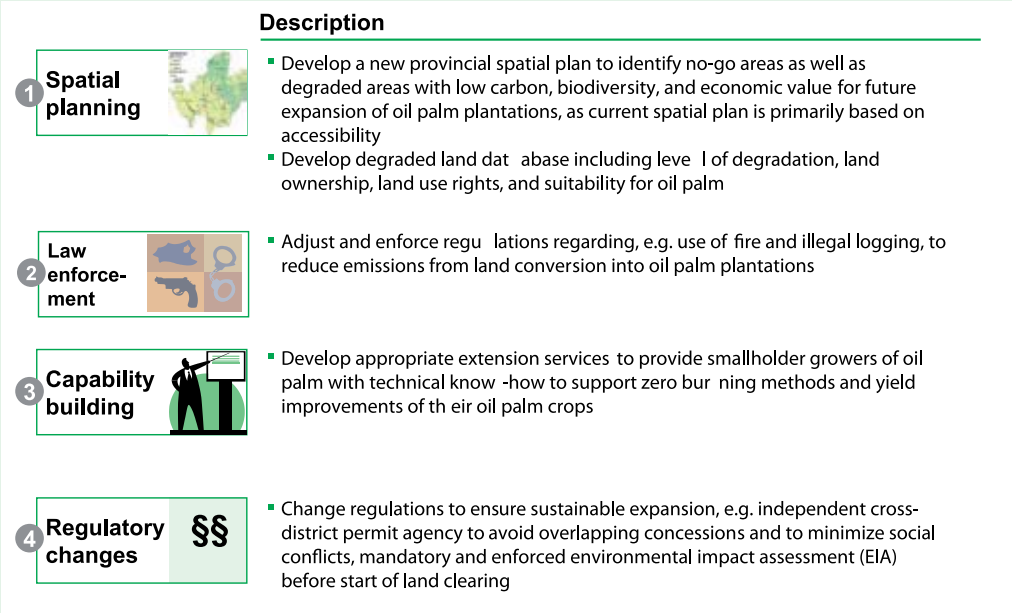


Figure 11 : Addressing critical enablers is required for successful emission reduction in the oil palm sector

Required Policies and Institutions

Implementing these initiatives to reduce emissions and improve the growth of palm oil will require substantial changes from business-as-usual practices. Four institutional and policy reforms will be critical for capturing the abatement potential from the palm oil sector (Figure 11).

Holistic and integrated spatial planning is needed to optimize land use for palm oil. The existing spatial planning approach of East Kalimantan does not take into account climate change or ecological criteria. For example, forested areas are allocated to non-forestry use (Areal Penggunaan Lain, APL), while large areas of degraded land within the forest estate (kawasan hutan) are officially designated (and therefore managed) as permanent forest areas. Going forward, a broader spatial planning approach is required that incorporates environmental, economic, and social factors. The main goal for the new spatial planning approach should be to identify degraded areas (including the size of the area, soil type and suitability for different land uses, land ownership, and current land use) outside and inside the forest estate. This will enable the prioritized use of degraded land for economic development. The permanent forest estate should comprise actual remaining forests. Spatial planning consequently has to happen in much closer cooperation between the local planning agency (Bappeda), the Indonesian Ministry of Forestry, and local communities. The inclusion of local communities in the overall spatial and economic planning process has to follow a set of standards known as free, prior, and informed consent (FPIC). This approach has been developed to respect the rights of indigenous communities and can help reduce or prevent social conflicts related to land use in an area.

Law enforcement is required to ensure policies and changes are fully implemented. At present, at least 60 oil palm concessions in the province are operating without the full set of legal permits required to do so (Box 3). It is essential for the future development of the palm oil sector that existing regulations regarding permits, the use of fire for land clearing, and illegal land clearing are enforced. Without enforcement, the lowest cost and quickest option to establish a palm oil concession would be to pay a bribe to plant on forest lands. We are committed to the national anticorruption policies and thus enforcement must have strict and visible consequences. Our efforts will also help to gain the trust of international consumers and promote the image and integrity of oilpalm- derived products produced in Indonesia.

Capability-building is needed to support the necessary behavioral change required. Emission reductions need to go hand in hand with productivity improvements so individual stakeholders gain benefits from their efforts to reduce emissions. We recognize East Kalimantan needs to provide smallholder farmers with training and technical support, as well as give them access to input components required for growing oil palms, such as cheap fertilizers and premium seedlings that will result in improved yields, lower production costs, and higher incomes.

Regulatory changes are also required to support change in the palm oil sector. At present, granted concessions exceed the total land area of the province excluding protected forests. This is a result of different agencies and levels of government being involved in the concession licensing process without common datasets or sufficient coordination. Providing an additional mandate and authority to the provincial planning agency Bappeda to track and give final approval for new concessions could help reduce duplication of concession licenses in the province and thus help reduce land-use conflicts. In general, such decision-making is pushed down to the lowest level of government as local governments have more on-the-ground knowledge and greater responsiveness to local stakeholders. However, in this case, the need to coordinate among different agencies issuing permits as well as to optimize land across all of East Kalimantan requires a central coordination effort. While there is the potential of a slightly longer bureaucratic process;

Box 3

The Case of Oil Palm Permits and Related Area Consumption

Permits for oil palm concessions are generally issued by the head of the district government, and operators require three significant steps to legally operate a concession. At present, the official target formalized in the long-term strategic plan is to have an additional 1 million ha of oil palm plantations planted by 2025.

- Location Permit (Izin Lokasi, IL) is a preliminary boundary setting of a plantation, which is issued by the district leader (Bupati or Walikota) based on a recommendation by the provincial governor. At present, location permits for oil palm plantations in East Kalimantan cover an area of 3.2 million ha, of which more than 400,000 ha are located on peatland. In the last six months, the area for location permits increased by more than 350,000 ha.
- Plantation Business Permit (Izin Usaha Perkebunan, IUP) is issued by the Governor in case of cross-district plantations or by Bupati or Walikota if not and requires an Environmental Impact Assessment (AMDAL). Although location permits and plantation permits are formally linked together and both are required, many companies operate with only one of the permits.
- Plantation Operating Permit (Hak Guna Usaha, HGU) is issued by the national land agency (BPN) and is the final step for legally operating an oil palm concession. Approved and active plantations with HGU cover approximately 465,000 ha at present, while HGUs have been issued but not activated for another 300,000 ha.

however, this does not need to be the case. The new process could actually translate into a clear competitive advantage for East Kalimantan in its efforts to attract new investments by reducing the legal complexity and time consuming delays facing oil palm investors.

Forestry Sector

Forests have always been an important resource for East Kalimantan: valuable timber is collected from legal logging, industrial plantations provide Acacia, Eucalyptus, Teak, and other tree species, communities harvest non-timber forest products, and forests provide vital ecological and environmental services such as watershed protection, biodiversity, habitat for countless species. Yet, since the 1960s East Kalimantan's production forests have experienced unsustainable rates of logging, which have resulted in the degradation of the forests. Those high logging rates could not be sustained as reserves of valuable timber were depleted and tree growth was insufficient to replace stocks. Thus, the forestry sector has declined since the mid 1990s in both relative and absolute terms in East Kalimantan's economy.

With the exception of two FSC-certified concessions, East Kalimantan's logging concessions do not meet international best practices for reduced impact logging (RIL). Unsustainable logging practices together with the conversion of natural forest into timber plantations and the decomposition of degraded peatland within the forestry estate (Kawasan Hutan) result in estimated annual net emissions of 45 $MtCO_2e$, which makes the forestry sector the third largest emitter in the province.

Significant reductions in forestry emissions are possible through the implementation of RIL practices, more efficient use of areas already designated as timber plantations, better water management in existing forestry concessions in peat areas, and a moratorium on granting new concessions on peatland. Increasing productivity in existing timber plantations and RIL within the logging concessions would enable a sustainable supply of wood to support an expanded downstream industry, which in turn would increase local employment by an estimated 40,000 to 60,000 new jobs and contribute up to IDR 20 trillion to provincial GDP.

Current Context

The forestry industry has been in a slow decline for over a decade. Still, forestry is East Kalimantan's largest sector in terms of land use, occupying an area of more than

7.5 million ha. In contrast to the large area deployed, the economic contribution of the forestry sector[13] is relatively small at approximately IDR 2.1 trillion GDP at present. This contribution to GDP has been steadily declining since the late 1990s when it peaked at IDR 3.4 trillion (Figure 12).

The decline in forestry is due to historical overlogging as well as low productivity in plantations. Many of the production forests (Hak Pengusahaan Hutan, HPH) have been over logged and illegally logged in the past and can today supply only a small number of high-value logs. Furthermore, East Kalimantan's timber plantations (Hutan Tanaman Industri, HTI) have had extremely low productivity levels, as a result of poor management practices, e.g., the inefficient use of silviculture. HTI productivity and utilization has also been slowed by lower than expected demand for timber (especially pulpwood) within East Kalimantan, as planned expansions and further investments in downstream processing capacities have not been realized.

Net emissions from forestry are significant at approximately 45 $MtCO_2e$. Four major land-use related factors are driving emissions from the forestry sector: forest degradation from legal logging, deforestation from conversion to timber plantations, peat decomposition from logging and conversion on peatlands, and fires used for clearing land and debris (Figure 13). The forestry sector is also the largest absorber of CO_2e in East Kalimantan, absorbing 34 $MtCO_2e$ in 2010.

The degradation of East Kalimantan's production forests (HPHs) is the largest single source of emissions within the forestry sector at 34 $MtCO_2e$ annually. Current logging techniques cause massive collateral damage and result in the subsequent death of many of the trees left behind when saleable timber is extracted. Emissions from this collateral damage to the forest is several times the emissions from the actual harvested trees for sale. Such damage to surrounding forest is not inevitable, but can be explained by unsustainable logging practices, minimal harvest planning, a lack of training for forest workers, a lack of management capabilities, and use of inappropriate skidding technology. All of the above result in low growth of the remaining trees. Poor logging techniques can cause the net loss of 30 percent of the initial carbon stock of a forest over a logging cycle.

The expansion of timber plantation area in recent years has resulted in large areas of natural forest being converted, causing emissions of 24 $MtCO_2e$ in 2010. Conversion of

13 Excluding wood products and pulp and paper manufacturing

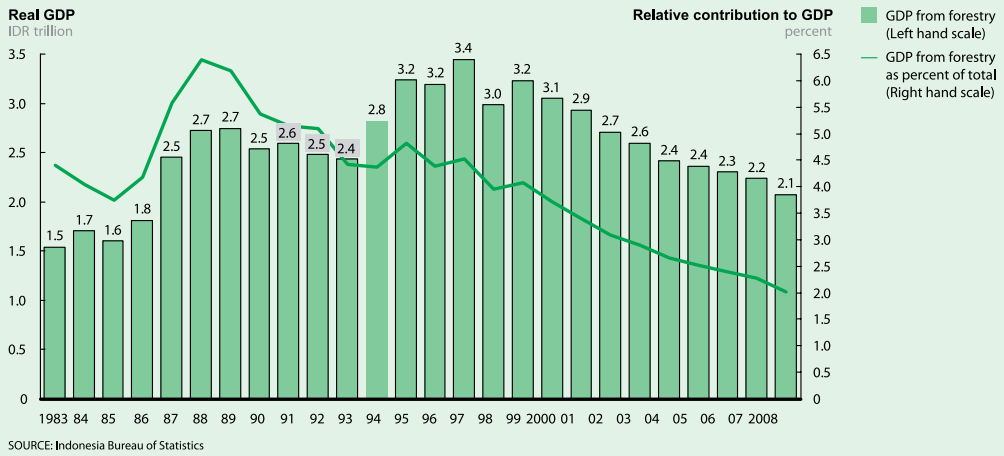


Figure 12 : GDP contribution of the forestry sector is declining since the 1990s both in absolute as well as relative measures

	Emissions Mt CO_2e	Description
Forest degradation	34	▪ Current planned logging activities are leading to a permanent loss of carbon in East Kalimantan's production forest ▪ Illegal logging is contributing significantly to forest degradation, however there are many uncertainties about size of impact
Deforestation	24	▪ Planned and unplanned conversion of natural forests result in significant net emissions even taking sequestration of plantations into account
Peat decomposition	17	▪ Drainage channels used for dewatering of peat transportation of timber and logging equipment lead to the decomposition of the peat organic matter
Fire	13	▪ Fire is used for land conversion but also land clearing from wood residues at the end of the rotation cycle

SOURCE: Ministry of Forestry Indonesia; Dinas Kehutanan; Wetlands International; Van der Werf et al 2008 Team analysis

Figure 13 : Emissions from the forestry sector have multiple causes

natural primary and secondary forests into timber plantations results in a net carbon loss of up to 70 percent of the initial carbon stock of the forest, making conversion the second largest emission source of the forestry sector.

Emissions from peat decomposition are smaller than in neighboring provinces, such as Central Kalimantan, yet still result in 13 $MtCO_2e$ emissions in 2010. East Kalimantan's peatlands are partly covered with timber plantations and logging concessions. Peat soils in these areas are degraded through drainage to allow for logging and harvesting activities. As the area of degraded peatland increases with new concessions, emissions are expected to reach 17 $MtCO_2e$ in 2030.

Fires within the borders of production forests, especially on peat soils, are another significant source of emissions, approximately 11 $MtCO_2e$ in recent years. The number of hot spots varies from year to year as fire is heavily influenced by rainfall and other weather factors. However, fires spread through degraded areas, thus these emissions are expected to increase to 13 $MtCO_2e$ in 2030 under a business-as-usual scenario with increased forest degradation. Besides emissions, fires cause massive economic losses, not least by destroying merchantable timber. The World Resource Institute estimated the financial losses caused by the ravaging fires across Kalimantan in 1997 and 1998 to be in the range of USD 3 to 5 billion.[14] In addition, fires damage the environment as well as the health of our people, leading to high levels of respiratory problems and indirect costs.

Counteracting these emissions, East Kalimantan's forests are a major source of carbon sequestration (or carbon sink). Based on different scientific publications and growth rate assumptions published by the Ministry of Forestry, it is estimated that East Kalimantan's secondary forests and timber plantations are sequestering 37 $MtCO_2e$ annually at present, of which approximately 24 $MtCO_2e$ is sequestered in natural secondary forests.

In a business-as-usual scenario (Figure 16) net emissions from forestry will grow from 45 to 71 $MtCO_2e$ by 2030. Emissions from forest degradation within logging concessions will continue at roughly the same pace as will emissions from the continued conversion of forests to timber plantations. Once drained, peatlands continue to degrade over many years, and so it is expected that emissions from peat decomposition as a result of drainage will rise and the damage from fires will also increase in newly opened up peatland. In addition, absorption from East Kalimantan's secondary forests and timber plantations will

14 World Resource Institute (2001) – State of Forests: Indonesia

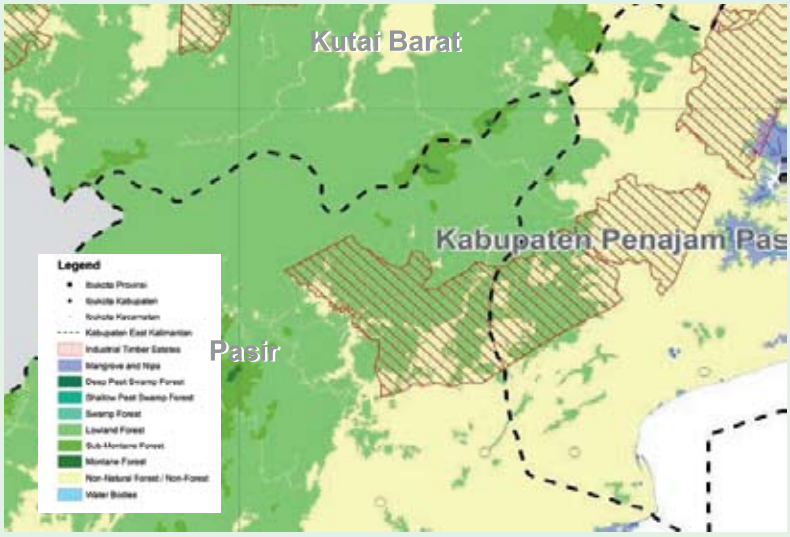


Figure 14 : Planned timber plantations on natural forest in Kutai Barat and Pasir

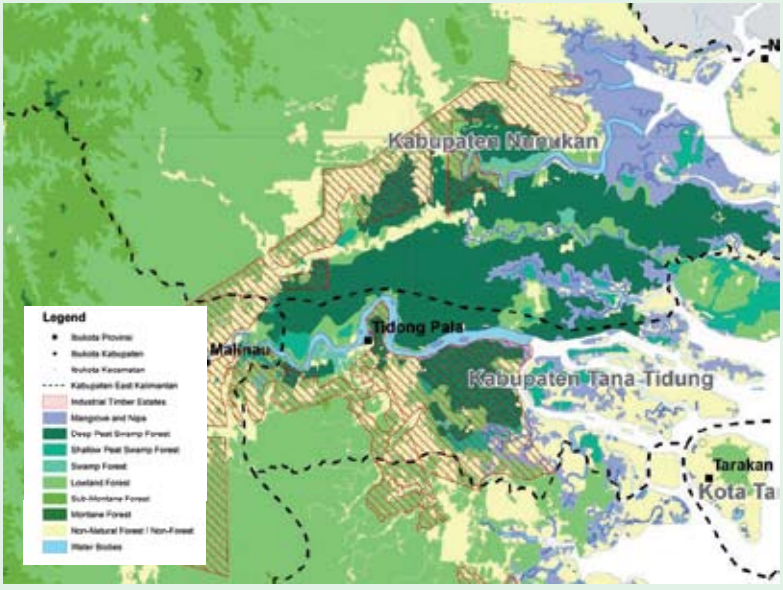


Figure 15 : Some timber plantations cover deep peat in Nunukan and Tana Tidung

be reduced to only 19 MtCO2e by 2030 as the overall size of the forest area decreases and timber plantations reach the end of their rotation cycle.

Abatement Potential

The forestry sector has the potential to become a net carbon sink over time. The forestry sector is unique; its abatement potential is larger than its estimated future gross emission levels. This abatement potential consists of the implementation of reduced impact logging in the production forest (HPHs), better water management and rehabilitation of peatland, and reforestation (Figure 17).

Reduced impact logging (RIL) is the largest abatement opportunity and could yield 34 MtCO2e by 2030. Reduced impact logging could be attractive to private companies as it allows the same amount of commercial timber to be extracted. Yet, the introduction of new harvesting techniques will require investment – training, initial capital, and monitoring. Currently, production forests, or HPHs, are largely ungoverned as they fall under the control of the national Ministry of Forestry, which lacks sufficient provincial-based staff to monitor concessions. Creating forestry management units (Kesatuan Pengelolaan Hutan – KPH) across the provinces to increase monitoring could be a powerful tool to strengthen monitoring and control and improve harvesting planning and practices, especially concerning the skidding[15] of timber. Investments in roads and skidding infrastructure are required to reduce the skidding distances and thus reduce damage caused during logging of the remaining forests. Additional investments in skidding technology and the training of forest workers are also required. The cost for implementation is relatively low compared to the abatement potential, approximately USD 0.5 to 2.5 per ton of abated CO2e. Still, for the timber companies, this translates into required investment estimated at approximately USD 50 to 250 per ha.

Utilizing degraded land for expansion of timber plantations would yield 13.9 MtCO2e of abatement. Using degraded land within and outside the forest estate for expansion should be prioritized for future timber plantations wherever possible. If not suitable for rehabilitation, degraded areas within the forest estate should definitely be used for future expansion of timber plantations. However, for other degraded lands, a new planning exercise will be needed to select the type of land use that holds the highest economic value for East Kalimantan.

15 Skidding is describing the process of hauling one or several felled logs with e.g. a bulldozer to an area accessible for other means of transportation e.g. rivers and major roads.

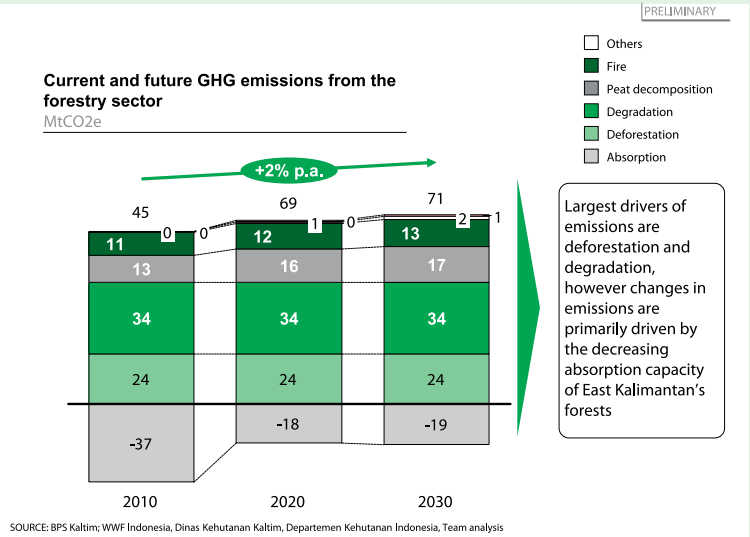


Figure 16 : GHG emissions from the forestry sector are expected to increase in a business-as-usual scenario

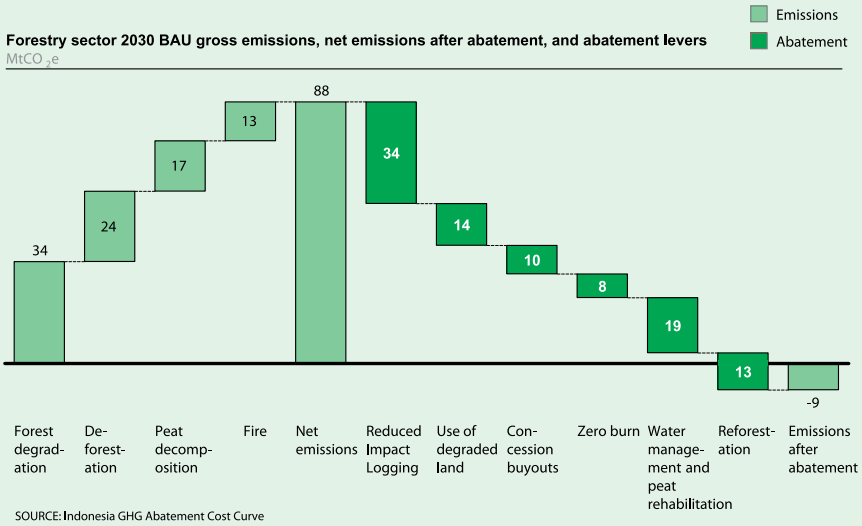


Figure 17 : Technically East Kalimantan's for estry sector could become carbon neutral in 2030

Utilizing concession buyout schemes could provide 9.8 $MtCO_2e$ in abatement. The use of standalone concession buyout schemes is the last option due to its high costs. This approach targets land owners or concessionaires and pays them for not starting economic activities, such as converting forests into pulpwood plantations. Without providing a substitute, such as degraded land or improved productivity, concessions holders may need to be compensated for the opportunity cost of the lost plantation (assuming all proper permits were received). This approach comes at relatively high cost, approximately USD 9 to 14 per avoided tCO_2e in the case of Acacia and even more for more valuable woods like Teak or Meranti. A compensation scheme that only covered historical costs and expenses would result in much lower cost per ton of abated carbon,

Improving yields in timber plantations could result in less expansion into forest, but only if coupled with other safeguard measures. Growth rates within East Kalimantan's HTIs are below best practice yields achieved in other parts of Indonesia. In 2008, harvesting targets for pulpwood plantations according to the Provincial Forest Ministry (Dinas Kehutanan) indicate an annual growth rate of approximately 20 cubic meters per ha. Best practice examples in Sumatra achieve annual growth rates for Acacia mangium of 40 cubic meters per ha. Given differences in soil quality, however, a more conservative target growth rate of 25 to 30 cubic meters per ha seems more feasible. Increasing productivity would allow for increased production with less forest conversion: approximately 150,000 ha less than in the business-as-usual scenario and result in avoided emissions of 120 $MtCO_2e$ over a period of 20 years.

Increasing growth rates can also be accomplished by using intensive silvicultural methods like thinning, better planting techniques, a better selection of seeds, and improved nursery techniques for seedlings. However, productivity improvements alone would not necessarily lead to less HTI expansion; in fact, it could make the sector more attractive and increase investment and expansion. Increased productivity would need to be coupled with additional measures to protect the available forest, for example REDD+ payments if reduced deforestation could be proven.

12.5 $MtCO_2e$ of abatement is possible from reforestation and forest rehabilitation. Degraded forests can be reforested and rehabilitated with new plantings and result in increased carbon sequestration. There is approximately 1.5 million ha of slightly critical land (agak kritis) located within the forest estate; these areas have forest cover of 50 to 60

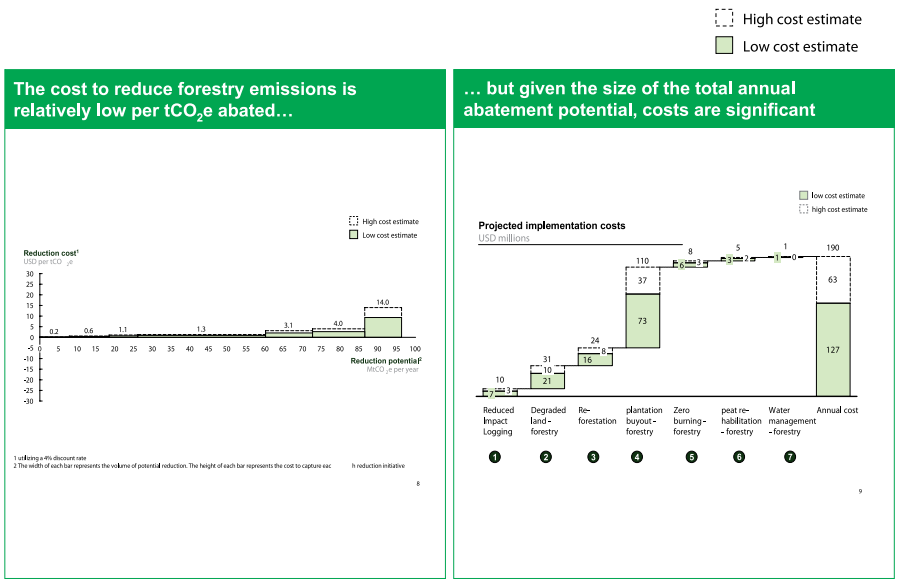
percent, and thus should not be used for land swaps for timber concessions but instead fully reforested. We have already launched a One Man Five Tree replanting program to engage the whole province in reforestation as well as raise awareness. To achieve the 12.5 $MtCO_2e$ abatement potential, approximately 35 to 40 million trees need to be planted each year to restore the degradation caused by non-sustainable logging practices.

Reforestation and forest rehabilitation only results in carbon sequestration if the replanted lands are set aside for conservation. Timber plantations are considered carbon neutral as nearly all carbon sequestered as trees grow is lost once they are harvested; thus replanting for timber plantations yields no permanent abatement of emissions. Reforestation and forest rehabilitation comes at a relatively high cost of approximately USD 2 to 5 per tCO_2e. However, fostering natural regeneration (if the remaining trees provide enough potential) by weeding and other techniques to increase the viability of tree seedlings could reduce the costs substantially and should be the preferred option for rehabilitation wherever possible.

Water management and peatland rehabilitation initiatives can produce 17 $MtCO_2e$ of abatement. The goal is to minimize drainage in logging and timber concessions on peatland to 50 to 70 cm below the peat surface. High growth rates of Acacia are possible at this level; any further drainage would result in higher emissions from peat decomposition, while lower drainage would result in decreasing yields. Drainage to 50 to 70 cm below the surface also allows for the transportation of pulpwood in the drainage channels. Proper water management requires an assessment of the hydrtological conditions around the peat domes and the construction of dams and sluice gates to regulate the water level to allow transportation of felled timber. In addition, water management can help to reduce the risk of flooding in the wet season and prevent the risk of drought in the dry season, events that often reduce yield and therefore result in financial losses.

Water management is relatively low cost, with an associated cost below USD 1 per abated tCO_2e. While the restoration of peatlands via water management is low cost, replanting degraded peatlands is relatively expensive with costs of USD 500 to 1,100 per ha, or USD 2 to 5 per ton of sequestered CO_2e. Fostering natural regeneration of existing tree cover could reduce the replanting costs significantly and should be applied wherever possible.

Fire prevention and management could yield 8 $MtCO_2e$ in abatement annually by 2030. The prevention of peat fires has a significant emissions abatement potential at a



SOURCE: JP Morgan, EMRP Masterplan, Ministry of Forestry, Wetlands International, team analysis

Figure 18 : Significant financial resources are required to reduce emissions within the forestry sector

relatively low cost of less than USD 1 per avoided tCO_2e. Major emission reductions could be achieved by implementing a zero burning policy to prevent encroachment of fires into plantations and logging concessions, providing appropriate and practical equipment (and, if appropriate, financial incentives) for fire fighting, developing appropriate early-warning systems based on fire risk status and field-based fire detection, strengthening fire brigades, ensuring strong enforcement and large penalties for rule violations, and building public awareness of the economic and social costs of forest fires in the province.

Costs for reducing carbon emissions within the forestry sector are, with the exception of a plantation concession buyout, relatively cheap if calculated per ton of abated CO_2e basis, averaging to USD 1 to 2. However, given the sheer size of the overall abatement captured, total costs reach considerable levels of up to USD 190 million per year (Figure 18).[16]

16 The two already FSC certified concessions of PT Sumalindo and PT Intracawood have not been considered as pilots, however those concessions could be models for future sustainable logging activities

Pilot Projects

Pilot projects have been identified for five abatement initiatives across the province, which could result in annual emission reductions of 34 MtCO2e. Pilot projects for implementation will need further screening to take into account important criteria such as support from companies and the communities involved and potential biodiversity benefits. A first list of potential pilot projects has been identified to target opportunities providing the largest abatement with quick, significant emission reductions and further economic development by (Figure 19).

PRELIMINARY

	Description	Abatement[1] MtCO2e
Reduced impact logging	▪ Pilot RIL based on new harvest planning system, skidding track layout, and harvesting technology in the 3 largest concessions in each district ▪ Implement empowered forest management unit across the province overseeing 10,000 ha of forest per employee	12.0
Degraded land	▪ Develop pilot projects to establish timber plantations on degraded land in Berau, Kutai Barat, Kutai Kertanegara, and Kutai Timur with support of TNC, WWF, and GTZ to capture potential of approx. 50% of total degraded land area	7.4
Concession buyouts	▪ Develop pilot projects in Berau and Kutai Barat to avoid ongoing emissions from forest degradation and inactive concessions	3.0 [1]
Peatland in Nunukan	▪ Rehabilitate drained and degraded peatland within concessions ▪ Implement water management in active concessions	4.0
Reforestation	▪ Rehabilitate slightly critical land in Kutai Kertanegara, Kutai Timur, and Kutai Barat to restore ecosystem services and carbon sequestration	8.0

1 if implemented to 100% of technical abatement
2 with sufficient international and domestic funding for REDD
SOURCE: team analysis

Figure 19: Identified potential pilot projects could reduce annual emissions by 34.4 Mt CO_2 e

The potentially largest pilot group would be to implement RIL within the 10 largest logging concessions. Those concessions cover an area of more than 1.7 million ha, and focusing on cooperating with those companies to implement RIL within those concessions could reduce emissions by approximately 12 $MtCO_2e$ p.a. while maintaining harvesting volumes at least at current levels. Seven concessions identified for the pilot are held by private companies, and three concessions are held by the state owned enterprise PT Inhutani.

Water management in active plantations and logging concessions and peat rehabilitation in inactive ones could be piloted in Nunukan. Nunukan holds the largest areas of deep peatland within the province. Action to protect and minimize degradation of those deep peatlands is urgent, as nearly the total area is already covered (but not yet developed) with concessions (Figure 20). Effective action on peatland in Nunukan could result in a significant emission reduction for the forestry sector of up to 4 $MtCO_2e$ p.a.

Other pilot projects include using degraded land within the forest estate for timber plantations. Districts like Malinau or Berau, have large and undisturbed forest cover, but their forests are under severe threat. They could be prepared for a REDD payment scheme. The latter project could also be part of the nationwide pilot to be launched in 2011 in accordance with the Norway–Indonesia REDD+ partnership signed on May 28, 2010. None of the potential pilot projects described above should slow economic growth; concession holders will be allowed to proceed with their economic activities.

GDP Potential

The economic decline of the forestry sector in East Kalimantan can be reversed through raising productivity and investing in downstream activities. These moves would increase the forestry sector's GDP by IDR 16 trillion by 2030 (Figure 22). The initiatives described earlier will reduce emissions from our current logging and harvesting activities, but such efforts should be complemented with efforts to extract more value from these activities. Currently, much of the felled timber from logging is left as waste in the forest: thiscould be further processed. After forests are converted to plantations, there are different opportunities to raise productivity within those concessions. And finally, much of East Kalimantan's timber is exported to Sumatra and Java where it is processed into higher value products such as pulp or furniture. East Kalimantan has the opportunity to capture a larger share of the downstream value-add going forward.

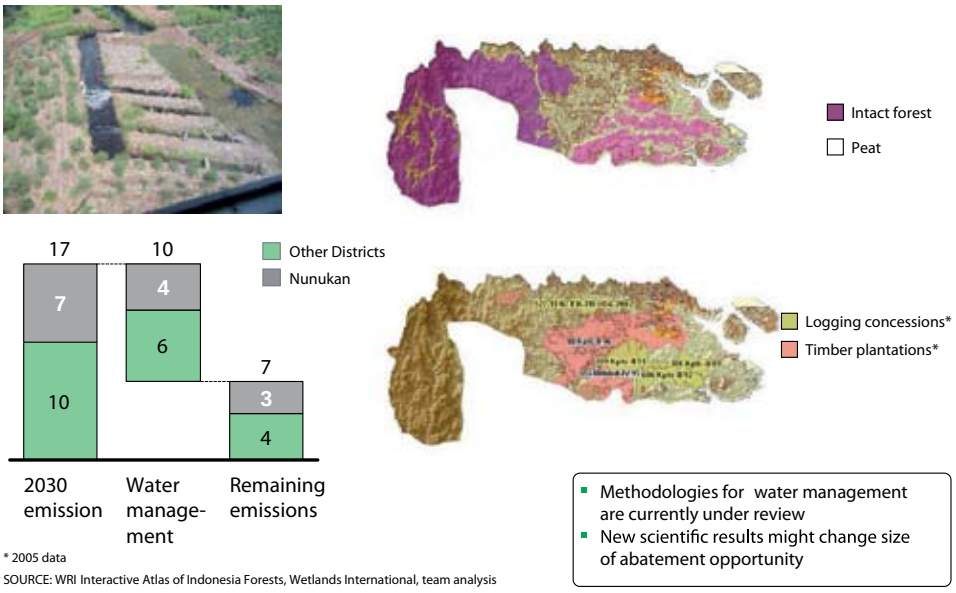


Figure 20 : Piloting water management and peat re habilitation in Nunukan's timber and logging concessions could result in 4 $MtCO_2e$ of avoided emissions

Improving timber utilization could yield IDR 0.7 trillion in additional GDP. Currently, logging operations produce large volumes of waste. The logging companies currently sell to domestic plywood and veneer mills or other solid wood applications. These buyers are interested in only large diameter logs. Thus, large volumes of small-diameter wood (e.g., tree crowns) and wood residues are left behind in the forest after the trees are cut. A more efficient approach is to fully utilize the felled trees and thus gain higher revenues from a given land area. A common approach in Europe, North America, and Brazil is to use large-diameter wood for high-value applications (as is already done in East Kalimantan), but then to sell small-diameter wood and wood residue for lower-value applications like pulp and paper, board manufacturing, and the production of wood chips and wood pellets (Figure 23).

Growth rates in East Kalimantan's timber plantations could be substantially improved and idle plantations brought back into production. As noted earlier, growth rates in

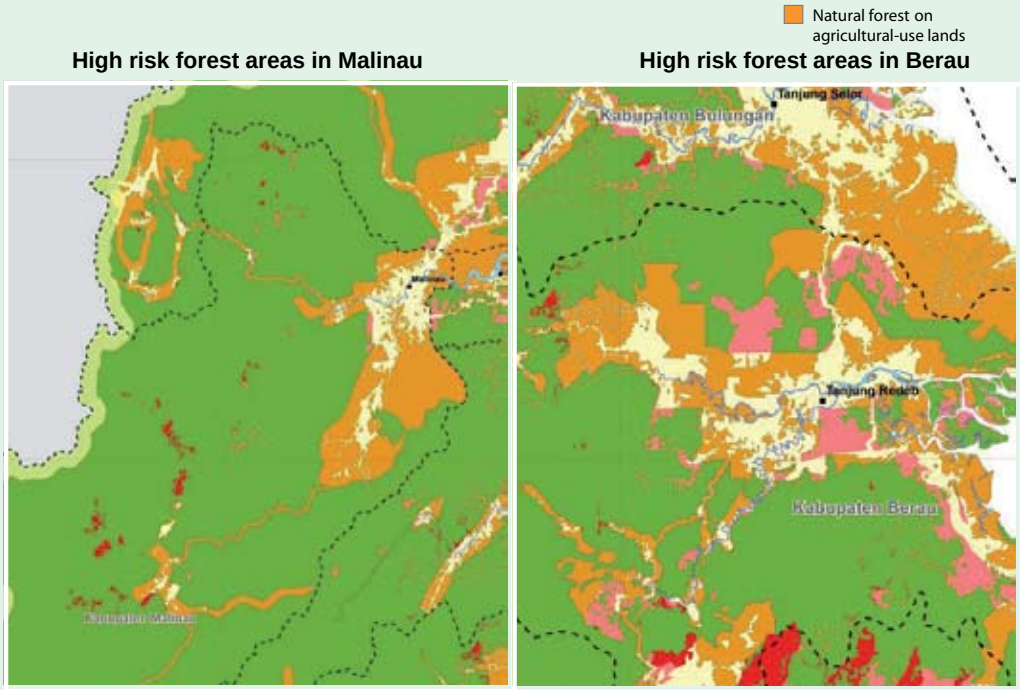


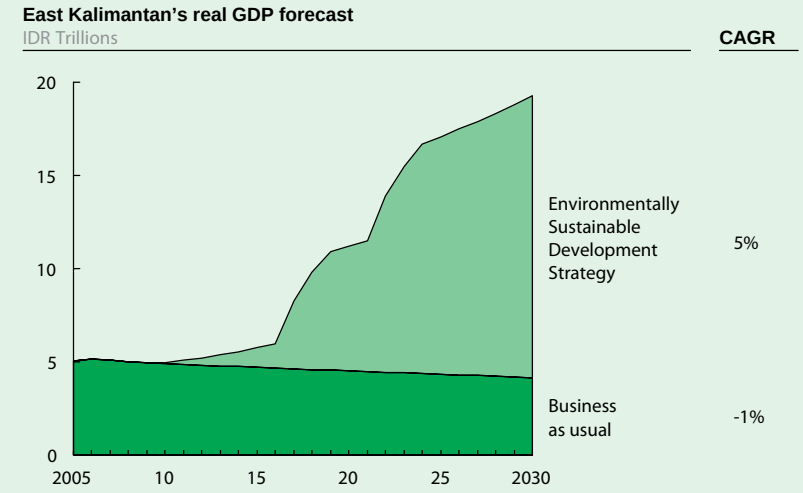
Figure 21 : REDD payments should focus on forest areas at most risk

East Kalimantan's industrial pulpwood plantations are low compared with best practice benchmarks in other parts of Indonesia. The annual growth rate is around 20 cubic meters per ha, while up to 40 cubic meters per ha is achieved in other parts of Indonesia. Given differences in soil quality, a more conservative range of 25 to 30 cubic meters per ha is targeted.

Increased yields could also come from bringing idle plantations back into production. At present, East Kalimantan's pulpwood plantations cover an area of approximately 800,000 ha, the majority of which were established during the 1990s. In line with current environmental regulations, approximately 160,000 ha have to be set aside for nature conservation (e.g., watershed protection and wildlife corridors) while the remaining area could be used for economic purposes. In theory, these 640,000 ha could yield an

annual volume of approximately 23 million cubic meters,[17] more than enough to supply a viable forest products industry. However, currently only 165,000 ha are actually planted, while the remaining area is degraded, and lies idle. Low productivity, and this low rate of planting mean East Kalimantan's annual harvest is only 0.7 million cubic meters. The continued conversion of natural forests into plantations is unnecessary for growth in the sector. Instead of expanding the overall plantation area, the focus should be on improving yieldsand ensuring that the area set aside for industrial timber plantations is fully utilized. Realizing this approach could increase annual sustainable wood production and the economic contribution from production forests by a factor of ten.

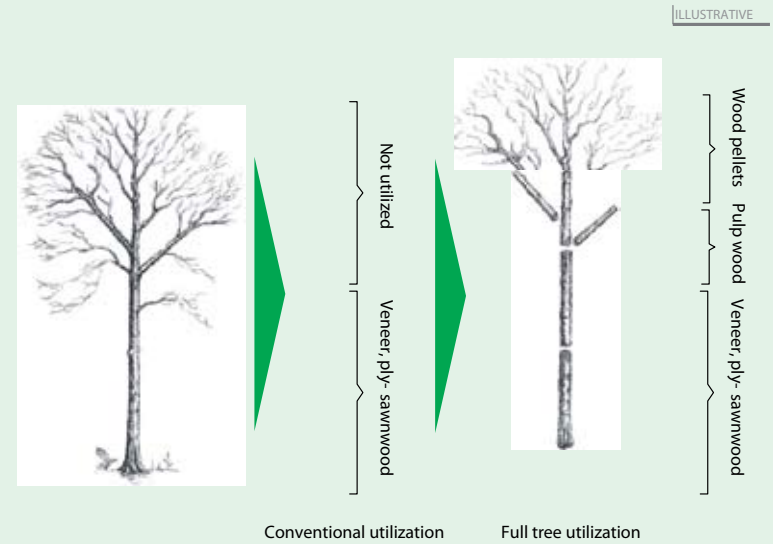
Downstream manufacturing (IDR 8.5 trillion): Several opportunities exist for the industry to move downstream into higher value-added production businesses. Based on future market developments, the largest opportunities are likely to be in pulp and paper and wood pellet production, which ideally would be located in close proximity of each other to lower costs of logistics, raw material, and energy. Additional opportunities for niche companies exist in production of high-value furniture (Figure 24).



SOURCE: team analysis

Figure 22 : Yield improvements in HTI, and increasing value added production could increase the GDP of the forestry sector to IDR19.3 trillion by 2030

17 Assuming plantations planted with Acacia maginum and Eucalyptus species



SOURCE: Institute of Forest Utilization Freiburg, team analysis

Figure 23 : Utilizing trees fully can increase the value from logging activities and decre ase harvesting waste

- **Pulp and paper:** In the pulp and paper sector, Indonesia has a proven track record of beworld class in terms of production. The pulp mills in Sumatra are amongst the worand lowest cost production sites.,They are extremely controversial from an environmental perspective as insufficient supply from plantations being heavily supplemented by timber cleared from natural forests. Sustainable pulp production in East Kalimantan would be competitive globally given its low costs and advantages of its location relative to the India and China markets for pulp.

  As described above, the area of East Kalimantan's industrial timber plantations to supply more than 20 million cubic meters of pulpwood if managed with best internatpractices. This volume would meet the full production requirements for the exiNusantara pulp mill in Berau, approximately 6 million cubic meters per year, as well as provide another 2 million tons of market pulp.

  The production of market pulp would result in a significant contribution to East Kalimantan's GDP and also provide significant working opportunities for our people (Figure 24). Prices for market pulp recovered quickly from the dip during the economic

	Description
1 Pulp and paper 	▪ A total of 300,000 ha of plantations required to produce 2 million tons of hardwood market pulp ▪ Demand for pulp is expe cted to increase steadily in China and India ▪ 2 millions t of pulp are worth USD 1. 5 billion at current market prices and would result in approx. 100,000 jobs
2 Wood pellets 	▪ Wood pellets can be produced from wood residues of the pulp and plywood industry ▪ Excess steam and electricity from near by pulp mills will make pellet production extremely cost competitive ▪ Steady demand in Europe and potentially china and Japan
3 High value furniture 	▪ FSC certified furniture could provide high value export opportunities from East Kalimantan's HPHs ▪ However, price premiums for certified products are still uncertain

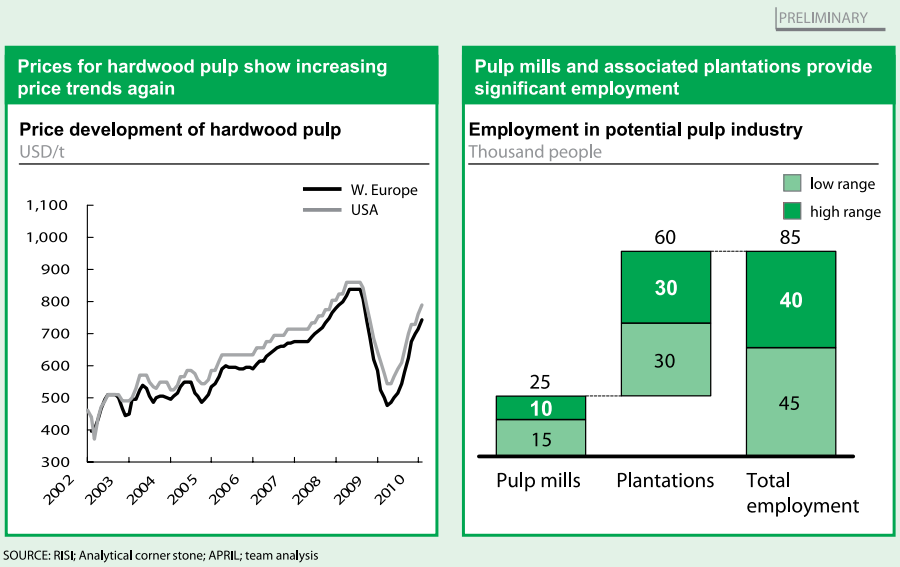
Downstream manufacturing investment cannot run ahead of investment in sustainable and certified sources of timber, whether from new plantations on degraded land or as a result of better productivity from existing plantations

Figure 24 : Downstream manufacturing would increa se economic value of the forestry sector, however wood supply needs to come from sustainable resources

crisis in 2009 and have reached levels of nearly USD 800 per ton delivered to Europe or North America. At this price level, the production of 2 million tons of market pulp coulrevenues of USD 1.6 billion p.a. The number of employees required to run a puadjacent plantations is significant as well. Pulp mills in Sumatra employ between 30,000 and 50,000 people for the production of 1 million tons of pulp.

Significant safeguards would need to be put in place before the expansion of the pulp and paper production capacity. Increasing the demand for timber without fsustainable supply will only lead to increased overlogging and deforestation. There are severaoptions to ensure the pulp and paper mills use only timber from sustainable plantations.

Investment loans for the mills could be routed through the IFC or other organization with established safeguard procedures. Timing the development of the pulp and paper mill to begin construction only after sustainable plantations have been planted



SOURCE: RISI; Analytical corner stone; APRIL; team analysis

Figure 25 : At current market prices, additional 2 million t of pulp will result in revenues of 1.5 billion USD annually and provide significant job opportunities

is another measure. Even choosing an appropriate location will help; as transportation is a major cost driver for a pulp and paper mill, locating any expansion in an area of degraded lands will make nearby timber plantations the preferred source from a commercial perspective.

- **Wood pellets:** Wood pellets for bioenergy production is a rapidly growing market in Europe and other developed markets. Opportunities exist also in domestically, especially for Indonesia's increasing number of small-scale decentralized power plants. Given sustainable sources of wood supply (residue from logging operations and saw mills or dedicated biomass plantations) and a location close to a nearby pulp mill, which would enable synergies from wood logistics and excess steam and electricity, wood pellets are competitive even for export to Europe. A sizeable plant with a capacity of 200,000 tons could yield revenues of approximately USD 20 to 25 million at current market prices with a return on investment (ROI) between 16 and 22 percent.
- **High-value furniture production:** Moving downstream into high-value furniture

production is an option for small to mid-scale plywood or veneer producers as it does not require the massive investments of the pulp and paper industry, which is based on large production volumes. Both international and domestic market opportunities exist, but complex logistics make local markets more attractive from a profit basis.

Overall, East Kalimantan is well positioned to develop its forestry industry with several downstream opportunities. Achieving high yields and utilizing wood resources better would enable East Kalimantan to provide the basis required to attract investments into the forestry industry. However, we will work to ensure that any changes to the forestry sector are based on sustainability. If a sufficient supply from sustainable sources cannot be achieved, we will not pursue expansion of downstream manufacturing as it would result in further deforestation and forest degradation, as has happened in other provinces.

Required Policies and Institutions

Several critical enablers are needed to implement the identified initiatives for reducing emissions and increasing GDP in the forestry sector. Four critical enablers have been identified. These include a new spatial planning approach, regulatory changes and enforcement, capacity-building to successfully implement sustainable forestry practices, and implementation of a reliable and up-to-date monitoring, reporting and verification system, which would be supported by the new forest management units.

Spatial planning: The existing spatial planning approach of East Kalimantan does not take into account climate change or ecological criteria. For example, forested areas are allocated to non-forestry use (Areal Penggunaan Lain, APL), while large areas of degraded land within the forest estate (kawasan hutan) are officially designated (and therefore managed) as permanent forest areas. Going forward, a broader spatial planning approach is required that incorporates environmental, economic, and social factors. The main goal for the new spatial planning approach should be to identify degraded areas (including the size of the area, soil type, suitability for different land uses, land ownership, and current land use) outside and inside the forest estate. This will enable the prioritized use of degraded land for economic development. The permanent forest estate should comprise actual remaining forests. Spatial planning consequently has to happen in much closer cooperation between the local planning agency (Bappeda), the Indonesian Ministry of Forestry, and local communities.

Regulatory changes: Current legislation regulating harvesting practices in Indonesia does not support sustainable forest management as it only focuses on volumes of merchantable timber and doesn't address the overall felling and skidding process. To be able to enforce RIL those regulations have to be broadened to consider the complete harvesting process. A new regulation published in 2009 by the Ministry of Forestry is trying to address sustainability, however the regulation is vague and not strong enough to enforce RIL. In addition, current regulations prohibit the felling of smaller trees for commercial purposes, i.e., those below 50 cm diameter at breast height (dbh). Changing those regulations would allow thinning, which can help focus the forest's future growth on the most valuable trees by providing enough light and space to foster natural regeneration. If properly done, thinning and improved natural regeneration result in higher growth rates and therefore better carbon sequestration. However, thinning and other intensive silvicultural treatments result in a loss of biodiversity as they focus on a small number of high valuable tree species and not necessarily on biodiversity. In the long term we need to seriously consider a complete replacement of logging in natural forests by sustainable timber plantations.

Law enforcement: Illegal logging – in the form of large-scale forest conversions into plantations without legal permits, logging levels exceeding the target given by the Ministry of Forestry, and illegal smallholder activities – remains rampant in East Kalimantan and is leading to high levels of deforestation and forest degradation. In order to better enforce the law, we need to employ additional forest rangers for the newly established forest management units (KPH), and ensure strict and visible consequences for illegal action, e.g., high fines and long jail terms.

Monitoring, reporting, and verification (MRV): All of the above efforts should be supported by an MRV system to assess the emission reduction efforts and to measure, report, and verify the impact of those efforts to a nationwide MRV system. In order to reduce transaction costs and increase the likelihood of carbon reduction projects attracting international carbon market payments for verified emission reductions, it is critical that the provincial government incorporates methodologies that have already been independently verified, are in line with national government regulation, and allow the establishment of a province-wide approach that includes local communities. Local communities could play a key role in ground-truthing satellite images in the field, which would also create additional jobs and increase income in local communities.

Agriculture Sector

Agriculture remains an important part of East Kalimantan's development and is one of the most important opportunities to improve rural livelihoods. Although agriculture, excluding palm oil, represents only 4 percent of East Kalimantan's overall GDP, in some rural districts it accounts for 20 percent of GDP. Its impact on rural communities is even broader as it accounts for almost 20 percent of total employment. By bringing jobs and incomes to rural households, which are typically poorer than the average household in East Kalimantan, agriculture is one of the most effective anti-poverty economic development strategies; by some estimates, a 1 percent increase in agricultural GDP can translate into 6 percent more spending for rural households. Yet, current agricultural practices also led to significant emissions from land use, and there are substantial opportunities to reduce the sector's carbon footprint. In this section, the agricultural sector includes both production of food crops and estate crops but excludes palm oil, which is addressed in a separate section given its disproportionate size and growth.

Current Context

East Kalimantan's agricultural sector is divided into food crops, dominated by rice production, and estate crops. Over 178,000 ha of agricultural lands are planted with food crops, often for subsistence farming. Rice is by far the largest food crop, accounting for almost 90 percent of production by hectare. Estate crops, excluding palm oil, are roughly equal in area to food crops with 181,000 ha planted. Rubber, followed by cocoa and coconuts, are the largest crops accounting for 80 percent of planted areas. Compared to Java and Sumatra, agriculture is small in East Kalimantan, taking up just 2 percent of land and 4 percent of GDP, but is still important for rural communities.

Agricultural practices differ substantially by type of farming in East Kalimantan. There are four main types of farming in East Kalimantan, upland food crop production, lowland food crop production, perennial estate crop production, and swidden or shifting cultivation. These are not mutually exclusive as individual farmers engage in multiple types of farming. Lowland farming is dominated by irrigated paddy rice fields and common among Javanese migrants. Upland farming is conducted in rainfed, hilly areas; again rice is the most common crop, but its yield is almost half that of lowland rice. Perennial estate crop farming practices differ by the type of crop. For example, the pepper plantations common among Buginese migrants are typically developed for three to five years, after which the

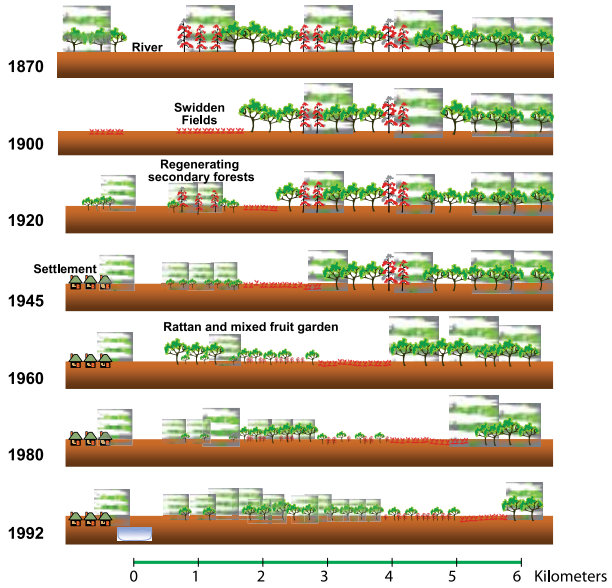
soil is depleted and must be restored or abandoned for new farmland. Rubber plantations, by contrast, take 10 to 15 years to reach peak productivity. Swidden or shifting cultivation involves the clearing of agricultural or forest land, typically by fire, cultivating the land for a short period until fertility or weeds decrease productivity, then shifting to a new area, eventually rotating back through fields as they have been restored. While conventional wisdom holds that shifting cultivation is a major force of deforestation and is inherently unsustainable, its impact depends on the length of the rotation. The swidden agricultural practices by Dayak tribes are considered more sustainable given their long rotation periods compared to swidden practices on lowland, smallholder estate crops, which have shorter periods.

Agriculture accounted for substantial emissions of 52 $MtCO_2e$ in 2005, primarily from its expansion into forests and peatlands. Agricultural processes, such as the fuel used to run farm equipment and transport crops, and methane release from flooded rice paddies, account for only 3.2 $MtCO_2e$ currently. The other 94 percent of emissions are due to the opening up of forest land for new agriculture (9.4 $MtCO_2e$), use of fires to clear land and their spread and subsequent destruction of abandoned lands (31 $MtCO_2e$), and peat decomposition from active and abandoned peatlands which have been opened and drained for agriculture (8 $MtCO_2e$). These emissions are greatest in the districts of Nunukan, Kutai Kertanegara, and Kutai Barat, respectively.

Abatement Potential

Agriculture can decrease its current CO_2 footprint by 24 $MtCO_2$ by 2030 through a policy of zero burning and the rehabilitation of peatlands. Smallholder fires represent a significant source of emissions. A zero burning policy could deliver 18.5 $MtCO_2$ at a cost of USD 0.40 per ton (excluding implementation costs) through a program of alternative land clearing methods, rigorous fire prevention, and the use of local fire fighting brigades. Rehabilitating degraded peatlands that were opened for agriculture and then abandoned will provide 5.4 $MtCO_2$ of abatement at a cost of USD 5.20 per ton.

A zero burning policy can reduce emissions from forest fires by prohibiting fire as a tool for land preparation, establishing fire brigades, and ensuring strong enforcement and large penalties for rule violations. On average, 250,000 hectares of land in East Kalimantan are burned each year. Pristine forest is virtually fire-proof, so the complementary strategy is to prevent land conversion of intact forests. Active agricultural lands are burned to prepare



SOURCE: Southeast Asia Sustainable Forest Management Network

Figure 26 : Swidden agricultural practiced by Diak Lay, East Kalimantan

for planting, so fire prevention strategies would include investments in alternative tools for land clearing and training. These strategies should also aim to remove regulatory incentives that encourage fire clearing as a means to prove 'active cultivation' for the purpose of retaining concessions or proving ownership. Abandoned lands are quite vulnerable to fires that spread from active lands. Thus, an important element of fire fighting strategies is the expansion of community fire brigades which can quickly identity and deal with fire hot spots.

Rehabilitating peatlands can be done by adjusting and maintaining the water table at a more sustainable level and through reforestation and wetting of degraded peatland that has little food or feed production value. Smallholder agriculture requires draining peatlands by 50 cm on average, which results in exposed peat that reacts with oxygen and releases CO_2e. For one ha of a smallholder plot, an average of 27 tCO_2e is released annually assuming a drainage level of 50 cm. Building dam systems and applying best

practices in water management can lead to a less destructive way of peatland utilization to a more sustainable level.

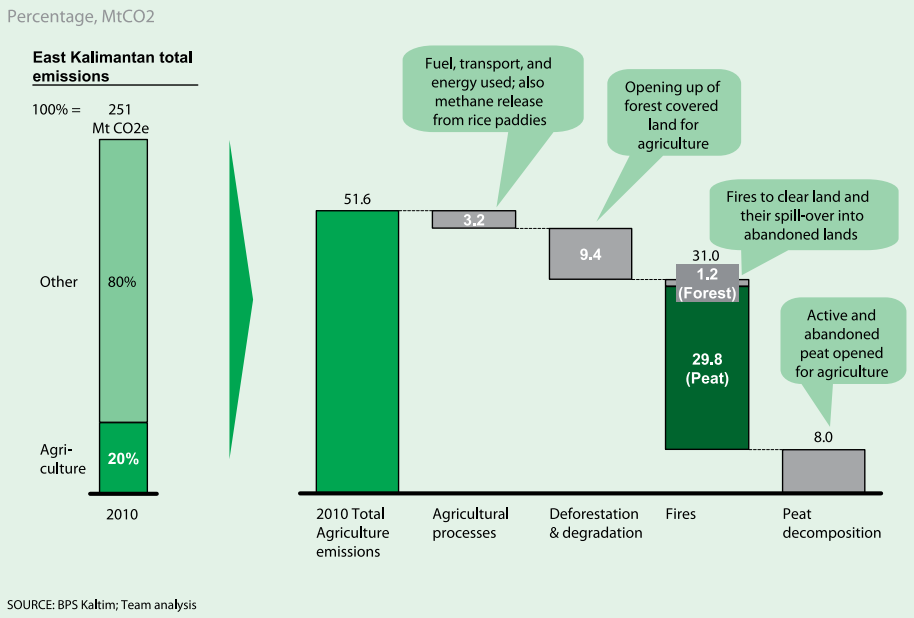


Figure 27 : Agriculture has substantial emissions largely from expansion into forest and peatlandsand the use of fires

Pilots

Almost 80 percent of the abatement opportunities can be captured by focusing on pilot districts with the highest emissions. The four districts of Nunukan, Kutai Kertanegara, Kutai Barat, and Kutai Timur account for 80 percent of the 18.5 $MtCO_2$ potential abatement from implementing a zero burning policy. Nunukan's fires, for example, are largely concentrated in two areas of about 60,000 ha near to and on peatlands. One command post and six brigades could likely cover most of the district's fires. Whereas in Kutai Kertanegara, fires are spread across wide areas, likely raising costs above the provincial average. Within this district, fire prevention brigades should focus on the 700,000 ha of land that is mostly degraded peat and thus susceptible to fire and large emissions. In terms of abatement from rehabilitating abandoned peatlands, 80 percent of the potential abatement will come

from the four districts of Nunukan, Kutai Kertanegara, Kutai Barat, and Bulungan. These potential pilot projects have been identified based on abatement potential; a finalized list of pilots would also need to assess criteria such as types of farmers in each area and community support.

GDP Potential

There is an opportunity to increase the value added from agriculture by boosting yields, which could yield IDR 3.2 trillion in additional GDP by 2030. East Kalimantan's yields on major food crops, such as rice and cassava, are 60 percent below best practice yields in Java and Sumatra. This is partially due to the difference in soil quality: East Kalimantan lacks the rich volcanic soils of Sumatra for example. However, low yields are caused not only by poor soil conditions, but also from low access to inputs such as fertilizers, seeds, and farming equipment. Even compared to the yields across all of Indonesia, East Kalimantan's production is still 20 percent below average production (Figure 31). If East Kalimantan could raise its agricultural yields to the average yield level in Indonesia, it could increase the annual growth of its agricultural GDP from 3 percent to 6 percent p.a. by 2030. This would result in an additional IDR 3.2 trillion of GDP in 2030 (Figure 32). Improving yields requires better seedlings, inputs, and farming practices, all of which will require substantial support to implement with many smallholders farmers on their lands. It will be important to raise yields sustainability and not by overuse of fertilizers alone, which could result in other environmental degradation.

Expanding aquaculture and estate crops on degraded land will allow the agricultural sector to expand and increase incomes for smallholders. There are over 50,000 ha of small plots and 400,000 hectares of mid-sized plots of degraded land that could be used for smallholder estate crops. A wide variety of estate crops can be grown in East Kalimantan, but a mixture should be used to balance the demands of capital, return, and jobs (Figure 33, Figure 34). While coconut generates high revenues of IDR 42 million per ha, it also requires a high capital investment in the early years of IDR 128 million per ha. Cocoa, in contrast, yields only IDR 20 million per ha, but requires much less investment at IDR 20 million per ha. Seaweed generates almost twice as many jobs per ha as rubber, but requires twenty times the initial investment. Seaweed also has the quickest payback of only two and a half years.

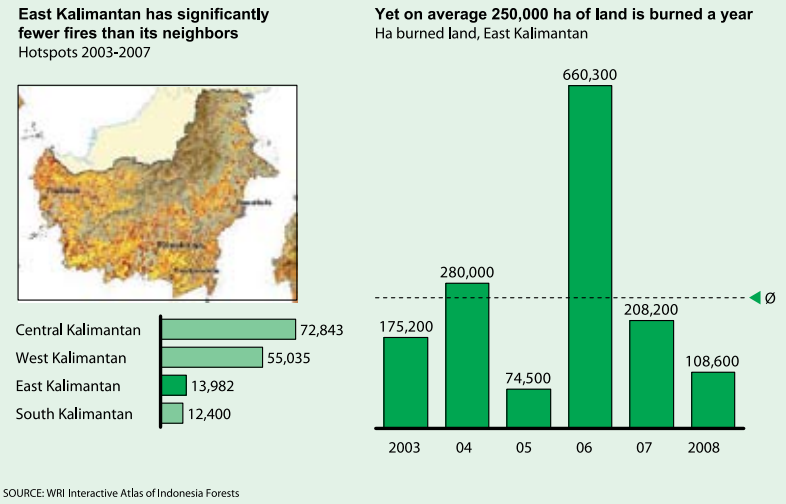


Figure 28: Although East Kalimantan has far fewer fires than its neighbors, a substantial amount of land is still burned each year

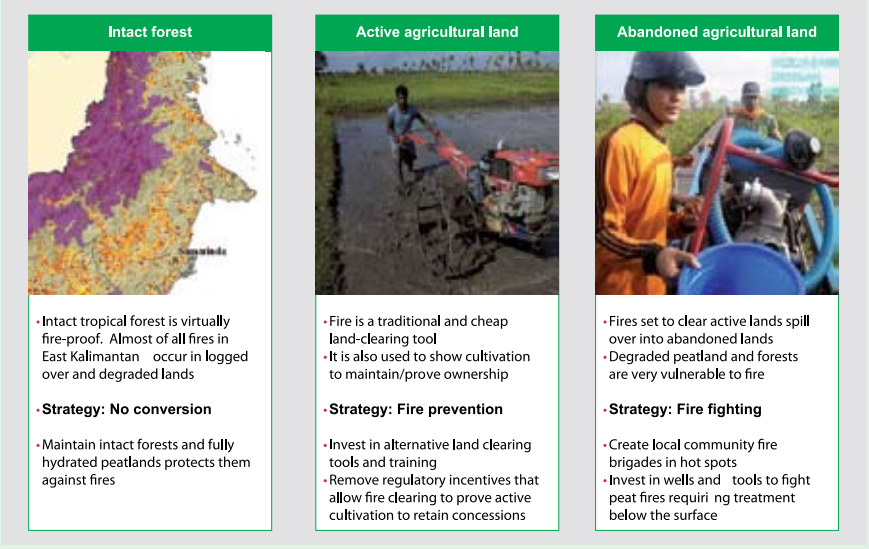
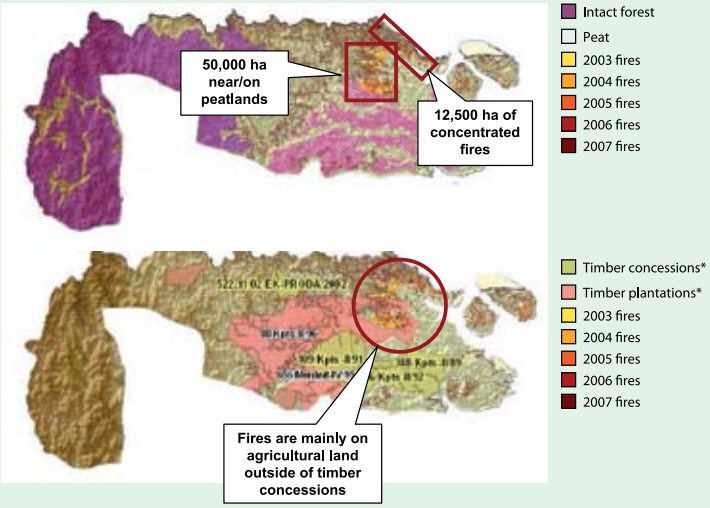


Figure 29 : Zero burning policy must be tailo red to different types of land



* 2005 data

SOURCE: WRI Interactive Atlas of Indonesia Forests

Figure 30 : Nunukan's fires are quite concentrated, on the border of a major peatland and outside current timber concessions

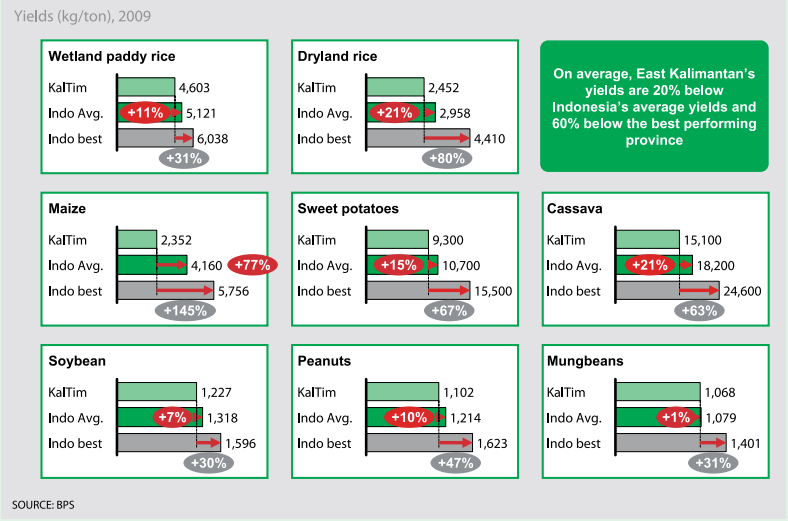
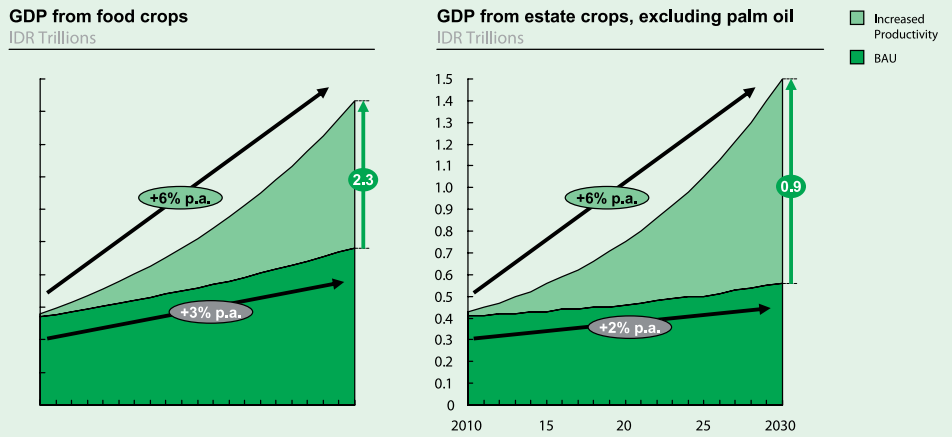


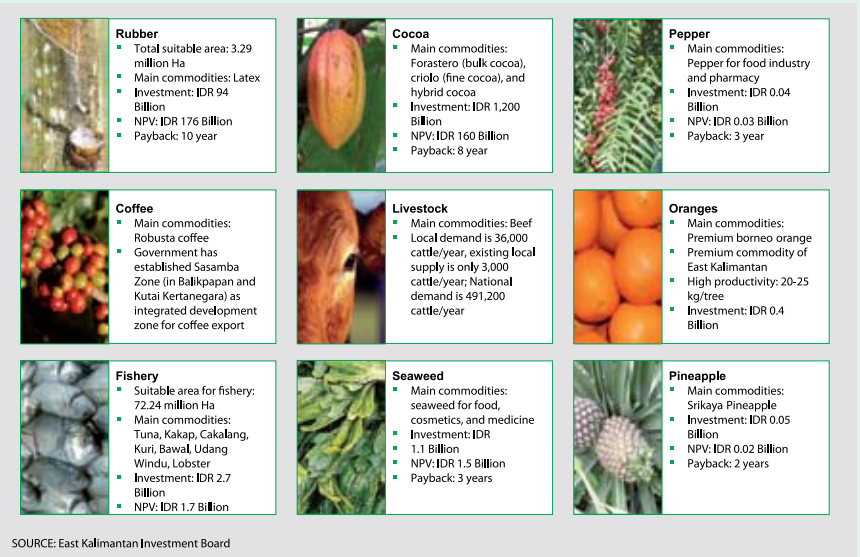
Figure 31 : East Kalimantan has the potential to raise crop yields by at least 20% and increase productivity in the agricultural sector



1 Scenario where East Kalimantan yields reach the forecasted average national yields in 2030; forecast national 2030 yields estimated by 2009 national yields grown at historical national annual productivity improvements

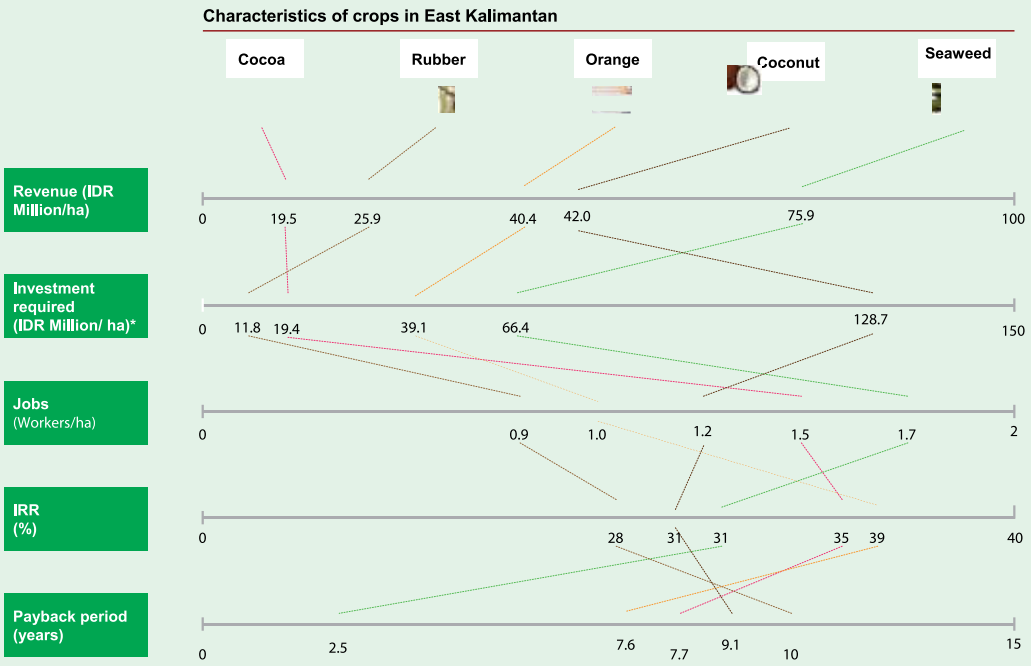
SOURCE: Team analysis

Figure 32 : Reaching average national yields by 2030 would increase the province's GDP from agriculture by IDR 3.2 trillion



SOURCE: East Kalimantan Investment Board

Figure 33 : New pockets of environmentally sustainable growth can be developed from agriculture and aquaculture on already degraded land



Source: Regional Investment and Permittance Board of East Kalimantan Province

Figure 34 : A wide variety of estate crops with different characteristics and returns can be developed in East Kalimantan

Required Policies and Institutions

Implementing these initiatives will require changes in how farmers manage their lands. These farmers will require significant support to make these shifts. Efforts to raise productivity and reduce emissions from ending fires should be done hand-in-hand, so farmers see both direct benefits as well as the intangible value of reducing emissions. The traditional approach to working with farmers has been through public research and government extension workers; however, funding for these has decreased since decentralization and are not always the most effective option. We aim to increase the private sector's contribution to improving farmers' livelihoods and practices in addition to government support. In addition, working with all of East Kalimantan's smallholders directly is too large a task and requires some form of aggregation to work with farmers . We have

identified several important enablers for the agricultural sector including spatial planning, technology, farmer productivity, market access, and MRV. An agricultural transformation depends on all parts of the agricultural system working together; while each element can improve the agricultural sector's production and abatement, a sustainable solution requires all elements working together.

In order to support the growth of the agricultural sector, spatial planning should focus on identifying several 'breadbasket' areas. A breadbasket strategy aims at a breakthrough in food production in certain defined geographic areas. Breadbaskets are defined as agricultural areas with potentially high productivity for specific food crops, good market access potential, and relatively high rural population density. In addition, to support East Kalimantan's goal to reduce CO_2e emissions, these breadbaskets should also be located in areas with degraded lands or grasslands to prevent further deforestation. By identifying breadbasket regions, agricultural expansion can be focused in the areas with highest potential as well as lowest emissions.

Nucleus-Plasma schemes (Perkebunan Inti Rakyat) are an important tool to raise yields of smallholder estate crops located near major plantations. Nucleus-plasma programs have been developed for palm oil plantations but could be expanded to other, high-value estate crops. The programs work by having plantation companies develop palm oil plots for smallholders in a 'plasma' area around their own plantation 'nucleus'. The management of the plasma area is run by a cooperative of the smallholders, which typically contracts technical functions back to the nucleus plantation company, thus growers often work as laborers on their plots. The smallholders receive seedlings, inputs such as fertilizers, and often a guaranteed price for their produce. These schemes have worked in East Kalimantan, and plasma smallholders have yields twice as high as independent palm oil smallholders. But the plasma schemes do have weaknesses as they can interfere with traditional community management of lands (adat) as well as change traditional land ownership patterns. Plasma schemes could be expanded to other high-value estate crops; for less profitable estate crops, government subsidies may be needed to get private sector support for such programs.

Capability building can be achieved by creating a limited number of aggregation units operated by private local change agents (e.g., local entrepreneurs and farmers as well as small warehouse operators on the post-harvest side) whom government, donors,

input/off-take companies, and banks can work with and who in turn will aggregate and extend support to lead farmers and or farmer groups and individual smallholders on the production side. One option is to develop Agriculture Centers that will perform three types of activities: (i) offer off-take from farmer groups; (ii) provide inputs on credit; and (iii) provide services (e.g., tractor services, storage). Each Agriculture Center should have a large warehouse facility. International examples suggest it could serve farmers within a 20 km radius and work with about 200 to 300 lead farmers who would in turn aggregate about around 5,000 smallholders overall. These centers should be placed in agricultural breadbasket areas with sufficiently dense smallholder populations; based on current agricultural lands, number of smallholders, and infrastructure or market access, potential pilots could be in Kutai Kertanegara, Kutai Timur, and Penajam Paser Utara.

Extension services are still an important government program to supporting smallholders, particularly in isolated regions. Private sector cooperation with farmers is often limited to those with high-value estate crops who are located in the lowlands near plantations and processing facilities. Thus, government extension workers are still important, particularly to provide access to credit, seeds, and technology to smallholders growing food crops and located in the more remote interior of East Kalimantan. Both the budget and number of extension service workers has fallen in Indonesia; today Indonesia has roughly 6 extension service workers per 10,000 farmers, compared to China, which has a ratio of 16 per 10,000. Moving to China's benchmark, East Kalimantan would need an additional 200 extension workers.

Real-time and publicly available MRV systems are needed to help communities fight fires. While the zero burningpolicies will help with fire prevention, inevitably some man-made fires will continue, and the community fire brigades will need to focus on extinguishing them. While watchtowers are an effective local means of monitoring, satellite detectors can identify remote fires or larger fires that will require support from the district and province to help suppress. There are already existing tools, such as the online IndoFire service, which are publicly available and can be used to support this monitoring.

Coal Sector

Coal mining has long been a source of tension in development plans. Coal's value attracts substantial investment to East Kalimantan, and it provides significant tax revenues

and contributes to GDP. Yet, coal mining provides few jobs compared to labor-intensive manufacturing or agriculture. If done poorly, mining can leave huge environmental consequences. Still, coal is a central part of East Kalimantan's economy and will remain so for decades. This strategy aims to improve its efficiency and seek measures to minimize its destructive impacts.

Current Context

East Kalimantan has several mineral resources, but coal mining dominates production. While there remain an estimated 50 million tons of gold and silver, there has been very limited gold and silver production since the closure of the PT KEM mine in 2004. East Kalimantan has substantial coal reserves, estimated to be 3.6 billion tons, equal to 19 percent of Indonesia's total. Thus, virtually all mining today is for coal. The majority of East Kalimantan's coal is low in sulfur and ranges from low-to high-calorie (43 percent of reserves are within 6,100–7,100 CV range), which means East Kalimantan coal can be exported to both steel mills (which require high-calorie coal) as well as power plants.

Coal mining is a significant driver of East Kalimantan's economy. From 2000 to 2008, coal production grew rapidly by 15 percent p.a., raising its contribution to total GDP from 8 percent to 20 percent. Production has already reached 119 million tons and some infrastructure, such as ports, are reaching their limits. Going forward, growth in coal production is expected to slow to 5 percent, as infrastructure constraints and concession limits are reached, in line with Indonesia's average. (Box 4 discusses concession types.) At this rate, by 2030, the coal mining sector will account for a significant 31 percent share of the provincial real GDP.

Coal mining in East Kalimantan contributes significant emissions, mainly through its associated deforestation, which are estimated to be 27 MtCO_2e in 2010. These emissions are equivalent to 11 percent of East Kalimantan's total emissions. Most emissions from coal mining are due to deforestation to open up areas for mining exploration and production, not the mining processes themselves. As each hectare of deforested land emits over 800 tons of CO_2e, the deforestation due to mine opening accounts for 68 percent of the emissions from the coal sector, while the mining process itself (such as digging, crushing, and transport) contributed only 21 percent of total emissions. The remaining 11 percent of emissions comes from methane that is released from the coal seam as it is mined. As the coal sector is growing, emissions will likely grow by 2 percent p.a. and reach 41 MtCO_2e by 2030, equivalent to 12 percent of the province's total emissions.

Deforestation is high as most miners use open pit mining, which strips the surface of the concession. Underground mining could avoid much of this deforestation, but it is unfeasible in East Kalimantan. Virtually all coal reserves in East Kalimantan are shallow, making underground mining technically unfeasible. Furthermore, mining in East Kalimantan is dominated by small companies, which lack the sophisticated equipment, knowledge, and funding to implement underground mining, which has much greater safety risks. Of 301 coal mining companies in East Kalimantan, only 2 have employed underground mining, i.e., Kitadin and Fajar Bumi Sakti.

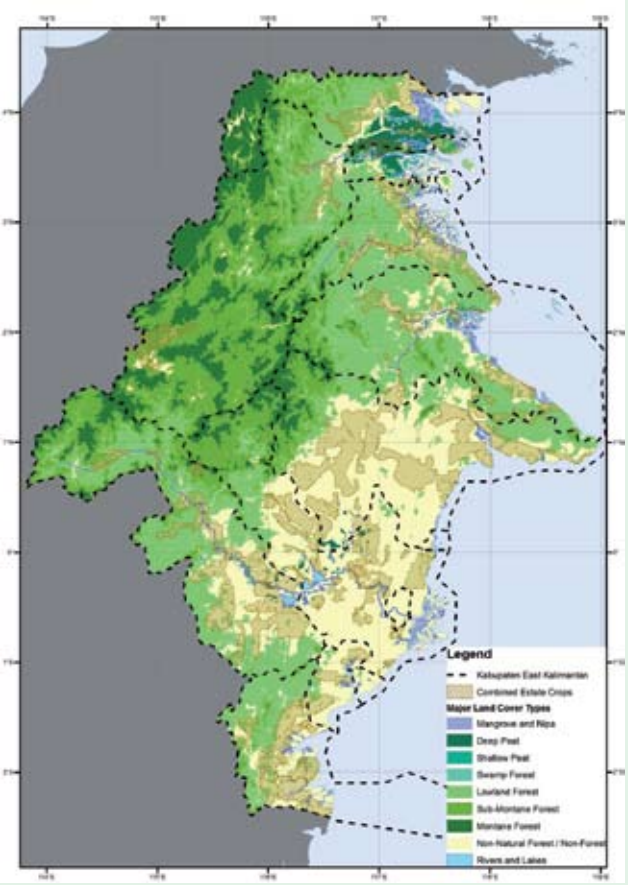


Figure 35 : Many mining operations are located within the natural forests

Box 4

PKP2Bs, KPs, and IUPs

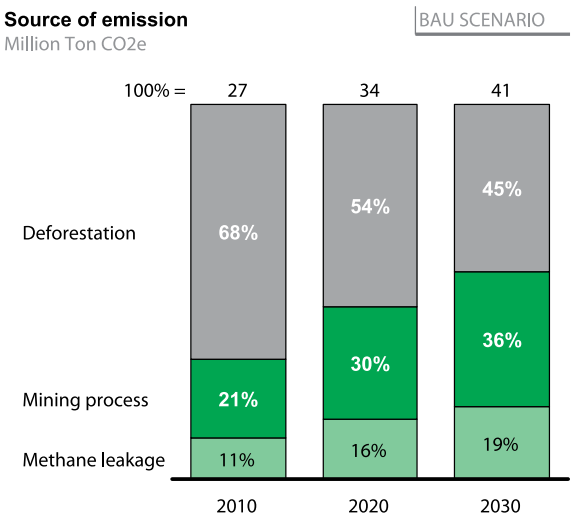
Currently, there are two main types of coal concession in East Kalimantan, i.e., PKP2B (Perjanjian Karya Pengusahaan Pertambangan Batubara – Working Contract of Coal Mining Business) and KP (Kuasa Pertambangan – Mining Right). There are several differences between the PKP2Bs and KPs, however the key differences are their legal status and sizes. PKP2Bs are contracts between the central Government of Indonesia and relatively bigger mining companies. The average size of a PKP2B production concession is around 28,000 ha. PKP2Bs pay land rent and a 'production share' to the central government. On the other hand, KPs are permits awarded by local government to the relatively smaller mining companies. The average size of a KP production concession is around 1,000 ha. KPs pay land rent and a 'production royalty' to the local government.

Both PKP2B and KP are legal products prior to the new mining law, the UU No 4 Year 1999, which was actually issued in 2010. As per the new mining law, the Government of Indonesia now issues only IUP (Izin Usaha Pertambangan – Mining Business Permit). IUPs are analogous to KPs from the perspective of size (a maximum of 15,000 ha for production and 50,000 ha for exploration), status (a permit instead of contract), and financial obligations to governments (profit sharing). Yet, unlike the KPs, IUPs are to be awarded based on transparent tender process. Going forward, all new licenses will be IUPs. The law requires all existing KPs to be converted into IUPs by 2011. PKP2B contracts issued prior to the New Mining Law remain valid until their original contract expires.

Unlike timber or oil palm plantations, only a portion of a mining concession is deforested. Initial mining concessions start with exploration or feasibility study permits. For large miners, these concessions typically shrink by 60 to 75 percent as they move to production concessions; this is the result of exploration identifying the actual areas with commercially recoverable coal. In addition, a land rent is charged based on the size of the production concession, which encourages companies to seek the minimum size required. The average production concession for a large miner is 28,000 ha; of this, typically 20 percent of the area is disturbed, meaning that the earth is dug up and all vegetation on the surface is

destroyed. The average size of a production concession for small miners is just 1,000 ha. Typically 75 percent of this small area is disturbed. (See Box 5 for more about being a KP miner.) The small companies have a higher deforestation rate for two reasons. First, they have far smaller areas than big companies; therefore the proportion of forested land they clear is bigger. Second, the small companies have less sophisticated exploration equipment; therefore they are less targeted and systematic in clearing the forests. The amount of deforestation depends on the whether the disturbed land originally contained forests or already degraded lands.

Deforestation contributes more CO2 emissions than the direct mining process



A Deforestation
Total carbon loss from fore sted lands and soils that are stripped during the mining process
- Around **800 ton** CO2e is emitted per ha of deforested area

B Mining process
Emission from energy consumption during mining process, e.g. for electricity and fuel
- Around **0.04 ton** CO2e is emitted per ton coal produced

C Methane leakage
Associated gases released when the coal seam is opened up
- 88.25% of emissions are methane – 20 times more potent than CO 2 as a greenhouse gas
- Around **0.02 ton** CO2e is emitted per ton coal produced

The model assumes no new exploration permits would issued beyond year 2008, thus all new production permits would come from existing exploration concessions
- Conversion rate: 90% of PKP2B exploration permits based on (1) ratio between average size of production and exploration concession and verified with (2) ratio of max area allowed during production and exploration phase; 33% of KP exploration permits based on (1) ratio between average size of production and exploration concession and verified with (2) interviews
- Conversion duration: maximum 7 years of exploration as stipulated in the UU No 4/2009

SOURCE: Indonesia Abatement Cost Curve; Interviews; Simulation; Team analysis

Figure 36 : Most emissions from the coal sector are due to deforestation to open the mining operation, not the process of mining

Box 5

Story of a KP Miner

Small miners face many challenges across the value chain in doing coal business in East Kalimantan. The challenges begin when the small miners apply for mining permits. Lack of transparency and lengthy bureaucracy of the application process create situations that are conducive for covert "transactions". Many small miners complained about the "transactions" which are, in many cases, costly, uncertain, and risky. Once the mining permit is obtained, the next challenge is securing land access. The small miners need to compensate the local communities who live on top of the mining deposit or convince the HPH companies who hold logging licenses for the area to allow them to access the land. The small miners also need to tackle the so-called land mafias and land speculators by themselves. The challenges do not end after land access has been secured. During the mining operation, the small miners must still manage the local mafias. These local mafias sometimes disguise themselves as legitimate stakeholders: members of local communities that are disturbed by mining operation, NGOs which fight for the local communities, or even as government officials that come to collect some kind mining retribution (lack of clear regulation allows this to happen). Furthermore, theft is common during the transportation of coal from the site to the port (small miners do not build their own ports or roads, but utilize the publicly available roads and ports). At certain locations, thieves come and hop on to the coal truck or coal barge, take whatever they can, and then hop off. Lack of infrastructure also causes problems for the small miners. When their coal arrives at a port, the small miners must wait for their turn to ship their coal. Many times at certain ports, when the water level is too low and no barge can come in, the waiting time can be very long. All of the above challenges – combined with their small area under license and lack of equipment and knowhow – lead to low margins for the small miners. To survive, the small miners then try to find ways to cut costs, which often results in skimping on proper land reclamation and rehabilitation.

Going forward, the deforestation rate will likely increase as new production concessions are increasingly likely to be awarded to small companies. In 2008, of the 1 million ha of licensed production concessions, around 192,000 ha have been deforested. Although

small companies hold only 28 percent of the total area of production concessions, they account for 61 percent of the deforestation area. There are currently an additional 3 million ha worth of coal exploration licenses in East Kalimantan; given historical patterns, these would translate into an additional 1 million ha of production concessions by 2030, of which around 564,000 ha would be deforested. This implies an average deforestation rate of 56 percent of the total production area. The higher deforestation rate predicted compared with the historical rate is because smaller coal mining companies will account for a higher share of future production based on the current pipeline of concessions.

Source of emissions	Abatement levers	Description	Emission reduction Mt, 2030	ESTIMATE % of 2030 emission
Deforest-ation	1 Stop illegal mining	▪ Survey all forested lands, check licenses held by mining companies, and stop the operation if illegal	11.32 [1]	(27%)
	2 Enforce proper post-mining reclamation	▪ Closely monitor mining companies ▪ Use special reclamation contractors ▪ Restructure the reclamation bond	2.01 [2]	(5%)
Mining process	3 Encourage process efficiency	▪ Encourage operation efficiency	2.56 [3]	(6%)
Methane release	4 Minimize methane release	▪ Reduce methane leakage by requiring methane flaring or utilization	4.77 [4]	(12%)
		Total emission reduction =	**20.66**	**(50%)**

1 Assuming 90% of existing and future production concessions located in: Hutan Lindung, Cagar Alam, Hutan Penelitian, Taman Nasional, and Hutan Raya are illegal (based on existing PKP2B rate)
2 Assuming 100% reclamation rate is possible through enforcement
3 Assuming 20% emission reduction could be gained from mining operation efficiency (expert estimate adjusted with the fact that majority of miners in East Kalimantan are small players)
4 Assuming 70% of methane release can be stopped (expert estimate)
SOURCE: Interviews; Simulation; Team analysis

Figure 37 : Four abatement levers have been id entified that could save up to 50% of East Kalimantan's total emissions

Abatement Potential

Four abatement initiatives have been identified which could abate 50 percent of the coal sector's total emissions. As deforestation is the largest source of emissions, the natural target for an abatement initiative is to stop deforestation; however, there are few good options to do this. Underground mining avoids large scale deforestation but it's infeasible in East Kalimantan. Unlike palm oil or timber, coal concessions can not be swapped to degraded lands. Coal reserves are located where they are located, regardless of the forest cover above. Stopping all mining on forest lands without outside compensation would result in significant loss of GDP.

There is illegal mining in protected forest areas, and this should be stopped. It would reduce CO_2e emissions by 27 percent to 11.3 $MtCO_2e$. Next, efforts should focus on reducing emissions from the mining activities themselves. An increase in operational efficiency levels would reduce emissions by 2.6 $MtCO_2e$. Reducing methane release could result in 4.8 MtCO2e emission reduction. Finally, the last strategy is to reverse deforestation emissions post mining. The enforcement of proper post-mining reclamation would save a further 2.01 $MtCO_2e$. It is important to stress that avoiding unnecessary or poorly planned deforestation is a far more important abatement lever than enforcing proper reclamation of forests after mining concessions expire. Enforcing reclamation regulations is certainly necessary, but the new trees will need 80 to 100 years to restore the original area as a net carbon sink.

Stopping illegal mining in protected forest areas would see a 27 percent reduction equivalent to 11.3 $MtCO_2e$. Vast areas of coal concessions are located in forest areas, some even within the protected forest estates. By some estimates, as much as 90 percent of the exploration and production concessions located within protected areas are illegal.[18] An effective abatement strategy would require that East Kalimantan surveys all forested lands and checks the licenses of all mining companies within the forested lands The estimated cost to implement this initiative, in present value and excluding the opportunity cost from

18 Not all mining operations located within protected zones are illegal. Within the protected zones, there are many different forest types. To simplify from the mining point of view, there are two main categories: 1) Conservation forests (e.g., Cagar Alam, Suaka Margasatwa) – strictly no mining unless the mining right or contract had been issued prior to the new forestry law, UU No 41 Year 1999; 2) Protection forests (e.g., Hutan Lindung) – surface mining is prohibited, underground mining is allowed with prior approval from the Minister of Forestry, unless the mining right or contract had been issued prior to the new forestry law, UU No 41 Year 1999.

illegal mining, is around USD 0.01 to 0.02 per tCO_2e p.a. by 2030. Box 6 discusses mining infrastructure and deforestation.

Box 6

Mining Infrastructure and Deforestation

If not managed well mining infrastructure could lead to further deforestation. In order to access the coal deposits in the middle of forests, many big miners in East Kalimantan build roads across the forest areas. However, the availability of roads allows settlers to encroach on the forest. It is not uncommon that the settlers also clear trees and build permanent structures along the roadsides. Small miners, unlike the big ones, are generally unable to afford their own infrastructure. Therefore, they leverage the existing public roads, HPH roads, or rivers. The use of existing HPH roads can actually prevent further deforestation, as the roads are typically managed by the HPH companies that have strong interests to control their logging area and prevent encroachment from the settlers. Going forward, big miners need to leverage the HPH roads or alternatively build railways instead of roads to minimize settlements along roadsides. To accommodate the coal mining workers, many big miners also build small encampments near the site in the midst of the forest. While the mine is operating, the encampments grow bigger as many local traders come to establish their businesses. Some even bring their families and build houses around the encampments. When these mining encampments have grown large enough, they can apply to be formal villages (desa) or even sub-districts (kecamatan). If approved, then the encampments will become permanent villages and will be entitled to some development funding. The growing sub-districts then increase their pressure on the forest areas. Going forward, East Kalimantan needs to encourage the big miners to prevent the unplanned growth of encampments.

Minimizing methane release could capture 4.77 $MtCO_2e$ of abatement. Reducing the release of methane into the atmosphere is the second largest abatement lever after deforestation. Methane is 20 times more potent than CO_2 as a greenhouse gas, and coal seams in East Kalimantan have high concentrations of methane, 1.46 m3 per ton of coal (around 88 percent of total gas concentration in coal). As coal mining in East Kalimantan

is dominated by open pit mining, methane is released from seams when miners remove the earth above the deposit (overburden). Additional methane trapped in rock pores is released during the crushing and milling process. Yet, no measures to mitigate the release of methane are currently in place in East Kalimantan. Existing mining legislation is not explicit enough in prohibiting methane releases. Moreover, the commercial utilization of methane gas is hindered by the current regulations for coal-bed methane, which requires coal miners to follow a lengthy process if they want to flare[19] or use the methane.

We have identified a number of recommended steps to help reduce methane release: petition the Ministry of Energy and Mineral Resources to simplify the requirements for CBM; pass new regulations requiring methane capture in mining operations; provide technical support to miners that apply for Clean Development Mechanism funding; and launch a new mining monitoring team to check on methane release at mining sites. The cost, in present value, required to reduce emissions by reducing methane release from coal mines is around negative USD 2 to 3 per tCO2e p.a. by 2030.

Encouraging operational efficiency could capture a reduction of 2.56 MtCO2e. Both emissions from the mining process and the profitability of coal mining are mainly driven by the consumption of fuel and electricity. Expert interviews suggest that East Kalimantan could reduce energy consumption (and hence emissions and costs) by around 20 percent through operational efficiency improvements. One step the provincial government could consider is training a new provincial mining monitoring team to be able to recommend operational improvements during their site visits. The members of the provincial mining monitoring team then will also assess efficiency and suggest improvements to the mining companies. Examples of operational efficiency initiatives include: reduce idle time of shovels, improve control of transport equipment, improve fill factor for shovels, improve haul road, optimize truck dispatch, and improve fuel monitoring and maintenance. Which initiatives are appropriate is dependent on the result of site assessment by the provincial mining monitoring team. The cost, in present value, to implement all these steps to improve operational efficiency is estimated at negative USD 4 to 6 per tCO2e p.a. by 2030.

19 Flaring converts the methane to CO2, and therefore it is more environmentally friendly than having methane, which is a 20 times more potent greenhouse gas than CO2, be released to the atmosphere directly.

Enforcing proper post-mining reclamation would save 2.01 $MtCO_2e$. Although the environmental impact of open pit mining is inevitable, the damage can be minimized through implementation of best practices for reclamation. In violation of existing regulations, many miners in East Kalimantan, especially the smaller ones, do not implement proper reclamation practices. Interviews with industry participants and mining sector analysts suggest that around 20 percent of big companies and 75 percent of small companies do not implement proper reclamation. Their reasons vary. Many smaller miners don't have the capital to finance reclamation activities. (An upfront reclamation guarantee fund does exist, however in many cases it is not adequate to cover the full cost of reclamation or it is simply not collected properly.) Some miners do not have the required knowhow and skills to implement reclamation correctly. And, some do not implement proper reclamation because they know that government has limited resources to monitor and control them, and therefore the consequences of violating the reclamation provisions are limited. Box 7 discusses the economic opportunity of post mining reclamation.

Three initiatives to enforce proper post-mining reclamation have been identified. First, to address the problem of a lack of skills and knowhow, certified reclamation contractors can be used. Miners with insufficient capability to do reclamation could contract one of the contractors on a recommended shortlist. Second, to address the lack of financial resources, the reclamation guarantee fund system can be adjusted. Instead of requiring applicants for mining permits to pay small upfront guarantees, East Kalimantan can require them to pay the full reclamation costs in advance to any certified reclamation contractor in East Kalimantan and attach the reclamation contract to their permit application. Then, the East Kalimantan government will only need to hold the certified reclamation contractors, instead of the applicants, responsible for implementing proper reclamation. It will be easier for East Kalimantan to manage a few certified reclamation contractors as opposed to thousands of mining companies. Third, to address the issue of lack of enforcement, East Kalimantan could establish a new mine monitoring unit with sufficient resources and regulatory authority.

To ensure successful reclamation (1) rehabilitation programs should be an integral part of operations from the commencement of mining; (2) lands should be rehabilitated immediately upon the closure of each mining pit; and (3) an extensive consultation process with community stakeholders should start a few years before the closure of a mine. There are several successful reclamation examples in East Kalimantan such as the Petangis coal

mine in Paser rehabilitated by PT Kendilo and the PT KEM gold mine in Kutai Barat. The Petangis mine rehabilitated its post mining lands into an eco-tourism park, for which it received the Gold Flag environmental award from the Province of East Kalimantan. To enforce proper reclamation, East Kalimantan will need to add 65 qualified personnel to a provincial mine monitoring team. The estimated total cost, in present value, for these steps to enforce reclamation would be around USD 6 to 22 per tCO_2e p.a. by 2030.

Box 7

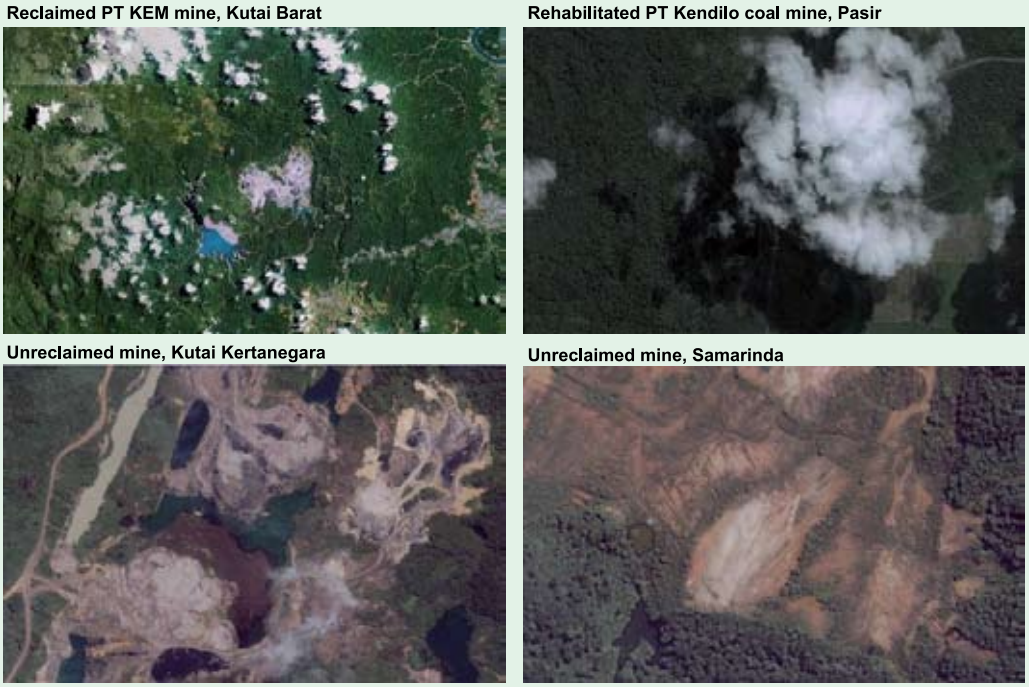
The Economic Opportunity of Post Mining Reclamation and Rehabilitation

While reclamation and rehabilitation is seen as a cost for private mining companies, it is actually an economic opportunity for East Kalimantan overall. Without proper reclamation, soils in mining concessions become degraded and cannot be used for other economic purposes. Another benefit, then, of strictly enforcing post-mining rehabilitation regulations is that it allows other sectors to use the mining concession area after the concession period has expired. Properly reclaimed lands ensure the continued viability of the soil, which could therefore be used for forestry, palm oil, or agriculture. This would result in decreased pressure on the primary forests, higher carbon sequestration than otherwise would be the case, and more job creation. Based on existing reclamation practices, by 2030 under the business-as-usual scenario, only around 137,000 ha of mined lands will become available for either forestry, palm oil, agriculture, or other uses after mining concessions lapse. However, if existing reclamation regulations were properly enforced, an additional 289,000 ha of reclaimed lands would become available for other economic purposes by 2030.

Pilot Projects

Potential pilots for coal initiatives have been identified in Kutai Kertanegara, Kutai Barat, and Kutai Timur. As 75 percent of miners with KP permits and 64 percent of KP coal concession areas are concentrated in these three districts, the highest emissions and greatest abatement potential are also there. Pilot projects in these three Kutai districts could capture almost 75 percent of the total abatement potential from the coal sector (Figure 39). Other criteria to be used for selecting the final pilot projects would include:

support from districts, support from mining companies, and the availability of biodiversity and HCVF at risk.



SOURCE: Google Earth

Figure 38 : Examples of mine reclamations in East Kalimantan

GDP Potential

Improving the productivity of coal miners could increase the sector's contribution to GDP in the order of IDR 10 trillion by 2030. In a business-as-usual scenario, 88 percent of the new production concession areas would be dominated by small companies. However, most small companies are far less productive than the big ones due to differences in mining tools, production equipment, knowhow, and extraction methodology. Currently, the average productivity of small miners is 59 tons per ha p.a., far lower than the average

productivity of the big companies of 144 tons per ha p.a. With over 1,200 small miners, it is difficult to support them all with financing, technology, and training to increase production. The natural response of the market would be consolidation of the small miners into larger, more efficient mines and companies; yet, this has been slow to occur in East Kalimantan. Thus, the best identified option is to improve productivity by better screening of new miners and issuing production permits only to companies with sufficient technical capabilities. The provincial mining monitoring team can help districts assess the technical capabilities of the applicants and any contractors they intend to employ.[20] Based on those assessments, the mining monitoring team would then recommend to the districts whether to reject or accept the application.

Other potential initiatives to increase GDP from coal have been rejected as they are too carbon-intensive. Beyond improving the productivity of coal extraction once a site has already been deforested, the options for increasing the economic value added from coal require moving downstream and utilizing the coal itself, which creates more emissions. There is downstream potential for coal-to-liquid processing to produce diesel, but this produces far more CO_2e than conventional oil refining. The coal could be burned to produce power, potentially for export for other parts of Kalimantan or Malaysia, or used to power energy-intensive industries such as steel, aluminum, and cement. Yet, all these options do not move the coal sector to less-carbon intensive activities. There may be some opportunities to use blending with higher quality coals to gain the premium price for steel-quality coal and thus earn a higher return, but this type of blending is typically done by end-users and any margins are captured by them.

Required Policies and Institutions

A strong mining monitoring team is crucial for the success of the abatement and GDP improvement initiatives. The monitoring team would play many important roles in the implementation of abatement and GDP improvement initiatives.

East Kalimantan, today, already has personnel to monitor the mining companies, i.e., the special mining police or mining inspectors (polsus pertambangan or inspektur tambang). However, the monitoring is not effective due to several challenges. One is the number of personnel. Experts estimate that the minimum ratio between the number of personnel

20 The mining contractors will need to be rigorously inspected as well

Mining Abatement Potentials by lever
Million ton CO2e 2030

0 - 1
1 - 2
2+

	Stopping illegal mining	Enforcing post mining reclamation	Encouraging process efficiency	Minimizing methane release	Total Abatement
Balikpapan	-	-	-	-	-
Berau	0.91	0.17	0.16	0.29	1.52
Bontang	-	-	-	-	-
Bulungan	0.41	0.08	0.03	0.05	0.57
Kutai Barat	2.37	0.46	0.19	0.36	3.39
Kutai Kartanegara	3.04	0.59	0.30	0.56	4.48
Kutai Timur	2.88	0.41	1.50	2.80	7.60
Malinau	0.05	0.01	0.00	0.01	0.07
Nunukan	0.70	0.14	0.06	0.11	1.00
Paser	0.57	0.09	0.26	0.49	1.40
Penajam Utara	0.26	0.05	0.02	0.03	0.37
Samarinda	0.10	0.02	0.04	0.07	0.22
Tana Tidung	0.02	0.00	0.00	0.00	0.03
Tarakan	-				
Total	11.32	2.01	2.56	4.77	20.66

Note: The model assumes no new exploration permits would issued beyond year 2008
1 KP = Kuasa Pertambangan (Mining Rights); licenses given to small companies with average size of 1,000 ha
2 PKP2B = Perjanjian Karya Pengusahaan Pertambangan Batubara (Working Contract for Coal Mining); contract between Government of Indonesia and big mining companies with average size of 30,000 ha

SOURCE: Distamben; Indonesia Abatement Cost Curve; Interviews; Simulation; Team analysis

Figure 39 : 75% of the abatement potentials come from the 3 Kutai Districts

and number of operating mining companies for effective monitoring should be 1:10. Currently, the ratio in East Kalimantan is 1:150 with only two part-time members of special mining police to oversee 301 mining companies in production. The estimated number of mining companies that will be operating by 2030 is around 620 companies. Therefore, East Kalimantan will need a total of 62 full-time personnel.

The second challenge is a limited budget to conduct site visits. Ideally, each mining company needs to be visited every six months (this means 1,240 visits per year for 620 companies). However, current budget only allows the monitoring personnel to visit one company per year. Furthermore, the current personnel has limited authority to do unannounced site inspections. They need to report to the mining company first before they come, and then take a guided tour led by the mining company.

Another challenge is the quality of personnel. Ideally, the members of the mine monitoring team should be mining experts. Therefore, the members of the provincial mining monitoring team should have the following qualifications: (1) educational background related to mining; (2) relevant work experience in the industry, e.g., ex-manager of a good mining company; and (3) training in site inspection.

In summary, it is very important for the provincial monitoring team to have:

- Sufficient authority and power to undertake all of its responsibilities
- Clarity of roles and responsibilities between the team members and the provincial and district mining authorities (dinas)
- Sufficient expertise and knowledge
- Highest possible integrity of people and processes, and world-class governance processes

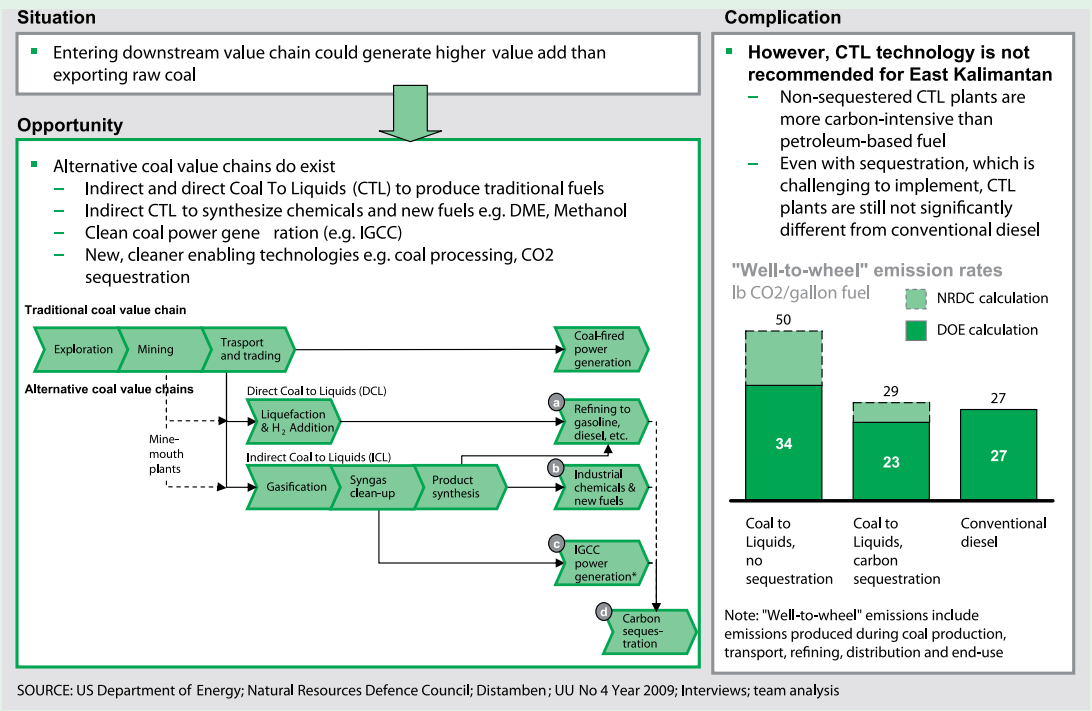


Figure 40 : Entering downstream value chain would generate more emission than conventional diesel

Initiatives		Can a mine monitoring team help?	What role can the mine monitoring team play?
GDP improvement	1 Implement stricter review of license applications	Yes	As the provincial expert body who reviews the application [1] ▪ Quality of AMDAL and mining technical plans ▪ Company background check
Abatement	2 Stop illegal mining	Yes	As the surveyor/inspector who can survey the forested lands and check the company's licenses
	3 Enforce proper post-mining reclamation	Yes	As the inspector who visits the sites and monitors closely
	4 Encourage process efficiency	Yes	As the expert who visits the sites, observes and diagnoses the mining practices and recommended improvement initiatives
	5 Minimize methane release	Yes	As the inspector who visits the sites and monitors closely; Also as a facilitator that he lps companies to apply for CDM projects

1 All administration papers still handled by the district's mining *dinas*

SOURCE: Interviews; Team analysis

Figure 41 : Almost all of the abatement levers could be implemented through a provincial mine monitoring team

Oil And Gas Sector

The oil and gas sector has been a fundamental driver of East Kalimantan's economy for decades. Onshore fields have been producing oil in East Kalimantan since before Independence; in the 1970s, the sector developed further with the discovery of massive offshore gas fields. Recently, East Kalimantan has been pioneering Indonesia's development of coal-bed methane. East Kalimantan's production has been important nationally; it accounted for 42 percent of national upstream gas production and 90 percent of national LNG production in 2008. Yet, the sector is currently in decline with oil and gas production falling 1 percent p.a. since 2000. Thus, in a business-as-usual scenario, emissions from the oil and gas sector will decline naturally. In the other sectors discussed in this report, we have first evaluated options for reducing the current carbon footprint of the sector before

considering how to expand the sector with new higher value-adding and lower carbon-emitting activities. Given the expected decline of oil and gas sector going forward, we have switched the order here and first explore how to reverse the sector's decline. We then turn to the topic of how to reduce emissions from a larger, revitalized industry.

Current Context

The oil and gas sector contributes almost half of East Kalimantan's GDP but has been declining at an accelerating rate, 1 percent p.a. since 2000 and 3 percent p.a. since 2005. The majority of East Kalimantan's oil and gas fields are already mature and production volumes are declining 3 percent p.a. The impact on the province's GDP of this decline is further amplified by the subsequent drop in downstream gas processing. While the Balikpapan refinery continues to run at 99 percent of its maximum capacity by importing crude oil supplies, the Bontang LNG production facility continues to decline and in 2008 was operating at 80 percent capacity, as it must rely on the declining gas feed from nearby upstream fields. If these trends continue, there will be a significant drop of GDP contribution from oil and gas to East Kalimantan, from IDR 47.2 trillion in 2008 to IDR 31.6 trillion in 2030. This declining role of the oil and gas sector is likely to increase East Kalimantan's dependence on other, more carbon-intensive sectors such as agriculture, palm oil, and coal mining to secure its future growth.

In 2010, the oil and gas sector produced approximately 17.8 $MtCO_2e$ from both its upstream and downstream activities. Upstream oil and gas production produced 6.9 $MtCO_2e$; 23 percent of this stemmed from the energy used for the drilling and operating of the production fields. The remaining 77 percent was due to flaring. Flaring occurs most commonly in oil fields where associated gas is produced along with oil from the fields; this gas is separated from the oil at surface facilities and then flared (burned) if the operators do not use it for internal purposes or sell to others. Flaring can also occur at gas fields if production exceeds the field's processing capacity as well as at downstream processing facilities. An estimated 3.3 $MtCO_2e$ are generated from the Balikpapan refinery due its energy needs and processing of oil. The Bontang LNG plants produces an estimated 7.6 MtCO2e from its high energy needs to process, cool, pressurize, and liquefy the natural gas.

GDP Potential

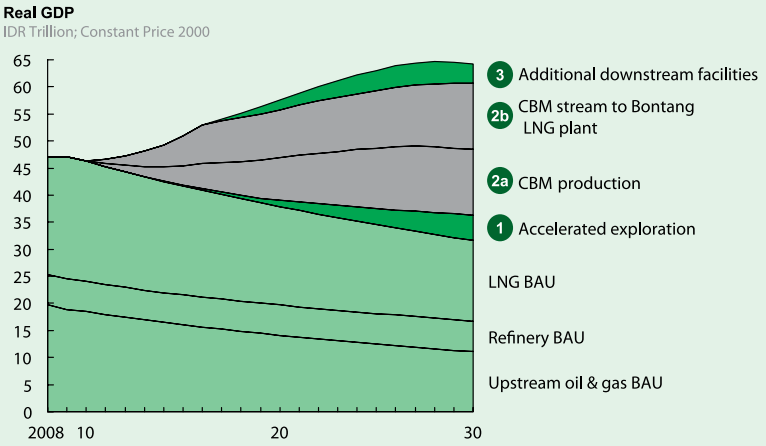
We have identified three GDP improvement initiatives that could reverse the decline of East Kalimantan's oil and gas sector and increase GDP by an additional IDR 64.3 trillion by 2030. These initiatives are accelerating upstream exploration (2030 GDP increase of IDR 4.7 trillion), developing coal-bed methane (CBM) fields (IDR 24.3 trillion), and building new downstream gas facilities once the new CBM stream is online (IDR 3.63 trillion)(Fig. 41).

Accelerating upstream exploration would see an increase of 2030 real GDP by IDR 4.7 trillion. East Kalimantan's oil and gas resources have been largely exploited, but there remains some potential for new exploration and production, particularly in gas. East Kalimantan's oil and gas deposits are found in two main basins, the Kutai Basin and Tarakan Basin. The Kutai Basin, for example, still holds estimated reserves of 474 million barrels of oil and 20,663 billion cubic feet (bcf) of gas. Besides in-field exploration, the United States Geological Survey (USGS) routinely estimates how much resources are "yet-to-find" and could be expected from future exploration efforts in a basin. For the Kutai Basin, for example, there is an estimated 50 percent chance (F50) that at least 59.8 trillion cubic feet of gas could be discovered in fields of various sizes. Doubling current exploration efforts could yield new oil and gas production of 35 mbpd and 766 million cubic feet per day (mmcfd) by 2030. Yet, this is insufficient to fully offset the decline in existing mature fields. Accelerated exploration can merely slow the decline in oil production from 8 percent p.a. to 3 percent and the decline in gas production from 2 percent p.a. to almost 0 percent.

Coal-bed methane (CBM) is one of the biggest opportunities for East Kalimantan and could increase 2030 GDP by IDR 24.3 trillion. Coal-bed methane is a recent development that allows methane (natural gas) trapped in coal seams to be located, drilled, and sold to conventional gas buyers. East Kalimantan has CBM resources of 109 trillion standard cubic feet (tscf), almost a quarter of Indonesia's CBM potential (Figure 42). The current CBM explorations are focused on four exploration blocks within the Kutai Basin that are close to the Bontang LNG plant; they were granted in 2008–2009 and contain 12.7 tscf. Assuming continued auctions of CBM blocks[21] to 2030 (but at a more conservative pace and size)

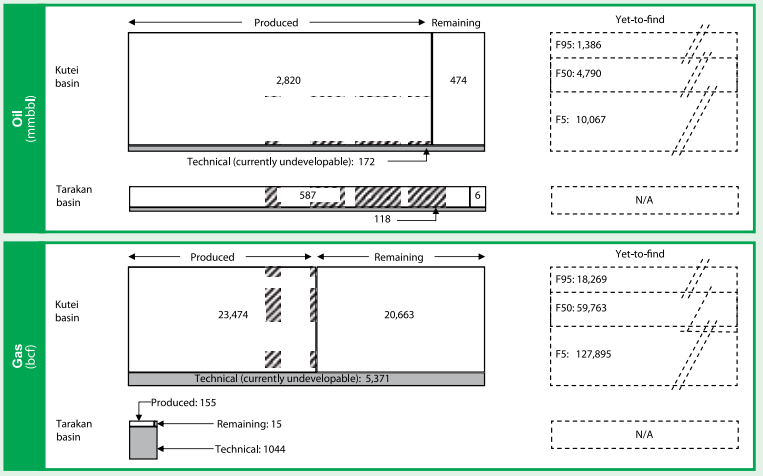
21 The four exploration blocks are Kutai West (5.1 tscf, explored by Newton Energy, Ephindo, and CBM Asia), Sanga-Sanga (4.0 tscf, explored by Vico, BP, and ENI), Kutai-Ephindo (3.1 tscf, explored by Ephindo), and Sanggata West (0.5 tscf, explored by Pertamina, Arrow, and Ephindo)

that would cover at least 60 percent of current resources, East Kalimantan could produce an additional 2,500 mmcfd of CBM gas production by 2030.



SOURCE: BPS; Global Insights; Team analysis

Figure 42 : Three GDP improvement initiatives could reverse the decline to lift 2030 real GDP to IDR 64.25 trillion



SOURCE: WoodMackenzie, USGS, team analysis

Figure 43 : East Kalimantan's oil & gas resourc es have been largely exploited but there remains some potential for ex ploration, particularly in gas

This new stream of coal-bed methane would double business-as-usual gas production by 2030 from 2,200 mmcfd to 4,700 mmcfd. Furthermore, this new supply of gas from CBM could be used to raise LNG production at Bontang LNG plant to its historical utilization rate of 92 percent, despite the declining conventional gas feed. There should be ample markets for the additional LNG from Bontang, from the existing buyers in South Korea, Japan, and Taiwan as new markets such as China.

Located in East Kal

	Basin	Target Formation	Completeable Coal Thickness	Coal Rank	Avg Depth	High Graded Area	CBM Complet Able
			(m)	(R0%)	(m)	(km2)	(Tcf)
1	S. Sumatra	M.Enim	37	0.47	762	7,350	183.0
2	Barito	Warukin	28	0.45	915	6,330	101.6
3	Kutai	Prangat	21	0.50	915	6,100	**80.4**
4	C. Sumatra	Petani	15	0.40	762	5,150	52.5
5	N. Tarakan	Tabul	15	0.45	701	2,734	**17.5**
6	Berau	Latih	24	0.45	671	780	**8.4**
7	Ombilin	Sawaht	24	0.80	762	47	0.5
8	Pasir/ Asem	Warukin	15	0.45	701	385	**3.0**
9	NW Java	T.Akar	6	0.70	1524	100	0.8
10	Sulawesi	Toraja	6	0.55	610	500	2.0
11	Bengkulu	Lemau	12	0.40	610	772	3.6
	TOTAL					30,248	453.3

109 tcf in East Kalimantan (24% of national resources)

SOURCE: SPE: Stevens, S. "Indonesia Coalbe d Methane Indicators and Basin Evaluation"

Figure 44 : East Kalimantan has CBM resources of 109 TSCF, almost a quarter of Indonesia's CBM potential

Building additional downstream gas processing facilities would result in a GDP increase of IDR 3.6 trillion by 2030. Coal-bed methane should be fed to the Bontang LNG plant and PT Pupuk Kaltim fertilizer plant until the gas feed exceeds the maximum capacity of these plants. By 2017, the CBM gas feed would reach the maximum capacity of the Bontang LNG plant: 3.7 billion standard cubic feet per day (bscfd). By 2023, the excess CBM supply would reach 1.0 bscfd, enough to operate two additional LNG liquefaction

and purification facilities (called LNG trains) and by 2030, three additional LNG trains. Building a new LNG train requires large capital investment and can require up to five years to complete; thus investors are typically reluctant unless they can be assured of sufficient long-term supplies. The decision whether to expand LNG trains based on CBM supplies would be made in the future and depend on the regulatory framework at the time, LNG prices, domestic demand, and certainty over supply. It may be easier to find investment for capital-intensive downstream facilities such as fertilizer and petrochemical complexes that use also natural gas as an input. We recognize that we will need to work with the national investment board and regulatory agencies to encourage new investment into CBM.

Abatement Potential

Emissions from the oil and gas sector are forecasted to fall naturally from 18.5 to 11.4 $MtCO_2e$ as oil and gas production declines under business as usual. Emissions from the Balikpapan refinery would remain constant as the plant continues to operate at capacity. Emissions from the upstream processes to produce oil and gas would decline as oil and gas production decreases. In addition, under business as usual, the emissions from flaring would decline in tandem with the decline of upstream oil production.

The revival of the oil and gas sector, through the implementation of the GDP improvement initiatives outlined above, would counteract the natural decline in emissions under business as usual. With the decline of oil and gas production, the total emissions of the oil and gas sector are estimated to naturally decline from 18.5 $MtCO_2e$ in 2008 to 11.4 $MtCO_2e$ in 2030. However, the GDP improvement initiatives above would see higher production of oil, conventional gas, CBM gas, and LNG, which would push total sector emissions to 26.3 $MtCO_2e$ by 2030.

Three abatement initiatives have been identified for the oil and gas sector that could reduce emissions by 2.8 $MtCO_2e$, equal to 10 percent of the revived oil and gas sector's emissions. Implementation of a zero flaring program in East Kalimantan would result in emission abatement of 1.7 $MtCO_2e$ p.a. by 2030. The Ministry of Energy and Mineral Resources, under the Green Oil & Gas Industry Initiatives, has targeted Indonesia to reach zero flaring by 2025. East Kalimantan could be the first pilot province for this program and introduce a Kaltim Zero Flare program (Box 8). The total cost, in present value, of implementing this initiative would be USD 8 to 10 per tCO_2e p.a. by 2030.

Box 8

Zero Flaring is Possible and Could Be Cost Negative

It is possible to achieve the negative cost of zero flaring from a technical perspective. There are many viable options for utilizing associated gas from a field; the appropriate option depends on the amount of gas and the characteristics of the field. If the field is near existing gas infrastructure and pipelines, the associated gas can be sold commercially into the system (after investing in connecting pipelines) instead of flared. If there is no gas grid within an economical distance, excess gas can be sold to neighboring energy-intensive factories or local power plants. If this is not available or the amount of gas is small, then the excess gas can be used for power generators and compressors at the field site, replacing diesel fuel. The gas can also be reinjected into the reservoir itself to maintain pressure and production levels under the right circumstances.

In addition to the revenues and cost savings from the above options, there is the potential to receive CDM funding for flare reduction initiatives. At the Tambun and Pondok Tengah fields, up to 40 mmcfd of flared gas is utilized for power generation, and the estimated carbon reduction is around 0.4MtCO_2ep.a. Thus, zeroflaring, in many cases, can be achieve data negative cost.

Implementation of an LNG plant operational improvement program, such as improved planning, would reduce emissions by 0.8 MtCO_2e p.a. Improved planning can save fuel, as plants can reduce unnecessary pressurization and depressurization by actively matching compression needs with natural gas demand. In addition, improved planning places emphasis on running compressors at their most efficient point, called the working point. The total cost, in present value, of implementing this initiative would be negative USD 19 to 28 per tCO_2e p.a. by 2030, as the revenues and cost savings from improved planning outweigh the cost of equipment and investment.

Implementation of a refinery operational efficiency program would reduce emissions by 0.3 MtCO_2e. The Balikpapan refinery can reduce its emissions by implementing efficiency measures that involve replacement, upgrades, or additions that do not alter the process flow of the refinery, e.g., waste heat recovery via heat integration and replacement of

boilers, heaters, turbines, or motors. The total cost, in present value, of implementing this initiative would be negative USD 10 to 15 per tCO_2e p.a. by 2030, as the revenues and cost savings from the refinery operational efficiency programs outweigh the cost of equipment and investment.

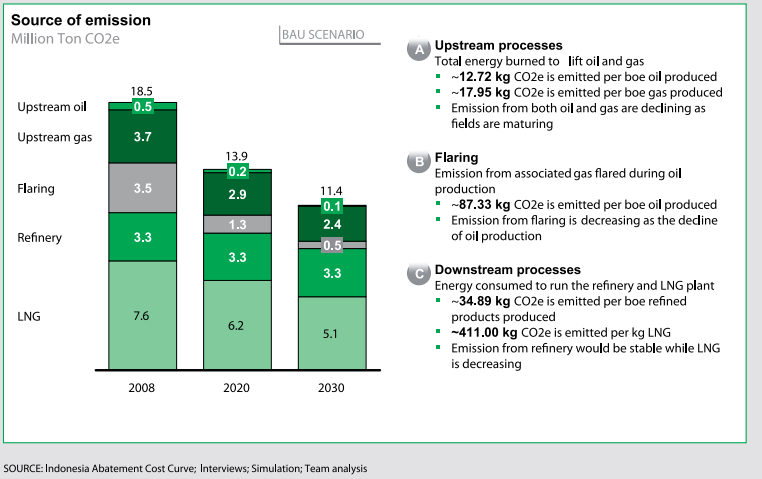


Figure 45 : Emission from flaring is declining fast following the decline of oil production

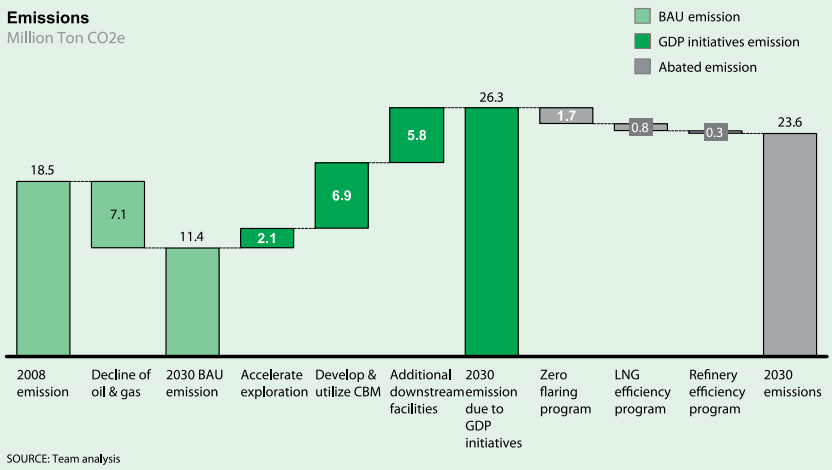


Figure 46 : The revival of the oil a nd gas sector, through initiatives to improve GDP, would inevitably increase the 2030 BAU emission

Pilot Projects

The pilot projects should be implemented in Kutai Kertanegara for zero flaring program, Bontang for LNG efficiency program, and Balikpapan for refinery efficiency program. By 2030, Kutai Kertanegara, Balikpapan, and Bontang will account for 98 percent of the sector's emissions with 1.4 $MtCO_2e$ from flaring at Kutai Kertanegara, 15.0 $MtCO_2e$ from Bontang LNG, and 3.32 $MtCO_2e$ from Balikpapan refinery. These three districts will also account for 91 percent of the abatement potential by 2030. Kutai Kertanegara, with many fields, has high emissions from flaring that contribute almost 85 percent of East Kalimantan's flaring emissions. Satellite images detect more than 10 flare points in the district. By 2030, implementing a zero flaring program in Kutai Kertanegara could abate around 1.4 $MtCO_2e$. Implementing operational efficiency programs at Bontang LNG plant will reduce 0.8 $MtCO_2e$, and implementing energy efficiency programs at Balikpapan refinery will abate 0.3 $MtCO_2e$.

Required Policies and Institutions

To accelerate exploration, there are five challenges to be addressed as reported by the industry: uncertainty of cost recovery regulations hinder private sector investment; contract sanctity is sometimes violated; unforeseen disputes with other agencies such as the tax office create additional costs; the overall taxation rate is not competitive with other exploration locations; and lack of security of assets and ownership rights causes uncertainty.

East Kalimantan should help the industry to address these exploration challenges by: encouraging BP MIGAS to switch from a cost recovery focus to maximizing investment; encouraging BP MIGAS to quickly settle the Offshore Mahakam dispute in a transparent and credible manner; actively collecting feedback related to interference by other agencies from major companies and escalating it to national ministries; actively collecting feedback related to total tax rate from major companies and escalating it to national ministries; and creating a one-stop center with staff dedicated to the largest PSCs to facilitate access and ensure security.

There are four regulatory issues that constrain the development of CBM: PSC regime, local procurement requirement, land access, and water management. The existing oil and gas based PSC regime is not conducive for CBM development. Due to the cost recovery

scheme, all well drilling, work programs, and budgets need to be approved beforehand by BP MIGAS. This is not suitable for the complex and long-term nature of CBM activities. For example, with the lengthy approval process of the current PSC regime, it could take up to one year for the approval of one well, yet CBM developments require hundreds of wells to be drilled. Similarly other approvals for work programs, budgets, and other items take a long time and are thus ill-suited to the phased development required for CBM. The existing PSC scheme also requires First Tranche Petroleum (FTP), a mechanism that allow the Government of Indonesia to claim upfront 20 percent of gross production regardless of whether the production volume will be sufficient to cover the total exploration and development costs invested by the contractors or not. This scheme, while ensuring income for the Government of Indonesia, means higher risk for contractors. This is not conducive for CBM development that requires higher upfront investment. Countries like India and China offer better fiscal regimes to address the high upfront risk related to CBM development.

SOURCE: Google Earth; Team analysis

Figure 47 : Satellite images can help monitor the flaring points

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	Oil & Gas Emissions by source, MtCO2e, 2030 [1,2]						Oil & Gas Abatement potential, MtCO2e, 2030			
	Upstream Oil	Upstream Gas	Upstream Flaring	Refinery Process	LNG Process	Total Emission	Zero flaring	Refinery efficiency	LNG efficiency	Total Abatement
Balikpapan	-	-	-	3.32	-	3.32	-	0.30	-	0.30
Berau	-	-	-	-	-	-	-	-	-	-
Bontang	-	-	-	-	15.05	15.05	-	-	0.75	0.75
Bulungan	0.01	0.00	0.09	-	-	0.10	0.09	-	-	0.09
Kutai Barat	-	-	-	-	-	-	-	-	-	-
Kutai Kerta.	0.21	5.72	1.43	-	-	7.36	1.43	-	-	1.43
Kutai Timur	0.02	0.26	0.15	-	-	0.42	0.15	-	-	0.15
Malinau	-	-	-	-	-	-	-	-	-	-
Nunukan	-	-	-	-	-	-	-	-	-	-
Paser	-	-	-	-	-	-	-	-	-	-
Paser PU	-	-	-	-	-	-	-	-	-	-
Samarinda	-	-	-	-	-	-	-	-	-	-
Tana Tidung	-	-	-	-	-	-	-	-	-	-
Tarakan	0.00	-	0.01	-	-	0.01	0.01	-	-	0.01
Total	**0.24**	**5.98**	**1.67**	**3.32**	**15.05**	**26.27**	**1.67**	**0.30**	**0.75**	**2.72**

1 Oil and gas field locations by district:
Kutai Kertanegara = Offshore Mahakam, Kalimantan TAC, Sanga-Sanga, Nilam Badak, Rapak, Ganal
Kutai Timur = East Kalimantan PSC, Makassar PSC
Bulungan = Pertamina Kalimantan
Tarakan = Tarakan PSC
2 Refinery plant located in Balikpapan; LNG plant located in Bontang

SOURCE: WoodMac; Simulation; Team analysis

Figure 48 : Bontang, Balikpapan, and Kutai Kertanegara account for 98% of emission and 91% of abatement

The requirement for local procurement hinders the development of CBM. Current regulations require operators to use local contractors and procure equipment locally. Non-local procurement is only allowed with the approval of the Minister of Energy and Mineral Resources. However, as the CBM business is relatively new for Indonesia, no local equipment suppliers and contractors have yet built the skills to support large-scale CBM development projects. Existing procurement rules and local content requirements make it difficult for CBM operators to import necessary skills and equipment.

Conflicts regarding access to land hinder the development of CBM. Much of the land on top of CBM basins is likely to be already held by other parties, e.g., coal miners, oil and gas companies, oil palm plantations, or logging companies. Although Kepmen No 36/2008 has clarified the rules on CBM operators' rights and land access, i.e., CBM companies

can negotiate with other parties for land access, it does not go far enough to resolve the lengthy negotiation process involved between the CBM operator and multiple parties and the price to be paid for land access.

Unclear regulations on water management, especially when the CBM fields are far from the sea or rivers, hinder the development of CBM. The dewatering processes during CBM development produce large streams of water that need to be properly diverted. However, current regulations are not clear about how to implement this requirement.

East Kalimantan needs to lobby the Ministry of Energy and Mineral Resources to address four challenges of CBM development: (1) In 2011, the central government plans to introduce new PSC regulations that will provide more flexible procedures for CBM operators. East Kalimantan should play a proactive role in collecting feedback from major CBM companies and escalating this back to the central government; (2) East Kalimantan should request that the central government permit CBM operators to import non-local equipment and supplies without having to apply for ministerial approval until local contractors and suppliers emerge; (3) East Kalimantan should take a proactive role to facilitate the negotiation processes of land access between multiple parties; and (4) East Kalimantan should work with relevant parties, such as the Ministry of Environment and Ministry of Mining, to clarify the issue of water management once for all.

Feasible Technology Options to support the Establishment of MRV for REDD+ in Indonesia

Farhan Helmy and Steffen Kuntz

1. Introduction

Reducing Emissions from Deforestation and Forest Degradation (REDD) - is an effort to create a financial value for the carbon stored in forests, offering incentives for developing countries to reduce emissions from forested lands and invest in low-carbon paths to sustainable development. "REDD+" goes beyond deforestation and forest degradation, and includes the role of conservation, sustainable management of forests and enhancement of forest carbon stocks.

Following the recommendations of IPCCC a REDD+ inventory MRV (monitoring, reporting, verification) system shall be based on International Agreements and Guideline which are translated into a national Legal Framework. The Draft decision [-/CP.16] of COP16 in paragraph 70 "Encourages developing country Parties to contribute to mitigation actions in the forest sector by undertaking the following activities, as deemed appropriate by each Party and in accordance with their respective capabilities and national circumstances:

(a) Reducing emissions from deforestation;
(b) Reducing emissions from forest degradation;
(c) Conservation of forest carbon stocks;
(d) Sustainable management of forest;
(e) Enhancement of forest carbon stocks"

This decision paves the floor on world-wide level for the implementation of the so-called "Reducing Emissions from Deforestation and Forest Degradation (REDD+)". It is an effort to create a financial value for the carbon stored in forests, offering incentives for developing countries to reduce emissions from forested lands and invest in low-carbon paths to sustainable development and including the role of conservation, sustainable management of forests and enhancement of forest carbon stocks.

However, the interaction between land use/land cover dynamics and their impacts to the carbon flux is poorly understood. This is due to the lack of appropriate information baselines on the dynamics and impacts and missing of comprehensive means linking socioeconomic and institutional drivers of these changes. Here, a number of challenges that can influence land use changes include energy production, forestry land conversion, sustainable patterns of production systems, risk and vulnerability assessment, urban governance, and technology innovation within the overall perspective of climate change. Of particular importance is the need for extensive and dependable monitoring of the extent of avoided land use/land cover changes across space and time.

Achieving truly climate-compatible development will require substantial changes to Indonesia's economic structure, its land-use planning, and its government policy. It will also require a new mindset focused on long-term, environmentally-sustainable development taking hold within the government, the business community, and the non-profit sector.

A principal goal of the low carbon growth strategy is to ensure that the people of Indonesia do not achieve reduced emissions at the cost of reduced growth. Additional financing will be needed to underwrite the considerable investments associated with the transition to a climate-compatible development path. Some of that financing will likely be provided by the domestic government, some by international donor agencies covering opportunity cost of stakeholders, some by future carbon trading and some by the private sector as companies see the potential to generate positive returns.

A number of challenges may influence the success of the implementation of a low carbon economy including policy design, data acquisition and management, technology and technical capacities as well as institutional mechanisms among key agencies operated at different level of governance. Therefore, there is a need to establish further strategic efforts to mobilize expertise and resources of interested countries in the area of science, policy and implementation of the broader issues of low-carbon development.

2. Key Drivers for a National MRV for Indonesia

According to the principles of the IPCC Good Practice Guidelines (IPCC 2003 & 2006) a national MRV system shall address the following 5 issues:

1. **Consistency:** Information on carbon stocks shall be provided based on consistent data sources. However, in most cases in developing countries the use of heterogeneous data sources (especially looking into the past to establish base lines) will be the only technical feasible possibility rather than a systematic and consistent monitoring approach. The latter is only possible looking into the future once a national MRV is installed.
2. **Transparency:** Expert opinions, independent assessments or model estimations are commonly used as data. But it should be the goal of the country to establish a technically feasible and scientifically sound basis for national reporting with the involvement of science, public and policy.
3. **Comparability:** few countries have experience in using the IPCC Good Practice Guidelines (GPG) as common estimation and reporting format. However, setting up a national MRV in Indonesia most recent technology should be applied to achieve comparable results in the future.
4. **Completeness:** lack of suitable forest data is evident in Indonesia for both area change and changes in carbon stocks. The latter requires carbon emission factors for at least the main Indonesian forest types including peat lands.
5. **Accuracy:** Although in the past limited information on the uncertainty and error sources of estimates could be provided by countries, there are well established approaches to analyze, reduce, and deal with comprehensive error budgets in order to facilitate internationpal reporting

The cost for a MRV is directly dependent on the total number of thematic classes, the mapping scale defined by the so-called minimum mapping unit[1] (MMU) and the thematic accuracy. Hence, changing any of these parameters towards higher values and higher accuracy, respectively, may lead to an exponential increase of effort and cost.

For instance, the IPCC guidelines recommend that carbon stock information can be obtained at three different Tier levels which can use (1) IPCC default factors, (2) country

1 The MMU defines the smallest object size to be mapped. For instance a 1 ha MMU will not map any object which is smaller than 100 x100 m2.

specific data for key factors, and (3) detailed national inventory of key C stocks, including repeated measurements of key stocks through time or modeling (see Annex 6.1 for details). For each Tier a range of methods is available which differ significantly with respect to effort and operationality under tropical conditions. For any Tier IPCC expects that estimates should be accurate and uncertainties should be quantified and reduced as far as practicable. It is recommended that carbon stocks of key categories and pools should be estimated with higher tiers. The balance between accuracy/precision and effort should be guided by the principle of conservativeness i.e. a tier lower than required can be used – or a carbon pool can be ignored if the overall estimate of emission reduction is likely to be underestimated.

In general in developing countries a cost-effective monitoring and evaluation system for REDD requires a balanced approach of remote sensing and ground measurements. While LULUCF monitoring is relatively easy, the assessment of forest degradation (i.e. forest remains forest but undergoes a certain reduction of biomass) and carbon stocks is more challenging, and largely relies on ground measurements, complemented by very high resolution (VHR) remote sensing. In the following a range of methods for different Tiers are discussed and respective architecture elements are described.

An open issue in the international political discussion on REDD is the question of Reference Emission Levels (RELs) which can become a main cost driver for a MRV. RELs (including carbon sequestration) are needed as benchmarks to identify if national carbon reduction goals have been achieved and how they can be rewarded by the carbon market or international policy. They can be applied on different national scales, with different scopes and varying conceptual approaches. But they are needed for all accounting purposes and to fulfill voluntary of compulsory commitments. Hence, they need to address historic, recent and future carbon stock developments (dynamics). At the same time RELs have to be pragmatic and technically feasible to be accepted. As the negotiations on international level are still on-going the recommendations or rules to follow have to be carefully monitored in order to assure compliancy and to avoid wrong investments.

3. The REDD Service Infrastructure Elements

For the establishment of an Indonesian REDD+ Spatial Data and Service Infrastructure the following architectural components need to be considered (Figure 1):

(1) Technical Infrastructure

The technical infrastructure comprises all technical hardware and software components to assure data flow from various sources, data storage and retrieval, data analysis and reporting and the link to users via intranet and the Internet.

(2) Deforestation/afforestation monitoring

This aims to monitor wall-to-wall the whole land of Indonesia by means of remote sensing.

(3) Degradation monitoring

Monitoring forest degradation is more challenging, and largely relies on ground measurements, complemented by very high resolution (VHR) remote sensing.

(4) Carbon stock modeling

The link between LULUCF information from remote sensing to carbon stock is achieved by Carbon Accounting models which combine spatially explicit information from remote sensing with carbon emission factors for the different land cover/use classes.

(5) Quality Assurance and Quality Control (Verification System)

For internal and external verification (e.g. for reliable error budget estimation) of carbon stock estimates, as requested by IPCCC and international donor organizations.

(6) Dissemination of Results

The results obtained by the above mentioned components need to be analysed and disseminated to various interest groups, such as

- the international climate change community (IPCCC, Donors),
- the international stock market to allow the trading of carbon equivalents estimated by the monitoring system,
- the citizens interested in the progress of forest protection and the national efforts to reduce the overall carbon emission reduction rates
- the forest service to support/enforce the control of sustainable forest management across the country.

In the following chapters each of the 5 components will be described in more detail.

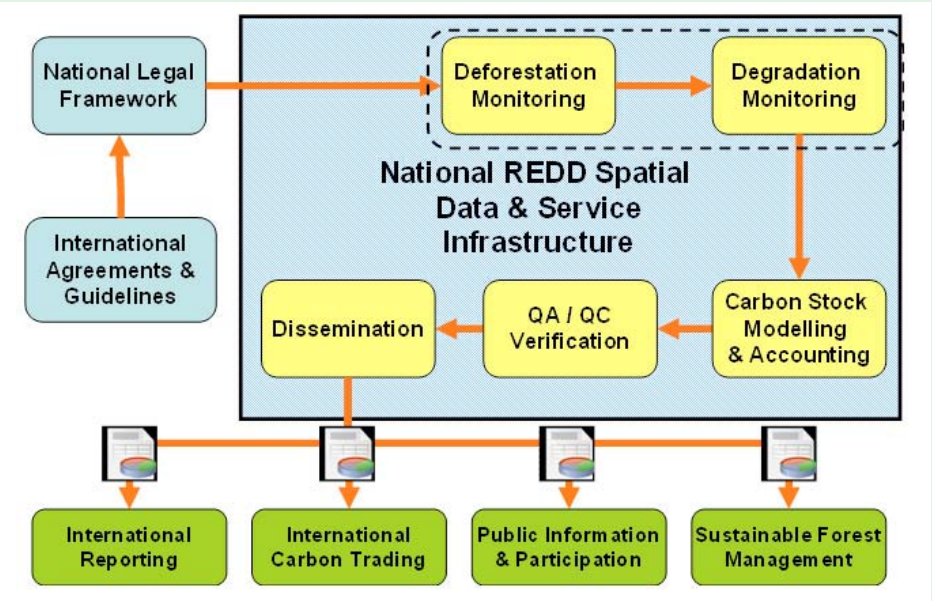

Figure 1 : Main architecture elements for a national MRV system

3.1. Hard- and Software (Technical Infrastructure)

The technical REDD Infrastructure can be based on existing installation in Indonesia. However, in certain cases an upgrade of existing hard- and software components together with experienced staff may be necessary. In order to allow a comprehensive analysis of existing installations and possible gaps for a national REDD infrastructure the following capabilities need to be assured:

1. Assure data flow and ingestion into the REDD data analysis component from various sources: this comprises not only remote sensing data from different satellites but needs to cover data from terrestrial survey and other sources, such as topo maps, DEMs, LIDAR, GPS, etc. It also requires the management of various data formats, scales, and thematic content
2. Data storage and retrieval based on a flexible national data base model linked to Web map servers and Web Feature Servers (WMS/WFS) to allow decentralized access (up- and download) and to manage data quality issues, access rights, etc.

3. Data Analysis allowing digital image processing, GIS functions (including carbon sequestration and loss models)
4. An independent national verification system for Quality Control / Quality Assurance (QA/QC) which surveys internal workflows and results. The system may be linked to external QA/QC approaches carried out by auditors as most probably will be required by donors and the carbon stock markets.
5. Visualization & Reporting: this shall enable national agencies to create in an highly automated way all necessary regular reports on national carbon stocks development, including early alerts and mitigation monitoring e.g. to take measures if illegal logging activities are detected. In addition, via WMS/WFS this element will allow to inform the public via Internet about the status of REDD and recent forest protection activities.
6. Very important for the efficiency of the system is a comprehensive interface management on all levels of the REDD system. Otherwise there is a high risk that data exchange between the different components might become difficult which may lead to significant time delays and higher costs during operations.

3.2. The Forest Monitoring System (Forest Cover and Degradation)

Taking into account the recent discussion towards integration of REDD+ and LULUCF[2] the information on Forest Land needs to be accomplished by at least 5 other land cover types such as Cropland, Grassland, Wetlands, Settlements, and Other Land. Hence, the level of detail (i.e. the thematic content) for LULUCF[3] estimation determines the effort to be considered. State of the art methods are based on high resolution (HR) remote sensing data from today's sensors (such as Landsat, SPOT, IRS, RapidEye, etc.).

However, the national system should be able to ingest high resolution spaceborne SAR[4] data (such as ALOS PalSAR, RADARSAT-2, in the near future Sentinel-1), as well. The reason for that is that optical data are always hampered by cloud cover and may require too

2 Land use, land-use change and forestry (LULUCF) is defined by the UN Climate Change Secretariat as "A greenhouse gas inventory sector that covers emissions and removals of greenhouse gases resulting from direct human-induced land use, land-use change and forestry activities." LULUCF has impacts on the global carbon cycle and as such these activities can add or remove carbon dioxide (or, more generally, carbon) from the atmosphere, contributing to climate change. LULUCF has been the subject of two major reports by the Intergovernmental Panel on Climate Change (IPCC). Additionally, land use is of critical importance for biodiversity. Source: http://en.wikipedia.org/wiki/Land_use,_land-use_change_and_forestry

3 ! Land Cover, Land Cover Change and Forestry

4 Synthetic Aperture RADAR

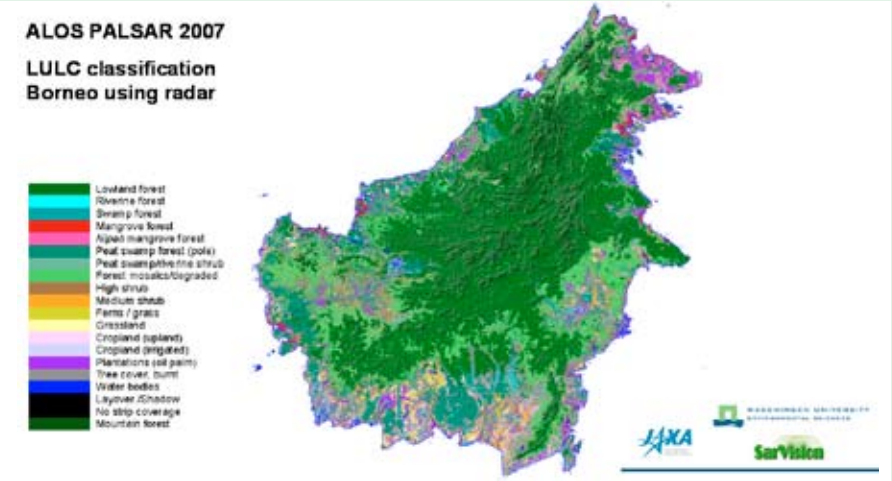

Figure 2 : Land Use Map of Borneo from 2007 based on ALOS PalSAR data prepared for GEO FCT[5]

long acquisition windows to guarantee a full coverage. In addition, a multi-mission approach assures against system failures of single source solutions.

Although SAR data processing is more demanding than the analysis of optical imagery in the meantime there exist operational approaches which can take benefit from the all-weather capability of SAR systems. This allows closing gaps in due to frequent clouds coverage in many tropical regions (Figure 2). Respective training of national experts on SAR data analysis should be foreseen in the initial implementation phase.

To link the spatially explicit forest cover and degradation maps to the carbon content and its flux over time so-called carbon emission factors (CEF) for all important forest types and land cover classes need to be available. As for many forest types and other classes detailed CEFs are currently not available a cost-effective monitoring and evaluation system for REDD requires a balanced approach of remote sensing and ground measurements.

5 The Forest Carbon Tracking Task (GEO FCT) has been established to support countries wanting to establish national forest-change, carbon estimation and reporting systems. It will facilitate access to long-term satellite, airborne and in situ data, provide the associated analysis and prediction tools, and create the appropriate framework and technical standards for a global network of national forest carbon tracking systems. The task is being carried out by a partnership of GEO member governments, key UN bodies, space agencies, the science community and the private sector. Source: http://www.geo-fct.org/

While remote sensing provides spatially explicit information on the area and its change for any thematic land cover / use class ground measurements could provide the necessary CEFs for Indonesia.

3.3. The Carbon Stock Modeling and Accounting System

To account for carbon stocks and carbon stock changes on national and regional level tools are needed to model the fluxes. Here a careful trade-off between effort and result is required as models today range from simple approaches using a few input parameters for biomes from literature (i.e. Tier 1) to locally adapted carbon emission factors for the different above ground and below-ground biomass components and their temporal behaviour (e.g. decomposition, burning, sequestration etc.).

As an example for a simple approach the Brazilian carbon accounting can be used. As in Brazil more than 80 % of carbon loss in forestry comes from deforestation and because the areas are large the assumption is that dense forest accounts for 100 t/ha and that gains and losses are calculated only via the changing area. In contrast to that the Canadian Forest Service over the last decade has developed a sophisticated carbon dynamics model which allows modelling the different fluxes in detail (Kurz, et al., 2009). It is highly flexible to adapt to country specific conditions and it can be used free of charge. However, it requires a lot of input data (emission factors for the various biomass components) to fully benefit from the detailed modelling approach.

It has to be noted that in Indonesia the peat swamp forests are a special source of carbon emissions. Hence, for that component country specific adaptations of any carbon model will be mandatory.

3.4. The Verification System

The main goal of a REDD verification system is to demonstrate to the stakeholders that all REDD measures are carried out according to IPCCC standards and good practice guidelines. In addition it will identify problems and gaps in the overall system performance leading to permanent system improvements.

For a national carbon accounting the estimation of the so-called “Minimum Reliable Estimate – MRE” of carbon stock and its changes is required. It is based on the estimation

of the total survey error (Figure 3). The reason for that is that in LULUCF mapping many possible error sources exist which need to be assessed in error budget estimations.

A REDD verification system comprises 2 main components:

(1) an internal QA/QC system which assures that all processes are carried out according to the pre-defined standards and that the results are in the error boundaries committed.

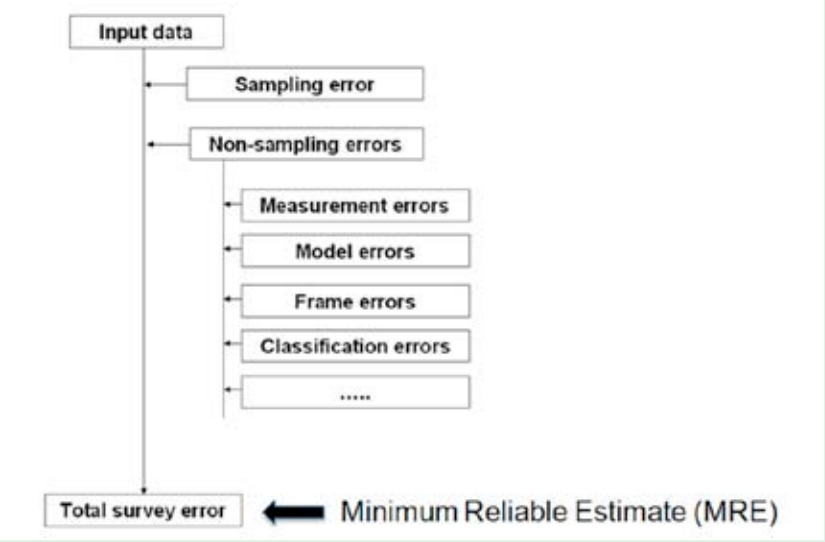

Figure 3 : Components of an error budget analysis to estimate the minimum reliable estimate (from Köhl et al., 2009)

(2) an external auditing which demonstrates to IPCCC, the stock market and the donor organisations that the resources have been used appropriately and that the carbon stock estimates are reliable, transparent and accurate.

With respect to the emission factors used the field sampling approach proposed will assure that the mandatory verification of the carbon stock estimates can be carried out in high accuracy and with a good estimation of the minimal reliable estimate of carbon stocks (MRE – as requested by IPCCC and donor organisations). At the same time it can be used to validate the quality of the LULUCF mapping and monitoring approach.

It should be noted that an appropriate QA/QC system for REDD may require 7-10 % of effort

of the total system cost. Hence, it is a major cost element and requires close management attention with respect to efficiency and transparency.

3.5. The Information Dissemination System

The information dissemination system of the MRV serves two different communities:

(1) governmental agencies responsible to update the system, to analyse the content, to report the results and to initiate measures, in case of deviations detected (e.g. illegal logging, pests, etc.). This component may need to be protected from external access in order to assure that the REDD data base will not be corrupted and that internal (confidential) elements are not passed to the public without official release.

(2) The public, including IPCCC, the market and the citizens. Today, the Internet will most probably serve for that. However, it needs to be decided which functions should be offered e.g. visualisation of mapping results including GIS functionality (e.g. search and combination of data sources) or only fixed text elements and statistics.

Here, as well a trade-off is needed between the functionality to be offered and the effort which it will required. For instance one could consider to use public domain tools from the internet (e.g. Google facilities) or to install commercial systems in order to keep the full control over the system's content and functionality.

4. Feasible Options

The cost of an MRV is country specific and is mainly addressed by the

- The extent of forest cover
- The level of forest stratification (e.g. while the Democratic Republic of the Congo has only one major forest type, Indonesia or Mexico have four or more forest ecotypes which require specific emission (factors).
- The tier of carbon accounting applied
- The integration of additional activities such as nature protection, biodiversity, landscape planning, socio-economic issues, etc.

In the following for each main component of the MRV a trade-off between possible options is given.

4.1. Technology Options

Table 2 lists the main options for carbon stock inventories and indicates the accuracy of each approach versus the.

Possible Carbon Stock Assessment Means	Accuracy	Effort
Ground-based measurements	high	high
Biome averages	low	low
Remote sensing measurements	medium - low	low
Combinations (e.g. multi-stage inventories)	high	medium

Table 1 : Comparison of effort and accuracy for different carbon stock assessment methods.

4.1.1. Carbon stock inventory options

4.1.1.1. LULUCF Inventory based on remote sensing

As described in chapter 3.2 a wall-to-wall LULUCF mapping and monitoring approach can serve reporting obligations for Tier 1. The national reports on carbon emissions from forests from the Min. of Forestry are already following this approach. However, the data base used requires an update and could be supported as well by new emission factors which are currently established by on-going development projects such as GTZ (in Kalimantan) or FAO (in Sulawesi).

4.1.1.2. Multi-stage inventory

Carbon stock estimates are necessary to determine net forest emissions, and are derived by combining the area extent of deforestation and/or forest degradation with carbon density measurements.

For degradation monitoring the REDD Sourcebook (2009) recommends the use of very high resolution (VHR) imagery or field survey in order to allow the identification of selective or reduced impact logging activities (i.e. removal of single trees). As VHR imagery for large areas is expensive and still has limitations in acquisition capabilities in very large area acquisitions campaigns it is recommended to use a sampling approach instead and combine this with the mandatory ground survey required to estimate carbon emissions factors (Figure 4).

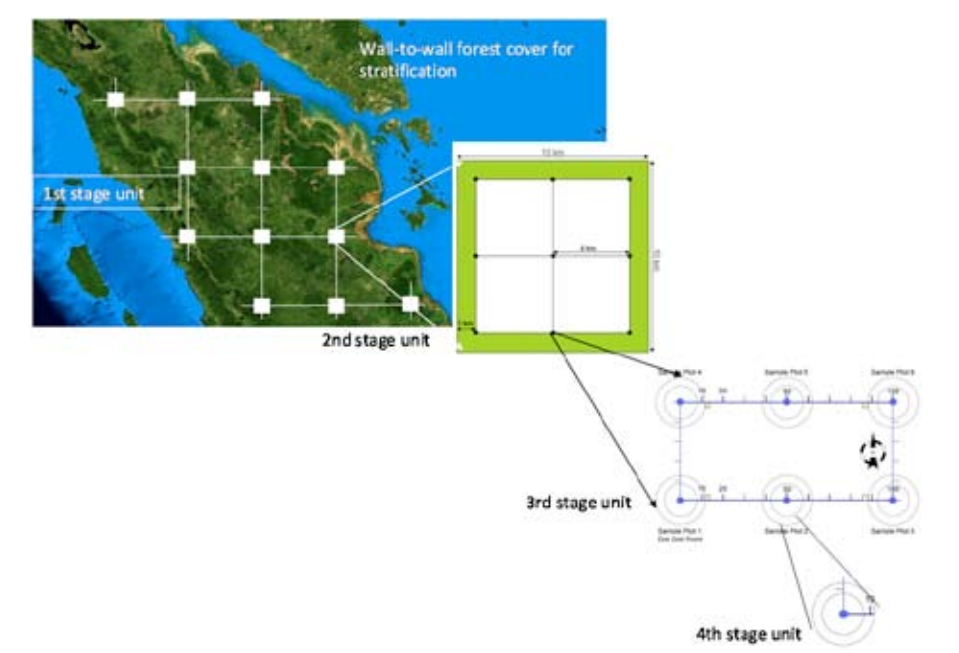

Figure 4 : Example for a multistage cluster sampling approach for REDD (Kuntz et al., 2010, modified). Based on wall-to-wall forest mapping from remote sensing - the forest cover is assessed. This allows a stratification of the 1st stage units. In the second stage a further sampling grid with a spacing of 4x4km and a buffer of 1km will be implemented in the above selected sampling areas resulting in 9 clusters. Each cluster consists of 6 sample plots (3. stage), which are surveyed on ground and where dendrometric measurements are carried out to estimate carbon stock.

4.1.2. Satellite options

Different methods are available and suitable for monitoring deforestation, forest degradation and carbon stocks. Deforestation monitoring today can rely on remote sensing technology with high resolution optical systems (e.g. SPOT, LANDSAT, IRS, RapidEye, DMC, ALOS PalSAR, Sentinel-1, etc.). However, it should be integrated into the monitoring of LULUCF in order to achieve the basis for annual reporting and to build an early warning system on forest cover deviations from national plans.

Monitoring forest degradation and carbon stocks is more challenging. However, in Indonesia, the forest stock is decreasing by 6% a year and forest degradation is responsible for two thirds of this, whereas deforestation is responsible for only a third (Marklund and Schoene 2006). Here, the MRV system needs to identify the removal of single trees or at least a change in canopy density. The REDD Sourcebook recommends for that ground measurements, complemented by very high resolution (VHR) remote sensing (e.g. IKONOS, QuickBird, TerraSAR-X).

Taking into account the frequent cloud-cover over large Indonesian regions possible strategies are

(1) Monitoring based on high temporal and medium spatial resolution systems (MERIS, MODIS, Sentinel-3, etc), or
(2) A multi-mission approach (e.g. by deploying SPOT, RapidEye, DMC, IRS, Landsat, Sentinel-2, ALOS, RADARSAT-2, ENVISAT, ClimateSAR, etc) to increase the effective revisit time.

In tropical countries SAR technology can complement the optical satellite systems by providing weather-independent reliable data in medium to very high accuracy. Especially when data availability is time critical (e.g. if images have to be available to the field survey teams before they go out for survey or if a dead line for reporting needs to be kept) the use of SAR data becomes mandatory.

The implementation of the satellite based monitoring system can be done in 3 phases:

(1) start today by establishing framework contracts with EO data providers based on budget lines negotiated with the international donor community.
(2) On mid-term Indonesia may install in-house receiving and tasking capabilities for external EO systems, and
(3) on the mid to long term Indonesia may install own dedicated satellite(s) to serve national/international needs.

4.1.3. Training and enabling (Train the Trainers)

An important element for Indonesia is to close the gap between recent technical developments and local know-how. Here a set of training workshops should be foreseen

which can start immediately in order to prepare decision makers and technical staff for national MRV activities according to IPCC Best Practice Guidelines and the REDD Sourcebook.

A non-comprehensive list of training blocks is shown below:

Topic	Trainees	Duration of a workshop
State of the art in remote sensing and carbon stock accounting for MRV	Decision makers & researchers	1 week
Data analysis for LULUCF (national level); training on the job • Optical data analysis • SAR data analysis	Technicians	4-6 weeks
Multi-stage forest inventory (terrestrial survey)	Technicians	4-6 weeks
Carbon models / carbon accounting	Technicians	4 weeks
National data base infrastructure & maintenance	Technicians	2 weeks
Dissemination infrastructure & maintenance	Technicians	2 weeks
Other tbd.		

4.1.4. Topics for Research and Development

This chapter identifies a few important scientific fields which do require special attention. It is in any case non-comprehensive as a more complete analysis would require an own science document. However, in order to realize on a short term a coordinated approach it is recommended to stimulate international cooperation in the domains addressed and to install a scientific centre of excellence on tropical forestry, carbon stock dynamics and related issues.

4.1.4.1. Sustainable Forest Management for low-carbon emission

A challenge for tropical countries is an adopted forest management approach which

can efficiently reduce the carbon emissions. Here, issues like low impact logging, fire prevention, agro-forestry etc. need to be enforced.

4.1.4.2. Carbon stock dynamics in main Indonesian forest types

For most tropical rainforest ecosystems the carbon stock dynamics are not well understood. The complexity of combinations of high biodiversity, temperatures and humidity is still a challenge for science. Hence, emission factors from such complex ecosystems are difficult to be estimated and measured. However, in order to improve carbon stock models such basic research is urgently needed.

4.1.4.3. Peat land sensing (Japanese Proposal)

The very high amount of extensive peat lands in Indonesia (270,000 km2 and more than 500 M tons C02/a[6]) introduces a special challenge to the national MRV system. In fact field data on the depth of the peat layers, the variety of peatlands and their dynamics is needed. Here, remote sensing today can only partially support these activities, e.g. land cover change (e.g. restoration, protection, fires, etc).

As carbon balance in peat is strongly affected by both, the water statue and the ecosystem (vegetation, farming system and topography), the carbon budget should be estimated as a multifunctional system among the carbon-water-ecosystem. For that Japanese researchers have proposed a so-called "Peat Carbon Initiative". It comprises two major elements:

(1) "MRV Unit": a monitoring system for the carbon-water-ecosystem, applying new remote sensing technologies with different survey levels such as satellites, aircrafts, and ground measurements.
(2) "Field Laboratory Unit": to be established in local peat areas, supporting 1) Capacity Building for low carbon societies in regions dominated by peatlands by introducing carbon credit mechanisms, and 2) field research and monitoring.

4.1.4.4. Socio-economic impact of REDD

The sustainable reduction of carbon emissions of a nation will produce positive and negative impacts which are not well understood today. However, a general change of behavior based on a better understanding of the pros and cons among the citizens and stakeholders is required. How this can be achieved (legally enforced, incentives, public

6 Wetlands International, 2008

advertisement, etc.), what the impacts of economically and politically may be and how the change of public perception will impact on the long term the political stability and economic welfare requires interdisciplinary research on many levels.

4.2. Comparative Assessment

In the following table a comparative assessment of the different technology options for the Indonesian MRV is given.

Technology	Assessment				Effort in (Mio US $)	Ranking 1 - 5 (low - high priority)	Remarks
	Maturity	Reliability	Degree of complexity	Time line			
Hard-/ Software	Commercial	High	High	Immediate	Tbd. according to existing installations (gap filling only)	5	Commercial of the shelf (COTS) software & hardware for all components available
LULUCF	High	High	Medium	Immediate	3-6	5	Either update of existing LC map or new mapping
Deforestation	High	High	Medium	Immediate	Same as above	5	Same as above; multi-mission approach advisable
Degradation	High	High	High	Immediate	28	5	To be linked with national forest inventory based on multi-stage sampling approach; will provide national emission factors required for carbon stock modelling
Carbon Stock modeling	High	High	High	Immediate to Mid-term	Tbd. according to Tier level	5	Phased approach; starting with Tier 1 (existing) and upgrade to Tier 2/3 once emission factors from national forest inventory are available
Verification	High	High	High	Immediate	7-10% of system cost	5	

Dissemina-tion	High	High	High	Immediate	Tbd.	5	To be linked with national spatial data infrastructure; requires standards and interface management
Satellite Data							
Medium resolution	High	low	Low	Immediate	Marginal	2	Can use international efforts (e.g. GlobCover, USGS, …)
High resolution	High		Medium	Immediate	None	5	Assumption is that costs for this data type will be free of charge (e.g. Landsat, Sentinel-2) or will be covered by governmental agreements
Very high resolution	High	High	High	Immediate	See "Degradation"	5	To be covered by agreements among donor agencies
National Satellites	Medium	High	High	Mid-term	> 100	3	Financing model to be explored
Peat Land monitoring system	Low	High	High	Mid-term	> 30	2	Still basic research; sensors to be developed/tested

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7. Annexes

Tier 1 methods are designed to be the simplest to use, for which equations and default parameter values (e.g., emission and stock change factors) are provided in IPCC 2006. Country-specific activity data are needed, but for Tier 1 there are often globally available sources of activity data estimates (e.g., deforestation rates, agricultural production statistics, global land cover maps, fertilizer use, livestock population data, etc.), although these data are usually spatially coarse.

Tier 2 can use the same methodological approach as Tier 1 but applies emission and stock change factors that are based on country- or region-specific data, for the most important land-use or livestock categories. Country-defined emission factors are more appropriate for the climatic regions, land-use systems and livestock categories in that country. Higher temporal and spatial resolution and more disaggregated activity data are typically used in Tier 2 to correspond with country-defined coefficients for specific regions and specialized land-use or livestock categories.

1. At Tier 3, higher order methods are used, including models and inventory measurement systems tailored to address national circumstances, repeated over time, and driven by high-resolution activity data and disaggregated at sub-national level. These higher order methods provide estimates of greater certainty than lower tiers. Such systems may include comprehensive field sampling repeated at regular time intervals and/or GIS-based systems of age, class/production data, soils data, and land-use and management activity data, integrating several types of monitoring. Pieces of land where a land-use change occurs can usually be tracked over time, at least statistically. In most cases these systems have a climate dependency, and thus provide source estimates with interannual variability. Detailed disaggregation of livestock population according to animal type, age, body weight etc., can be used. Models should undergo quality checks, audits, and validations and be thoroughly documented.

Proceedings towards REDD+ implementations in Indonesia

DNPI

Year	Milestones
2007	**National Action Plan on Climate Change (RAN-PI)** • Ministry of Environment developed The National Action Plan on Climate Change (RAN-PI) **COP 13 in Bali** • Indonesia pushed forest as the priority agenda • Paradigm shift: economic value of standing forest
2008	**National Council on Climate Change – Indonesia (DNPI)** • The National Council on Climate Change, established in July 2008, is a government organization which has been mandate by the President to: - Formulate national policies, strategies, programs and activities on climate change - Formulate national policies, mechanism and procedure on carbon trade - Coordinates activities in the implementation of climate change tasks - Monitor and evaluate policy implementation on climate change management and control - Support the negotiators on UNFCCC negotiations and compile Indonesia's position for each international negotiation meetings **Aceh: Forest Moratorium** • Aceh started to implement moratorium on its forest

2009	**G20 Summit** • President Soesilo Bambang Yudhoyono has committed to reduce 26 percent of its emission (domestic efforts) and up to 41 percent with the right level of international support by 2020 **Voluntary REDD+ Initiatives at Provincial Level** • Some provinces initiated REDD+ working groups (Aceh, West Kalimantan, Central Kalimantan, East Kalimantan, Papua, West Papua and Riau) **Indonesia's GHG Abatement Cost Curve and Provincial Low Carbon Growth Strategy** • Indonesia's GHG Abatement Cost Curve and Low carbon growth plans have been developed at national and provincial levels (East Kalimantan, Central Kalimantan and Jambi) by DNPI as the exercises to promote low carbon scenarios and integrate into existing development plans **Copenhagen Accord on REDD+** • GOI associated to Copenhagen Accord **Development of OSIRIS-Indonesia** • DNPI and Conservation International (CI) initiated collaborative efforts in developing policy analytical tools for REDD+ incentives assessment using OSIRIS (Open Source Impacts of REDD Incentives Spreadsheet)-Indonesia model. OSIRIS was developed by CI, Environmental Defense Fund, and World Resource Institute, in collaboration with DNPI and Indonesia's Ministry of Forestry, and generous support from the Norwegian Agency for Development Cooperation

2010	**Indonesia Climate Change Sectoral Roadmap (ICCSR)** • The National Development Plan Agency (Bappenas) developed The Indonesia Climate Change Sectoral Roadmap to provide inputs for the next five year Medium-term Development Plan (RPJM) 2010-2014, and also for the subsequent RPJMN until 2030, laying particular emphasis on the challenges emerging in the forestry, energy, industry, agriculture, transportation, coastal area, water, waste and health sectors **OSIRIS-Indonesia Prototype** • OSIRIS-Indonesia Prototype was available and was integrated into spatial modeling **Letter of Intent Between GOI and Norway** • GOI has signed the Letter of Intent (LOI) with the Government of the Kingdom of Norway on "cooperation on reducing GHG emission from REDD" through: - Conducting a policy dialogue on international climate change policy, in particular international policy on REDD+ - Collaboration in supporting the development and implementation of Indonesia's REDD+ strategy **National REDD+ Task Force (Satgas REDD+)** • Presidential Decree signed to mandate the creation of a taskforce to prepare REDD+ infrastructure in Indonesia **REDD+ National Strategy** • (Under Development)
2011	**National Action Plan on Climate Change (RAN-PI) Revision** • (Under Development)

Project Update

UN REDD Indonesia

Purpose

The UN-REDD Indonesia Joint Programme aims to assist and support the Government of Indonesia (GoI) to timely develop a REDD+ architecture that will allow a fair, equitable and transparent REDD+ implementation and to attain 'REDD-Readiness". In order to secure this Objective, three Outcomes with subsequent outputs and activities are being pursued:

Outcome 1: Strengthened multi-stakeholder participation and consensus at national level

- Output 1.1 : Consensus on key issues for national REDD+ policy development
- Output 1.2: REDD+ lessons learned
- Output 1.3: Communications Program

Outcome 2: Successful demonstration of establishing a Reference Emissions Level (REL), a Monitoring, Assessment, Reporting and Verification System (MRV) and fair payment systems based on the national REDD+ architecture

- Output 2.1: Improved capacity and methodology design for forest carbon inventory within a Monitoring, Assessment, Reporting and Verification System (MRV), including sub-national pilot implementation
- Output 2.2: Reference emissions level (REL)
- Output 2.3: Harmonized fair and equitable payment mechanism at provincial level
- Output 2.4: Toolkit for priority setting towards maximizing potential Carbon-benefits and incorporating co-benefits, such as biodiversity conservation and poverty alleviation under MDG

Outcome 3: Capacity established to implement REDD+ at decentralized levels

- Output 3.1: Capacity for spatial socio-economic planning incorporating REDD+ at the district level
- Output 3.2: Empowered local stakeholders are able to benefit from REDD+
- Output 3.3: Multi-stakeholder-endorsed District plans for REDD+ implementation

The Programme contributes to several national development goals and supports national processes, such as:

- Indonesia's Mid-Term Development strategy (RPJM)
- National Action Plan on Climate Change (RAN PI) produced by Ministry of Environment and National Council on Climate Change
- National Action Plan on Climate Change produced by Coordinating Minister of Social Welfare
- BAPPENAS Yellow Book
- Indonesian Climate Change Sectoral Roadmap (ICCSR)
- National Action Plan on Reducing Carbon Emissions (RAN GRK)
- Second National Communication
- "REDD Readiness" produced by Ministry of Forestry

The Programme is further in line with several UNDAF Outcomes, such as;

- Outcome 1, 'Strengthening human development to achieve the MDGs', and especially sub-outcome 1.4;' Increased opportunities for sustainable livelihoods'

- The UNDP outputs are particularly contributing to UNDAF Outcome 2, 'Promoting good governance', and sub-outcome 2.1; 'Increased adherence to the rule of law and human rights' and 2.2: 'Strengthened participatory and decentralization Processes'
- The Programme is equally in line with UNDAF Outcome 3, 'Protecting the vulnerable and reducing vulnerabilities', as its local capacity building and empowerment of local stakeholders will particularly take into account disadvantaged and discriminated groups, and ensure that a 'Free Prior Informed Consent' is given by all.

The Ministry of Forestry is the implementing partner of the UN-REDD Indonesia Programme.

Additionally, in 2010, UN-REDD Indonesia has worked with institutional partners such as the new 'REDD+ Task Force', The Development Planning Agency (Bappenas), The National Council on Climate Change (DNPI), The National Forestry Council (DKN).

Resources

Total approved budget for the National Programme is USD 5.6 million. The UN Agencies have the following budgets; UNDP: USD 2,996 000, FAO: USD 1,498 000 and UNEP: USD 1,150 250. Norway is the donor.

By 31 December 2010, UNDP had a delivery of USD 1,141,892.51 through UNDP and government implementation. The government implementation accounts for USD 1,020,775.56 of this sum. FAO had a delivery of USD 32,618 of which 781.15 was through government implementation. UNEP had no delivery. Please see part V- 'Financial Implementation'- for more information.

Other partners

There are several other partners contributing to REDD+ efforts in Indonesia. In May 2010, Norway and Indonesia signed a USD 1 billion Letter of Intent (LoI). This has been the most significant REDD+ effort made by a partner in Indonesia to date. In addition, Australia (AusAID and the Indonesia-Australia Forest Carbon Partnership (IAFCP)), Germany (GIZ, KfW) and the USA (embassy and USAID) are among other partners contributing significant funds for REDD+ initiatives in Indonesia.

Results

» **March 2010: UN-REDD Indonesia entered the 'implementation phase'**
'The Inception Workshop', held 30-31 March in Jakarta, marked a milestone for the programme development as it opened the 'implementation phase' of UN-REDD Indonesia. The workshop was officially opened by the Minister of Forestry, Mr. Zulkifli Hasan, and attended by a little over 150 participants representing various ministries, provincial governments, international organizations, NGOs and other stakeholders concerned with and interested in REDD+, both at national and sub-national levels. Please see the website of the Ministry of Forestry for more information: http://www.dephut.go.id/index.php?q=id/node/6282. The 'UN-REDD Inception Workshop Proceedings' were published on the UN-REDD workspace in April 2010.

» **March-July: Establishment of a functioning UN-REDD Project Management Unit (PMU)**
While the National Programme Director for the Programme was already appointed, in the aftermath of the Inception Workshop, advertising and preparations were made to hire additional staff for the PMU. By July, recruitment was almost complete. On June 28-29 and July 2-3, the PMU organized a Planning Workshop for revision and elaboration of a detailed Annual Work Plan, and was trained on Standard Operational Procedures (SOP) and how these are relevant for implementation of the UN-REDD Programme. By the end of 2010, the PMU includes a permanent team with diverse professional backgrounds, working from an independent office within the Ministry of Forestry.

» **May 2010- end 2010: The development of a new REDD+ architecture in Indonesia**
The first half of 2010 was an eventful period for REDD+ related work in Indonesia, with the signing of a Letter of Intent (LoI) between Norway and Indonesia on the 26th of May as a major event. The USD 1 billion agreement greatly influenced the REDD+ Readiness debate, and gave a new speed and intensity to the preparations. As a result, the Government of Indonesia experienced an urgent need to develop the capacity of central actors on climate change and REDD+. In this context, the UN-REDD Programme supported climate change and REDD+ training for institutions such as the National Council on Climate Change (DNPI) and provided practical support in implementing numerous REDD+ related activities to different institutions within

in the Government, such as the new 'REDD+ Task Force', led by the Head of the Presidential Working Unit for Supervision and Management of Development (UKP4), Mr. Kuntoro Mangkusubroto. The support to relevant institutions such as UKP4 in their preparations for the national REDD+ architecture has been a perfect fit with the UN-REDD Programme, and has led UN-REDD Indonesia to achieve key results under Outcome 1 of the National Programme; in contributing to 'strengthened multi-stakeholder participation and consensus at national level'.

» **Development of National REDD+ Strategy draft**

One of the key results achieved in 2010 has been UN-REDD Indonesia's draft National REDD+ Strategy in collaboration with Bappenas, where UN-REDD has supported drafting the document through an intensive and thorough multi-stakeholder consultation process. The methodology for this consultation method was inspired by the UNDP Legal Empowerment and Assistance to the Disadvantaged (LEAD) project, and the design targeted the National REDD+ Strategy through an inter-unit collaboration within UNDP. Starting in July 2010, and taking place over the course of several months, the process included Focus Group Discussions and Consultations at National Level and preparation and execution of a series of Regional Consultation Meetings. More than 300 experts representing more than 200 organizations from local, national, and international organizations participated in the 7 Regional and National Public Consultations. In addition to supporting the process with PMU staff, writers and resource persons were recruited to support the process. The Programme developed significant partnerships in the process, both with Bappenas and relevant line ministries, the Regional Governments, NGOs, civil society, academics and the private sector. Opening access to the process has increased participation and ownership by stakeholders and improved the quality of the drafts. The process produced three public drafts, a National REDD+ Strategy Executive Summary, and a report of the process to develop the National Strategy. On 18 November 2010, Bappenas officially submitted the final REDD+ Strategy draft to the REDD+ Task Force. In 2011, UN-REDD will work to maintain involvement of multi-stakeholders in the finalization of the Strategy. UN-REDD has supported translation and publication of the draft Strategies and Executive Summary, and will publish a Lessons Learned Report about the multi-stakeholder consultation process.

» **Other consensus-building activities**

Under Outcome 1, UN-REDD Indonesia has further supported other REDD+ activities to enhance consensus and multi-stakeholder participation at national level. In the second half of 2010, the Programme facilitated consultation meetings on Selection Criteria for the REDD+ Pilot Province under the aforementioned LoI. Additionally, to enhance coordination, UN-REDD has from an early stage (July 2010) discussed issues such as the Moratorium on all new concessions for conversion of peat and natural forest (planned to be effective in January/February 2011), quality of spatial data and statistical data, and MRV institution with the new REDD+ Task Force.

Other activities include:

- Participation in the Asia Forest Partnership (AFP) Conference and Exhibition in Bali in August 2010;
- Support for DNPI staff to participate in Climate Change Training organized by the Clinton Foundation in June 2010;
- Study trip to Brazil with DNPI staff in September/October 2010;
- Participation in side events at COP16 in December 2010 (on FPIC, organized by RECOFTC and on co-benefits, organized by UNEP) and facilitation of a youth delegation to COP16;
- Facilitation of meetings between Ministry of Forestry and the REDD+ Task Force;
- Participation in the 5th UN-REDD Global Policy Board Meeting in Washington DC;
- Participation in the First Regional UN-REDD Information Exchange Meeting in Bangkok in November 2010 (UN-REDD Indonesia presented progress on the National REDD+ Strategy and FPIC);
- Participation in RECOFTC workshop in Bangkok in November 2010;
- Participation in REDD+ Retreat on REDD+ Implementation in Indonesia in November;
- Facilitation of Ministry of Forestry workshop on status and coordination of REDD+ Demonstration Activities in December 2010;
- Collaboration with DNPI on Indonesia Carbon update in December 2010;
- Facilitation of a series of high-level meetings for decision makers in October, November and December 2010, where topics included the National REDD+ Strategy, the role of the yet to be established REDD+ Agency and Pilot Province Selection.

» **Pilot Province activities in Central Sulawesi**

In the aftermath of the Inception Workshop, the Pilot Province Selection for UN-REDD Indonesia was completed. Based on the Selection Criteria and multi-stakeholder inputs, Central Sulawesi was chosen as the main Pilot Province. However, it was also decided that there would be a secondary focus on the other Provinces in Sulawesi, for an island-wide approach. During the second half of 2010, a number of missions to Central Sulawesi were conducted. Meetings were held with NGOs, civil society and Local Universities (especially University of Tadulako) as well as with local government. Following this, a Kick-Off event (Launching) of UN-REDD activities was held at Provincial level (in Palu, Central Sulawesi) on 13 October 2010. More than 200 people, including the local Governor, UNRC and representatives from UNDP, FAO, UNODC, NGOs, CSOs, University partners and the private sector attended the event. A Working Group at Provincial level has been established. Local government and NGOs give their active support to the UN-REDD activities. In November, UN-REDD was provided with space to set up a regional facilitation office. A Regional Facilitator, based in the regional capital of Central Sulawesi, Palu, has been recruited. UN-REDD activities commenced in 2010 in Central Sulawesi include MRV and FPIC. For progress on these issues, see below.

» **MRV**

FAO together with the Ministry of Forestry has developed information materials on MRV to aid the discussion on MRV. Also several discussion sessions with the Ministry were held to increase understanding of MRV and REL. As part of the general capacity building in MRV, the UN-REDD Programme is preparing to implement a Remote Sensing and Forest Inventory training in Central Sulawesi together with Tadulako University. Preparation meetings for this were held to agree on the syllabus and course outline.

The UN-REDD Programme has also been meeting with the relevant actors working on MRV, to develop an overview of the initiatives and enhance cooperation and collaboration in this matter. The UN-REDD Programme focuses on developing a new National Forest Inventory (NFI) based on the existing NFI as a necessary part of a MRV system. For this an international consultant is being hired to make a NFI design in close collaboration with the Ministry of Forestry and other stakeholders. The other aspect of an MRV system is the satellite land monitoring. A satellite image interpretation of Lore Lindu National Park in Central Sulawesi was carried out to test the possibilities to

identify land-use categories. This resulted in several maps of the Park.

The UN-REDD Programme developed an initial historical emission level from forestry in Central Sulawesi for the period 2000-2009. This was done to present the methodology applicable to MRV and REL processes.

In the second half of 2010, the UN-REDD Programme contributed to several public consultation meetings discussing the new institution which will be responsible for MRV, REL and fair payment system in Indonesia. As stated in the Norway-Indonesia LoI, an independent MRV body will be established to manage and coordinate all existing agencies on MRV and REL related issues. In this respect, FAO is assisting the Ministry of Forestry with the development of a MRV Road Map for the REDD+ Task Force/ future Agency. This road map includes information on required tasks and possible entities to implement those tasks, a time frame and a budget.

» **Communication**

In terms of the Communication of the Programme, several steps have been taken. A Communication Officer and a Public Relations Officer have been recruited as part of the PMU. These Officers have developed brochures and information material in addition to promoting and facilitating UN-REDD Indonesia events. The Programme purchased the www.un-redd.or.id and www.redd.or.id web domains, and has actively been using the UN-REDD webpage to disseminate information about the Programme and its activities. This was especially important for the UN-REDD support to the National REDD+ Strategy process, since the various drafts of the National REDD+ Strategy were only available on the UN-REDD website. During this period, the UN-REDD Programme particularly actively promoted the website and its content, and the website had several thousand hits. The UN agencies have further taken regular action to update the global official and internal UN-REDD websites. A promotional film was made about the UN-REDD supported consultation process for the Bappenas led development of the National REDD+ Strategy. Another video film about REDD+ in Indonesia and the UN-REDD Programme activities was made and shown at the UN Climate Change Conference (COP16) in Cancun, Mexico, in December 2010. Lessons Learned Reports on the multi-stakeholder development of the National REDD+ Strategy draft are currently being developed, to be shared with national and international UN-REDD partners. A Communication Strategy and further development of information materials are planned for the FPIC process and other sub-national activities.

» **Networking and outreach**

UN-REDD Indonesia has worked with institutional partners such as the new 'REDD+ Task Force', The Development Planning Agency (Bappenas), The National Council of Climate Change (DNPI), The National Forestry Council (DKN) and others. Networking and coordination meetings with related initiatives have been an important part of the UN-REDD Programme, and regular meetings and discussions with actors such as GIZ, AusAID, USDA Forest Service and the World Bank have taken place. UN-REDD has also had frequent contact with Civil Society Organizations and Indigenous Peoples (IP) representatives, such as AMAN, the Rainforest Foundation, WWF, TNC, WRI etc. Researchers from CIFOR, ICRAF, foreign and Indonesian Universities have further contributed to the dialogue concerning the national REDD+ architecture. Moreover, the Norwegian Embassy and Norad, the UN-REDD Secretariat and the UN-REDD Programme in UNDP, FAO and UNEP Headquarters and regional offices have been active partners. Meetings were also held with other UN-REDD countries, to draw upon lessons learned.

» **FPIC and multi-stakeholder consultation processes**

UN-REDD has highly prioritized to develop its capacity on the Free Prior and Informed Consent (FPIC) principle for interaction with indigenous peoples and local communities, and – building on the work that was done in 2009, such as the development of FPIC Guidelines for UN-REDD Indonesia – UN-REDD has in 2010 strengthened its understanding of the FPIC principle, through for instance participation in the UN-REDD Programme Asia Regional Consultation with Indigenous Peoples on FPIC and Recourse Mechanisms, 16 – 18 June 2010, Hanoi, Viet Nam. At the national level, UN-REDD has started collaboration with the National Forestry Council (DKN) to develop National FPIC guidelines for REDD+ in Indonesia. Drawing upon work to develop global FPIC guidelines by the global UN-REDD Programme, the National Programme has in late December 2010 and early January 2011 supported the development of national guidelines. A National FPIC workshop was held in early January 2011 to support a national consensus on the importance of FPIC. The Chair of the REDD+ Task Force, Kuntoro Mangkusubroto opened this UN-REDD/DKN supported workshop. In parallel, implementation of FPIC process in Central Sulawesi has started. Through the active involvement of multi-stakeholders at sub-national levels, a targeted FPIC process will be implemented in the pilot province/districts. Workshops on FPIC mechanisms at

provincial and district levels were held at the end of December 2010, and several missions are planned to give further support to the multi-stakeholder development of the FPIC processes.

» **Inter-agency UN collaboration and implementation arrangements**

While UNDP and FAO have had daily cooperation since both agencies are located in Jakarta, UNEP has been represented through several missions by the regional coordinator of UN-REDD in Bangkok. The UN inter-agency collaboration was further strengthened through development of Harmonized Implementation Arrangements (HIA). A Harmonized Approach to Cash Transfer (HACT) assessment was conducted 24 September 2010 by a 'HACT team' from UNICEF. The results of the HACT were issued in quarter four.

All through 2010, several meetings were conducted between FAO, UNEP and the Ministry of Forestry, also involving Ministry of Finance, and Ministry of Foreign Affairs in order to finalize the arrangements needed for the implementation of the UNEP and FAO components of the Programme involving cash transfer. A Letter of Agreement (LoA) is needed for FAO implementation, while a Project Cooperation Agreement (PCA) is needed for UNEP implementation. The Ministry of Forestry suggested several revisions to the legal texts of these documents. According to the Ministry of Forestry, these legal texts portrayed the Ministry as sub-contractors to the Agencies, not equal partners. Other suggestions related to terms of payment, the legal status of the documents and other issues. The prolonged revision process of the agreements therefore postponed the signing of the documents. In December 2010 agreement was reached between the Ministry of Forestry and FAO resulting in the signing of the LoA in January 2011. The PCA finalization is still in progress.

Seeing that fund transfer to the PMU from UNDP, FAO and UNEP do not follow the same mechanism, the PMU suggests that for future similar projects a clear mechanism of fund transfer is decided upon before the Project Document is signed and that the LoA (FAO) and PCA (UNEP) are signed together with the Project Document.

» **Cross-cutting issues; Gender**

Concerning gender aspects of REDD+, UN-REDD Indonesia participated in a discussion at the UN Climate Change Conference (COP16) in Cancun, Mexico, in December 2010. UN-REDD also participated in a working meeting at the Ministry of Forestry for

mainstreaming gender in REDD+ programmes, and is building partnerships with NGOs and CSOs working on gender issues in Central Sulawesi. UN-REDD Indonesia further plans to hire a consultant to mainstream gender issues in the REDD+ implementation in Central Sulawesi.

Future Work Plan

As recommended by the Programme Executive Board meeting 12 January 2011, UN-REDD Indonesia will seek a no cost extension of the Programme. The Programme therefore plans activities for the full calendar year of 2011. Some of the key activities include:

Consensus on key issues for national REDD+ policy development and capacity to implement REDD+ at decentralized levels (UNDP)

- Develop capacity on fair payment systems and benefit distribution systems. This includes compilation and evaluation of existing payment mechanisms and organization of an event on this topic in the first half of 2011.
- Follow up Provincial activities in Central Sulawesi, including selection of pilot districts.
- Continue FPIC process, both on national level for national policy development of FPIC and piloting of the process on sub-national levels.
- Follow up on National REDD+ Strategy development and lessons learned.
- Support development of the Ministry of Forestry REDD+ Roadmap and internal and external coordination mechanisms.
- Active participation in the establishment of REDD+ Agency and payment mechanisms with the REDD+ Task Force.

Communications (UNEP)

- Recruitment of an international consultant to develop a communications strategy and design the awareness impact monitoring system and training programme on REDD+
- Target messages, target groups and national partners identification through consultations and design social marketing campaign to facilitate high-level government decisions
- These actions will be important in order to get UNEP represented on the ground, and to strengthen inter-agency cooperation.

Multiple benefits (UNEP)

- Toolkit for priority setting towards maximizing potential carbon-benefits and incorporating co-benefits, at the provincial level likely to start in April 2011
- Spatial analysis of co-benefits
- (GIS) Training of provincial staff in use of the Priority Setting Toolkit
- Integration of the results into local spatial planning process, national REDD policy, and decision making.

MRV, REL (FAO)

- Training on Basic Remote Sensing planned in February 2011, FAO, PMU, Tadulako University
- Training on Forest Inventory methodology (March 2011)
- Progress on MRV road map with the TF (Danilo Mollicone, Joel Scriven), mission planned in February 2011 to solidify this further.
- Several workshops on MRV for purpose of consultation and capacity building
- Developing methodologies for reporting and verification
- Develop Reference Emission Levels through a process of consultations and scientific peer review.

Contributors

Agus Purnomo

Agus Purnomo was appointed as Special Assistant to the President of the Republic of Indonesia for Climate Change issues in mid-February 2010. As President Yudhoyono's Special Assistant, his main task is to update the President with the latest development on climate change negotiations and to deliver the President's specific assignments on climate change issues. Agus Purnomo is also the Head Secretariat of the National Council on Climate Change of the Republic of Indonesia(NCCC) in Jakarta. The NCCC was established on July 4th 2008 and assigned to a) formulate national policies, strategy, program and activities on climate change, b) to coordinate strategic climate change activities such as adaptation, mitigation, technology transfer and financing, and c) to formulate national policies and procedures on carbon trade. Agus Purnomo has served as the Head of the Indonesian Delegation in five of the six UNFCCC negotiation meetings in 2009. During his tenure as Special Assistant to the Minister of Environment, from December 2004 to October 2009, Agus Purnomo was appointed as the Global Environment Facility (GEF) Operational Focal Point (2005-2009), UNEP President's Liaison Officer (2005-2007), and the Executive Chair of the National Committee for the UN Climate Change Conference in Bali in December 2007 (UNFCCC COP13/CMP3). Prior to joining the government, Agus Purnomo served as the Executive Director of WWF Indonesia for seven years since 1996. WWF has more than 300 professional staff working in 20 conservation areas across fifteen provinces of Indonesia with a total budget of USD 8 millions in 2002. Prior to running WWF-Indonesia, he served as the Executive Director of a policy research institute called Pelangi Indonesia for four years since 1992. Pelangi Indonesia has produced

reports on the impacts of climate change and the potential activities to reduce greenhouse gasses emissions, as well as books and papers on energy, transportation, public health and sustainable development. In his early career, Agus Purnomo served as the Executive Director of WALHI (Indonesian Forum for Environment). WALHI, a member of the Friends of the Earth International (FoE), has more than 300 environmental organization members across Indonesia and has filed the first environmental law suit against the government on deforestation and water pollution issues in North Sumatera province.

Doddy Surachman Sukadri

Doddy Surachman Sukadri is in charge of chairperson, LULUCF Working Group in the NCCC. He is a forest policy analyst, holding a PhD in Forestry from Colorado State University, Fort Collins, USA. He did his master program at University of Arizona, Tucson, USA, majoring in forest-watershed management. His BS in Forestry was obtained from Bogor Agricultural University (IPB), Indonesia. Having such a strong forestry educational background, most of his work have been dedicated to forestry-related policy problem-solving. Before joining NCCC, he worked for the Ministry of Forestry of Indonesia for more than 25 years, and during his tenure, he posted in various divisions, ranging from forest planning, reforestation and land rehabilitation, foreign cooperation, and forest policy research and development. He was also experienced in working with international organizations, including CIFOR and the World Bank. During two-year of his tenure in CIFOR, he, with an assigned research team, developed the so-called CIMAT (Criteria and Indicators Modification and Adaptation Tool), a computer-based programming system to be applied for different type of forests toward sustainable forest management (SFM) practices. Prior to his engagement with NCCCC, he was in the World Bank office in Jakarta, in charge of developing Indonesia wood-based Industry. He actively joint a task force established by the Ministry of Forestry in formulating the road map for sustainable forest-based industry in Indonesia. Presently, he has been assigning as a member of the REDD Plus Technical Team work, assisting the Indonesia REDD Plus National Task Force, especially in accomplishing the REDD Plus National Strategy.

Farhan Helmy

Farhan Helmy is a Secretary of Mitigation Working Group at DNPI. He is currently a Network Focal Point of Indonesia Carbon Update Network and Asia Forum on Carbon Update Network (www.indonesiacarbonupdate.net). He is a scientifically-trained professional and has wide national and international experiences in the field of natural resource and environmental policy analysis, with special interests and experiences in forestry governance, land use/spatial dynamics, low carbon growth strategy (LCGS), disaster risk reduction, risk assessment and environmental vulnerability mapping, and the use of open-source based tools for policy analysis and modeling, such as Geographic Information Systems (GIS), remote sensing, and Decision Support Systems (DSS). His specialties are conceiving, designing and assessing environmental information systems and decision support systems, and their implementation at national, provincial and district levels by using of various analytical tools, such as ArcGIS, IDRISI/LCM, GRASS GIS (Ubuntu, Windows) for spatial analysis; SPSS, R-Stats, Geo-Statistical Analysis for non-spatial statistical data analysis; and relational database management systems (RDBMS). He is also an Editor in Chief of Indonesia Carbon Update Network (ICU-Net), a substantive network among scientists, policy makers and practitioners' aims to share ideas, knowledge, and experiences on low-carbon development approach in facing the unprecedented challenges of global climate change; Editor in Chief of CC-BASE, a voluntarily initiative set-up with the aim of building global network among scholars in developing information baseline for adaptation and mitigation of climate change of Indonesia and surrounding ASEAN countries (2008 to date); Editor in Chief of Policy Tools 2.0, a voluntarily initiative set-up with the aim of promoting the use of open-source based policy analytical tools to Indonesian policy communities (2008 to date); Member of on-line professional groups related to IT and governance, environmental policy and economics and Indonesian forestry on-line discussion community, and the use of analytical tools for policy analysis; and Core Modeling team of OSIRIS-Indonesia (Open Source Impacts of REDD+ Incentives Spreadsheet) and Land Use Change Modeler (LCM), policy analytical tools developed in collaboration with Conservation International, Clark University and Ministry of Forestry.

Frederick Boltz

Frederick Boltz is Vice-President for Global Strategies and Climate Change at Conservation International (CI) and CI's Climate Change lead. Fred is a natural resource economist, with a Ph.D. from the University of Florida. He has 19 years of experience in economic, social and ecological aspects of biodiversity conservation and tropical forest management. He has worked throughout the tropics, with most intensive field experience China, Madagascar, Brazil, Bolivia, and Rwanda. Fred began his work with CI in 1992 when he was hired to initiate CI's first National Park conservation project in Madagascar at the Zahamena Reserve of the eastern rainforest. A native English speaker, Fred has learned French, Spanish, Portuguese, Malagasy and Chinese. He has published scientific articles in Ecological Economics, Journal of Forest Economics, and Forest Policy and Economics, Goodman and Benstead's The Natural History of Madagascar (2004), and is co-editor of A Climate for Life: Meeting the Global Challenge (Mittermeier et al., 2008).

Jonah Busch

Jonah Busch is a post-doctoral fellow in the economics of climate change and biodiversity at Conservation International. He has authored scientific publications on the finance, scope and design of a mechanism for reducing emissions from deforestation and forest degradation (REDD). As a leading researcher in the Collaborative Modeling Initiative on REDD Economics, Busch developed the OSIRIS model-a free, open source spreadsheet tool for comparing country-by-country climate and cost impacts of alternative REDD proposals. Busch has advised on REDD for Conservation International, the Global Environment Facility, the Government of Norway, and the President of Guyana. Busch holds a Ph.D. in Economics and Environmental Science from the Bren School of Environmental Science and Management at the University of California, Santa Barbara.

Muhammad Farid

Muhammad Farid had work for 12 years at Conservation International and now is working as a UNREDD consultant to address UNEP's components in Indonesia. He also became secretary of LULUCF taskforce in the National council on climate change. He had experienced in multi-stakeholder-based conservation planning process, conservation policy and planning implementation of REDD +. In relation with the development of REDD+, he participated in various discussions at the national level as well as member of Indonesia delegation on a series of meetings of UNFCCC and joining International and Indonesian team preparing OSIRIS modeling as a tool for decision-makers in Indonesia. As the delegation of Indonesia, he worked with national stakeholder, especially the forestry ministry to bring the Indonesia intrinsic value to the international negotiation table.

Rahmat Herutomo

Rahmat Herutomo is an Associate with Starling Resources. Heru supports research activities related to policy studies on issues such as decentralization, fiscal policy, natural resource management, poverty alleviation, etc. Heru has over eight years of experience related to social research and policy studies including working with a Jakarta-based prominent think tank focusing in poverty studies and with some international development agencies. He also has a unique experience in media environment, working as columnist with GlobeAsia Magazine, in charge of Eye on the Economy, a column highlighting recent economic and social development issues in Indonesia. In 2007, Heru was awarded Anugerah Adi Warta Sampoerna, a prestigious journalistic award in Indonesia for his essay on the implementation of E-government in Sragen Regency, Central Java Province. Heru holds a Bachelor Degree in Urban and Regional Planning

from Department of Architecture and Planning, Faculty of Engineering, Gadjah Mada University. Heru also has attended some overseas short courses related to policy design and knowledge management.

Sarah Conway

Sarah is a Senior Associate at Starling Resources. Sarah supports and leads work across all focus areas. She has experience with financial modeling and the design and development of business plans, conservation trust fund plans, and financing strategies for a number of protected areas and conservation projects in Southeast Asia. Utilizing her background and financial and analytical skills she brings a fact based, private sector approach to addressing conservation and community issues. She is also one of the architects behind the cost modeling and financial planning tools. Sarah recently presented an MPA Financial Management Tool to the Ecosystem Based Management Network. Prior to joining Starling in early 2007, Sarah worked for Pacific Investment Management Company (PIMCO) and Citigroup. She holds a BA in Economics with the Leadership Studies Sequence from Claremont McKenna College in Claremont, California. Sarah most recently led the Nantu Forest PA Network Finance Strategy project. Sarah managed the effort to develop a financial model and business plan for a conservation trust fund for the Nantu Forest in Sulawesi, Indonesia. The forest includes a wildlife reserve, production forest, and protection forest, so the report and model looked at the implication of conservation activities as well as the potential costs and revenues of implementing a reduced emission from deforestation and degradation (REDD) project through avoided deforestation (AD) or reduced impact logging (RIL). Sarah co-led the Cardamom Mountains PA Network Conservation Trust Business Plan project. This involved a full analysis of management activities and costs for a network of protected areas in the Cardamom Mountains, Cambodia, as well as the design of a business plan for a conservation trust fund for the protected area network. Working with Conservation International and Fauna & Flora International and their government partners, Sarah facilitated data collection, developed models and conducted analyses, and ultimately contributed to a comprehensive business plan for a conservation trust fund for the network.

Steffen Kuntz

Steffen Kuntz is a full professor at the Albert-Ludwigs-University in Freiburg, Faculty of Forestry and Environmental Science (since 2005) and a senior advisor for Geo-Information Systems and Climate Change Programs, employed by Infoterra GmbH (since 2002). He is a member of the GOFC-GOLD Land Cover Implementation Group, an international expert panel established by IPCC with the mandate to evaluate scientifically sound and technically feasible LULUCF monitoring concepts. He is member of the European INSPIRE Annex II working group for Land Cover (defining European-wide binding standards for data exchange within the member states of the European Union). He is an experienced consultant and project manager with more than 25 years of experience in the field of forestry inventories and environmental monitoring from design to operational implementation.

Ruben Lubowski

Ruben Lubowski is a Senior Economist at Environmental Defense Fund(EDF). Ruben oversees EDF's analytical efforts to reduce emissions from tropical deforestation using emerging carbon markets. He also develops and promotes proposals to integrate forestry and agriculture into domestic and international climate policies. Before joining EDF, he worked for the US Department of Agriculture's Economic Research Service, the World Bank, the Harvard Institute for International Development, and the United Nations Development Program. Ruben received his PhD. and AM in Political Economy and Government from Harvard University and his AB from Harvard College.

DNPI (Dewan National Perubahan Iklim), the National Council on Climate Change, estabilished in July 2008, is a government organization which has mandated by the President to formulate national policies, strategies, programs and activities on climate change; coordinate activities in the implementation of climate change tasks; formulate national policies, mechanism and procedure on carbon trade; monitor and evaluate policy implementation on climate change management and control; and to support the negotiatiors on UNFCCC negotiations and compile Indonesia's position for each international negotiation meetings.

The UN-REDD Programme is the United Nations Collaborative initiative on Reducing Emissions from Deforestation and forest Degradation (REDD) in developing countries. The Programme was launched in September 2008 to assist developing countries prepare and implement national REDD+ strategies, and builds on the convening power and expertise of the Food and Agriculture Organization of the United Nations (FAO), the United Nations Development Programme (UNDP) and the United Nations Environment Programme (UNEP). The UN-REDD Indonesia Joint Programme aims to assist and support the Government of Indonesia (GoI) to timely develop a REDD+ architecture that will allow a fair, equitable and transparent REDD+ implementation and to attain 'REDD-Readiness". In order to secure this Objective, three Outcomes with subsequent outputs and activities are being pursued: (1). Strengthened multi-stakeholder participation and consensus at national level, (2). Successful demonstration of establishing a Reference Emissions Level (REL), a Monitoring, Assessment, Reporting and Verification System (MRV) and fair payment systems based on the national REDD+ architecture, and (3). Capacity established to implement REDD+ at decentralized levels.

COP 16 in Cancun has achieved substantial decisions in defining the scope of REDD+. However, a number of key issues remain to be resolved in the international negotiations, including crediting scheme, scale, funding sources, reference levels, MRV, co-benefit scheme and the distribution of liability. This collection of DNPI Green Review discusses these critical issues based on lesson learned and insights at national and sub-national levels.

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