IFC Advisory Services in Indonesia

Using Climate Change Revenues to Grow More Wood and Reduce Net Carbon Emissions: Dual-Purpose Forest Plantations

In partnership with:

International Finance Corporation
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inside front cover

Executive Summary

Indonesian forestry faces a major challenge – meeting the nation's wood supply needs at the same time it seeks to reduce net greenhouse gas emissions. The government commitment to reduce emissions by 26% falls largely to the Ministry of Forestry, which is also tasked with reducing a gap between legal wood supply and demand. This gap has been as large as 50 million m^3 per year and while it appears to have closed somewhat in recent years – it remains large, if unquantified.

Meeting these two goals simultaneously requires actions that will increase legal wood supplies or reduce demand for forest products. In a country that grows by over 3 million people per year with GDP growth at over 5% per year it seems unlikely that major reductions in demand will occur. The options to increase legal wood supply are limited to either growing planted forest trees – either on state or private lands – or increasing production from natural forests. To have a net emissions reduction benefit while increasing carbon stocks from either of these actions is difficult – unless plantations are established on low carbon stock areas. Degraded sites, largely in coarse grass cover, offer the possibility of simultaneously meeting wood production and climate change objectives (IFC 2010).

These dual-purpose plantations can conceptually meet the additionality tests required for all of the current forest carbon registration standards (e.g. CDM A/R, VCS, CCBA, etc). They are on sites that are not currently planted for reasons that are generally easily defined and present net carbon benefits, particularly when soil carbon and below-ground biomass is included. Degraded land sites that have not been planted are most often too costly or too risky – costs that might be overcome by carbon project revenues.

An analysis of the return on investment from three different plantation schemes on the degraded land in Indonesia shows that without carbon revenues, the internal rate of return (IRR) for short rotation (8 year) plantations ranged from -5.7% to 6.5%. We analyzed the IRR for the same plantation schemes with different costs and variables at ***Low***, ***Medium***, and ***High*** investment, price and scale levels. Plantation IRR with carbon revenues ranged from 3 to 33% for the first rotation and ranged from 10 to 36% for total project length of 22 years (Table 1).

Table 1. IRR analysis for HTI plantations

Cost category		Internal Rate of Returns	
		With carbon	***Without carbon***
Low	Total rotation, 22 years	10.0%	2.1%
	2nd rotation, 15 years	8.6%	0.2%
	1st rotation, 8 years	3.2%	-5.7%
Medium	Total rotation, 22 years	22.6%	8.2%
	2nd rotation, 15 years	22.0%	6.7%
	1st rotation, 8 years	18.3%	1.8%
High	Total rotation, 22 years	36.2%	11.9%
	2nd rotation, 15 years	35.9%	10.8%
	1st rotation, 8 years	33.5%	6.5%

Figure 1. HTI Concessions - Net Present Value (NPV) analysis per hectare until to 3 rotations

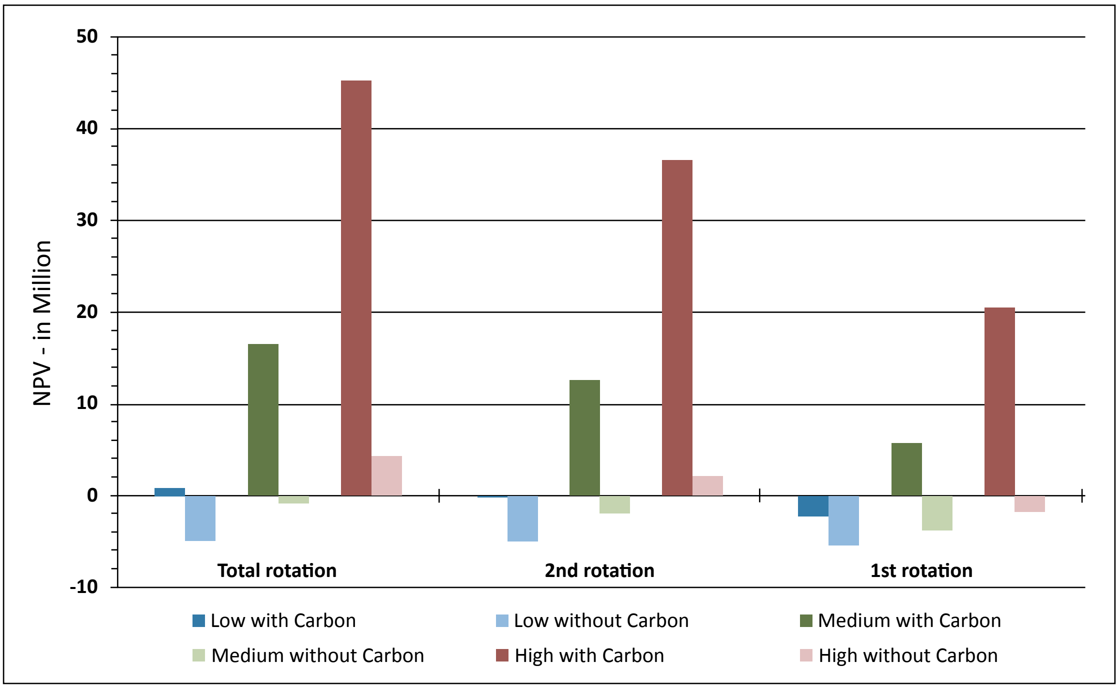


Table 2. Net revenue analysis for a hypothetical 20,000 ha HTI Plantation

Category		*With carbon benefits* (in million Rp)			*Without carbon benefits* (in million Rp)		
		Cost	***Revenue***	***Net revenue***	***Cost***	***Revenue***	***Net revenue***
Low	All rotation	(1,292,565)	1,695,240	402,675	(1,285,440)	1,368,000	82,560
	2nd rotation	(908,077)	1,130,160	222,083	(901,827)	912,000	10,173
	1st rotation	(523,588)	565,080	41,492	(518,213)	456,000	(62,213)
Medium	All rotation	(1,888,353)	3,300,300	1,411,947	(1,886,928)	2,325,600	438,672
	2nd rotation	(1,316,069)	2,200,200	884,131	(1,314,819)	1,550,400	235,581
	1st rotation	(743,784)	1,100,100	356,316	(742,709)	775,200	32,491
High	All rotation	(2,551,913)	5,731,200	3,179,288	(2,551,200)	3,420,000	868,800
	2nd rotation	(1,770,292)	3,820,800	2,050,508	(1,769,667)	2,280,000	510,333
	1st rotation	(988,671)	1,910,400	921,729	(988,133)	1,140,000	151,867

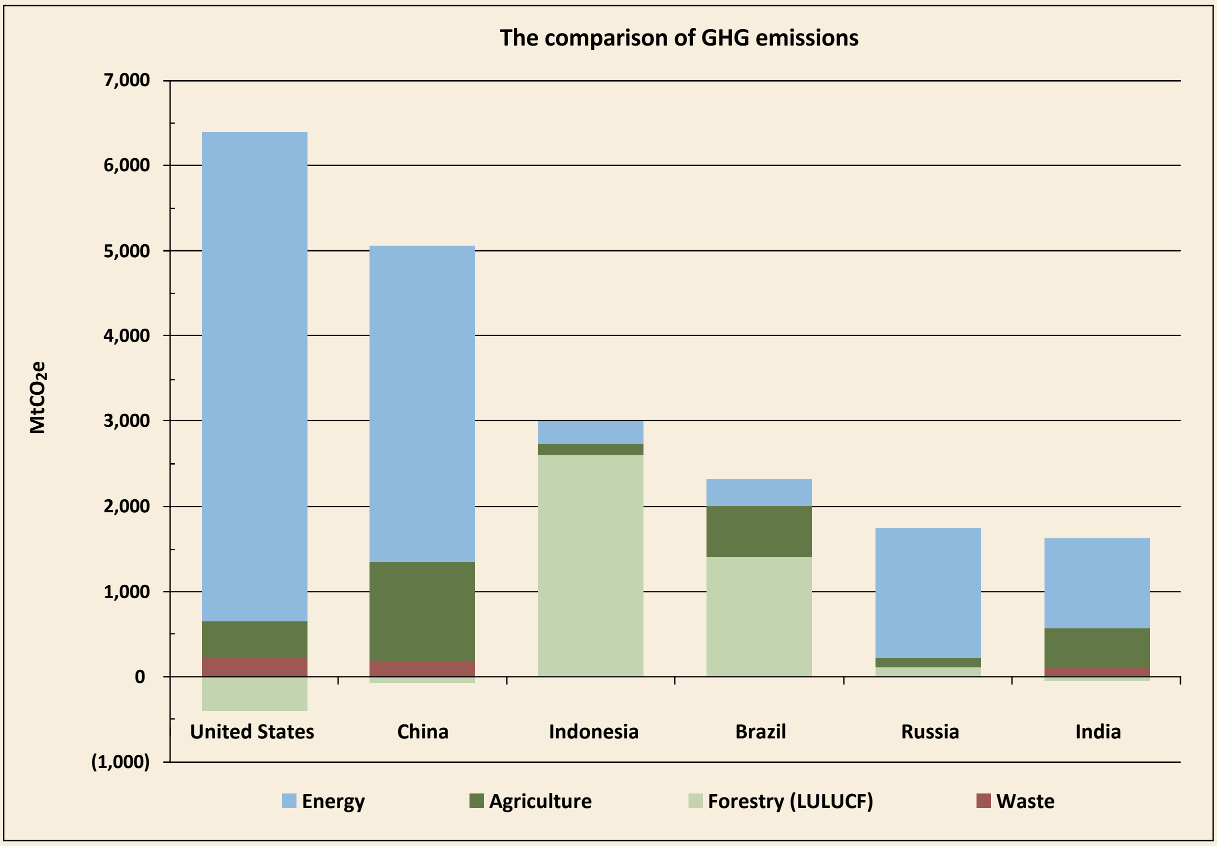
These increased revenues would need to be used to eliminate the constraints to planting. So, if the main constraint is inadequate revenue to meet community partnership needs – the revenues could be used there, if to improve soil fertility to improve yields to an adequate level, it could be used for those purposes.

As an example, costs of social engagement are estimated to range from 10 to 40 percent of the total cost for HTI plantation development (IFC 2010b) which would more than be covered under most of the increased revenue scenarios described above. Likewise for increased weeding and fertilization, the costs on the 20,000 ha site might range from Rp 500 to 700 million during the first rotation - with carbon revenues adequate to cover the costs and provide additional net revenue.

Dual purpose plantations have great potential to contribute to the legal wood supply for future generations and at the same time provide some of the climate change mitigation actions that the Government of Indonesia seeks.

Overview of Landuse-related Emissions in Indonesia

As defined by the stated commitment of the Republic of Indonesia's President Susilo Bambang Yudhoyono at the 2009 G-20 Meeting at Pittsburgh, the Government of Indonesia has set a target to reduce greenhouse gas (GHG) emissions by 26 percent by 2020. Indonesia is among the largest GHG emitters in the world due to the significant release of carbon dioxide from landuse and landuse change. GHG emissions from these sources contribute up to 85% of the total annual emissions of some 3,000 $MtCO_2e$ (Sari ***et al***. 2007).



Landuse change is often defined in terms of deforestation, which in Indonesia is estimated to be about 1.2 million ha (MoF 2009) per year and is driven largely by the conversion of natural forest lands into estate and forest plantations. By definition, this is not deforestation, but rather the conversion of natural forests into other woody crops that meet the UNFCCC definition of forests. Much of this conversion is done with the objective of increasing the value of financial returns from land use, since plantation crops produce substantially more revenues than long-term natural forest management. As a consequence, the conversion process has resulted in the creation of short-term net emissions to the atmosphere.

While one means of reducing these emissions is to call for a halt to the conversions, the reality may be that by reducing the area of production forest will inevitably result in the increase gap of legal wood supply and demand/consumption. This will in turn increase the profit incentives for illegal logging. Efforts to reduce emissions by avoided deforestation will be most effective when accompanied by adequate increases in legal wood supplies from other resources – namely forest plantations.

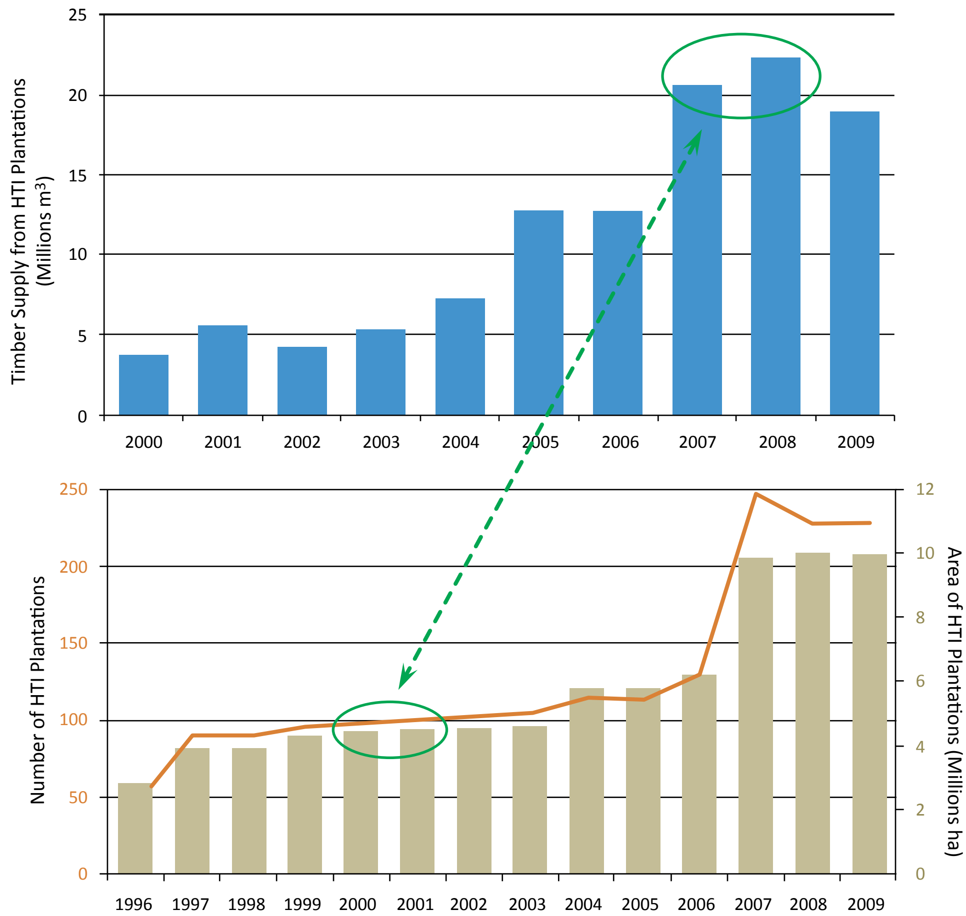
Degraded land and *Imperata* grasslands

Degraded lands are abundant in Indonesia – with some 96 million hectares of land that has been in some way degraded. At least 8 million of these degraded lands are perennial grassland usually dominated by *Imperata cylindrica* (Soekardi et al. 1993). Since 1990 there has also been a significant expansion in the area of estate crops, such as oil palm, forest plantations, and rubber plantations. Approximately 35 percent of these lands are within the legal Forest Estate areas. Thus, a significant portion of forest 'degradation' in addition to deforestation is occurring outside the area managed by the Ministry of Forestry (MoF).

Industrial Plantations in Indonesia: HTI

Indonesia's industrial timber plantation lands are not meeting current demand for timber in part because plantation lands are not being planted at a sufficient rate to produce timbers within the needed time frame.

Expansion of industrial forest plantation development between 1996 and 2009 (MoF 2009)



Twenty-three million hectares of land have been allocated for the conversion to alternative uses. Of these, about 10 million hectares have been allocated for industrial timber plantations. Although harvesting rights for clearing and planting have already been granted, up until December 2008, there were only 227 licensed industrial plantation companies with a total planted area of 4.31 million hectares. Predominant forestry plantation activities in Indonesia use fast-growing species with a rotation of 6-7 years, primarily for the production of pulpwood, which makes up for more than 75 percent of the HTI concessions licensed by the Ministry of Forestry (MoF). The MoF plans to add another 5 million hectares to HTI by year 2016 (MoF 2009).

A recent study by CIFOR on carbon dynamics (Verchot et al. 2010) showed that new HTI plantations should be developed on degraded grasslands. If Indonesia were to plant half of its degraded land to HTI, it could offset emissions through increased sequestration and contribute around 8-12 percent of the national emissions reductions target. New industrial plantations for non pulpwood purposes, with longer rotations, could contribute 22-23 per cent of the emissions reduction needed. However, to achieve a modest reduction through HTI within the timeframe necessary to meet emissions reduction targets would require a dramatic ramping up in plantation establishment rates. Moreover, there is a limited business case for firms to apply best forestry practices, particularly on degraded grasslands which are more expensive to operate and produce lower product yields than converted natural forest lands (IFC 2010).

The Government of Indonesia (GoI) recently announced a moratorium on forest and peatland conversion for plantations, accompanied by a plan to encourage industries to develop new plantations on degraded land. To succeed, this plan will require improved law enforcements and incentives for district governments and local stakeholders to preserve their forests and peat lands. Without law enforcement, consistent programs and policies across sectors, this plan will not reduce carbon emissions (Sudomo 2010; Verchot *et al*. 2010).

Making Commercial Rehabilitation of Degraded Lands a Viable Option

Plantation development on degraded lands often does not happen due to higher production costs and negative NPV's (Table 1). A study of costs in the West and East Kalimantan Provinces showed a negative NPV's due to the high costs of harvesting for land preparation and transporting wood (roading and barging) to the mill during the first year and at the end of rotation.

Industrial HTI plantation development that reduce barging costs through trucking to local mills will increase cash flow and improve the NPV (Table 2).

Table 1. Indonesia HTI Concessions - NPV analysis after 1 rotation (8 years)

Province	HTI Concessions	Cost Year 1 (Rp/ha)	Cost Year 2 (Rp/ha)	Rev. Year 1 (Rp/ha)	Cash Flow (Rp/ha)	NPV @ 9 % (Rp/ha)
Riau	Degraded Land	(5,830,000)	(8,416,667)	0	(14,246,667)	(3,126,351)
	MHW - Low density forest	(15,550,000)	(8,416,667)	25,600,000	1,633,333	11,442,456
	MHW - Medium density forest	(19,230,000)	(8,416,667)	32,000,000	4,353,333	13,937,869
	MHW - High density forest	(28,430,000)	(8,416,667)	48,000,000	11,153,333	20,176,401
W. Kalimantan	Degraded Land	(5,830,000)	(8,416,667)	0	(14,246,667)	(12,762,184)
	MHW - Low density forest	(28,350,000)	(8,416,667)	25,600,000	(11,166,667)	(9,936,496)
	MHW - Medium density forest	(35,230,000)	(8,416,667)	32,000,000	(11,646,667)	(10,376,863)
	MHW - High density forest	(52,430,000)	(8,416,667)	48,000,000	(12,846,667)	(11,477,780)
E. Kalimantan	Degraded Land	(5,830,000)	(8,416,667)	0	(14,246,667)	(3,126,351)
	MHW - Low density forest	(41,150,000)	(8,416,667)	25,600,000	(23,966,667)	(12,043,782)
	MHW - Medium density forest	(51,230,000)	(8,416,667)	32,000,000	(27,646,667)	(15,419,929)
	MHW -High density forest	(76,430,000)	(8,416,667)	48,000,000	(36,846,667)	(23,860,296)

Note: Cost for year 1 from Harvesting, Transport, Roading, PSDH levy, Harvest & Transport permits, and HTI licence
Revenue for year 1 from MTH Mill door sales; Cost for year 2 from Plantation development, Maintenance, and Overheads

Table 2. Indonesia HTI Concessions - NPV analysis after 1 rotation (8 years), to local Mill

Province	HTI Concessions	Cost Year 1 (Rp/ha)	Cost Year 2 (Rp/ha)	Rev. Year 1 (Rp/ha)	Cash Flow (Rp/ha)	NPV @ 9 % (Rp/ha)
Riau	Degraded Land	(5,830,000)	(8,416,667)	0	(14,246,667)	(3,126,351)
	MHW - Low density forest	(15,550,000)	(8,416,667)	25,600,000	1,633,333	11,442,456
	MHW - Medium density forest	(19,230,000)	(8,416,667)	32,000,000	4,353,333	13,937,869
	MHW - High density forest	(28,430,000)	(8,416,667)	48,000,000	11,153,333	20,176,401
W. Kalimantan	Degraded Land	(5,830,000)	(8,416,667)	0	(14,246,667)	(12,762,184)
	MHW - Low density forest	(15,550,000)	(8,416,667)	25,600,000	5,323,333	1,806,624
	MHW - Medium density forest	(19,230,000)	(8,416,667)	32,000,000	5,323,333	4,302,036
	MHW - High density forest	(28,430,000)	(8,416,667)	48,000,000	5,323,333	10,540,568
E. Kalimantan	Degraded Land	(5,830,000)	(8,416,667)	0	(14,246,667)	(3,126,351)
	MHW - Low density forest	(15,150,000)	(8,416,667)	25,600,000	24,523,333	11,442,456
	MHW - Medium density forest	(19,230,000)	(8,416,667)	32,000,000	24,523,333	13,937,869
	MHW -High density forest	(28,430,000)	(8,416,667)	48,000,000	24,523,333	20,176,401

Note: *Cost for year 1 from Harvesting, Transport, Roading, PSDH levy, Harvest & Transport permits, and HTI licence*
Revenue for year 1 from MTH Mill door sales; Cost for year 2 from Plantation development, Maintenance, and Overheads

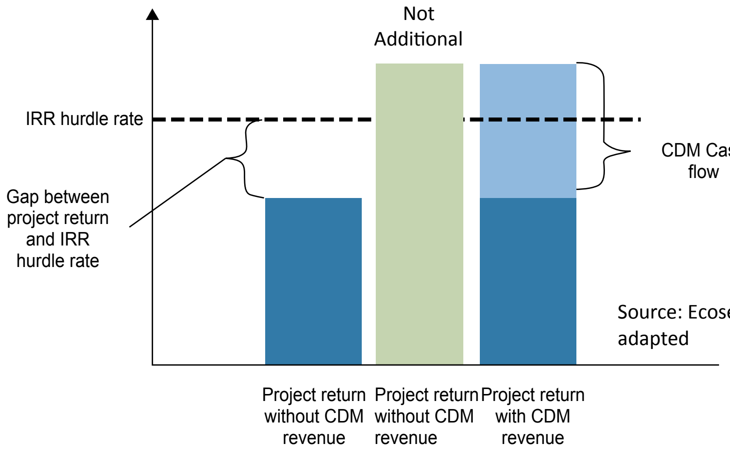
Opportunities to improve the viability of degraded land can come from carbon finance designed to pay for climate change mitigation. Climate change project revenues can help overcome the additional costs of plantation establishment and management on degraded lands, at the same time the land produces fiber for other purposes.

The Clean Development Mechanism

The Clean Development Mechanism (CDM) is a project-based mechanism under Article 12 of the Kyoto Protocol in the United Nations Framework Convention on Climate Change (UNFCCC). The purpose of the CDM is to assist parties that are not included in Annex 1 of the Kyoto Protocol (such as Indonesia) to achieve sustainable development and contribute to the objectives of the UNFCCC by working with Annex 1 countries.

The CDM recognises that afforestation and reforestation of degraded lands (AR-CDM) can lead to increased sequestration of carbon by removing CO_2 from the atmosphere. For the first commitment period, reforestation activities will be limited to reforestation occurring on those lands that did not contain forests on 31 December 1989. Project proponents must also demonstrate that the project results in a real, measurable and long-term emission reduction and that the sequestration must be an addition to any that would occur without the project.

Financial additionality for fast-growing plantations project

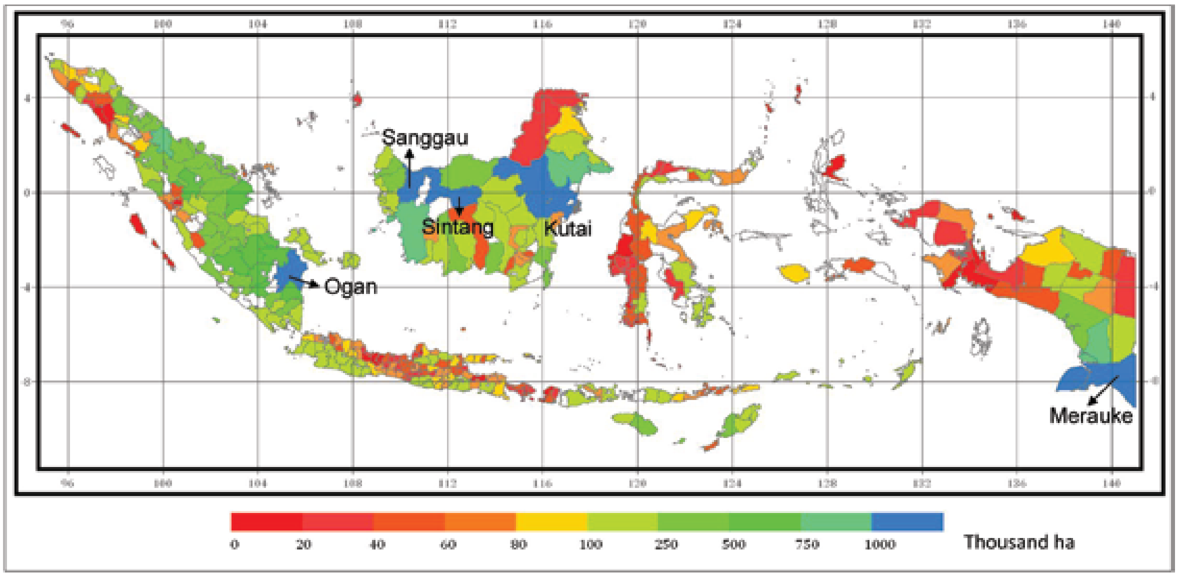


Source: Ecosecurities, adapted

Quantifying potential carbon benefits for degraded land plantations

Eligible lands for AR-CDM in Indonesia is based on the forest definition provided under Ministry of Forestry Regulation (*Permenhut*) P14/2004, which states that for the purposes of AR-CDM a forest have a minimum area 0.25 ha, canopy cover of at least 30% which is at least 5 m height at maturity. If lands meet these criteria on 1 January 1990 they do NOT qualify as Kyoto lands and are not eligible for consideration in a AR-CDM project. Although Indonesia has defined this forest classification by law, it has not officially submitted it to the UNFCCC.

Indicative Map of eligible lands for AR-CDM project in Indonesia



Source: Murdiyarso et al. *2006*

An AR project activity under the CDM meets additionality requirements if the actual net greenhouse gas removals by sinks are increased above the sum of the changes in carbon stocks in the carbon pools. This would be within the project boundaries, having occurred in the absence of the registered AR-CDM project activity (= baseline). In addition, the project should demonstrate financial additionality under the CDM activity from its gap between project return IRR hurdle rates.

Dual Purpose HTI Plantation Business Model

We use the term "dual purpose" plantations to describe those plantations that by design produce wood and climate change benefits at the same time. As of September 2010, there is only 1 approved AR-CDM project for industrial plantation wood supply purposes in the UNFCC, out of the 17 registered AR-CDM projects ("Reforestation as renewable source of wood supplies for industrial" in Brazil). Dual purpose plantations can sequester at much higher rates than plantations intended for restoration alone and can increase public economic values and community welfare (Sudomo 2010).

From our recent study using Sumatra literature, industrial plantation establishment on degraded lands with the *"business as usual"* plan, will cost approximately US$ 72 million for 60,000 ha (Table 3). Additional revenue for a dual purpose plantation will have a much higher cash flow and a total pre-tax wood fiber return compared to the traditional BAU plantation production (US$ 118 million and US$ 78 million, respectively).

Table 3. HTI Plantation development cost with BAU scheme

Variables	Units	Value
Target size of CO_2e captured	t CO_2e	20,000,000
Area required from CRDL	ha	60,000
Approximate fiber gross revenue	US$ per ha	$2,500
Total investment requirement	US$	$72,000,000
Total pre-tax wood fiber return BAU scheme	US$	$78,000,000

Table 4. HTI Plantation development costs with additional carbon revenue scheme

Variables	Units	Value
Target size of CO_2e captured	t CO_2e	20,000,000
Area required from CRDL	ha	60,000
Approximate fiber gross revenue	US$ per ha	$2,500
Total investment requirement	US$	$72,000,000
Approximate carbon project revenue	US$	$40,126,000
Total pre-tax wood fiber return BAU scheme	US$	$78,000,000
Total pre-tax wood fiber return carbon scheme	US$	$118,126,000

Table 5. Assumption for HTI development in a 10 year rotation

Component for HTI development	
Wood yield (m^3 per ha per yr) Conservative	10
Specific gravity	0.5
Below-ground biomass (%)	30
Total soil C accumulation (%)	1
Soil depth for C change (m)	0.5
Soil bulk density	1.2
Rotation length (years)	10
Wood price (US$ per m^3) Net of estimated	$25
Establishment cost (US$ per ha)	$1,200
MAI AG woody biomass C (tC per ha per yr)	2.5
MAI BG woody biomass C (tC per ha per yr)	0.8
Soil carbon increase (tC per ha) - per rotation	60
Total biomass C increase (t C per ha) - per rotation	33
Total biomass CO_2 increase (t CO_2 per ha) - per rotation	119
Total CO_2 increase including soils (t CO_2 per ha) - per rotation	339
Carbon offset price (US$ per t CO_2) Conservative estimate	$2
Carbon project development and monitoring cost (US$)	$500,000

In a Project Idea Note (PIN) for a proposed LULUCF CDM project in Sumatra we documented constraints that prevented the planting of the degraded portions of a 110,000 ha plantation concession. A primary constraint was encroachment by communities and illegal logging issues that caused significant limitations to commercial viability. These concerns are particularly prevalent around the edges of the concession areas and along the roads. Therefore, the project would focus on the rehabilitation of an estimated 10,437 ha degraded lands through the establishment of timber plantations with an expected net GHG removal of about 3,019,587 ton CO_2e. Proposed activities for the project are:

1. The establishment of *Acacia mangium* plantations (MAI 25 m^3/ha/yr, 9 yr rotation) for the production of sawn timber on degraded lands with high suitability (3,377 ha) ~ of approximately = 37 t CO_2e/ha/yr.
2. The establishment of *Acacia mangium* plantations (MAI 17 m^3/ha/yr, 12 yr rotation) for the production of sawn timber on degraded lands with medium suitability (7,060 ha) ~ of approximately = 25 t CO_2e/ha/yr.

The area proposed for the project is covered by grasslands and most are abandoned and used for animal grazing. Due to infertile soils and exposure to repeated fires, most of the lands are developed into grass and shrub lands. The costs for the establishment of plantations, for managing the fire, and grazing will be high. Without carbon financing, it is very unlikely that the land can be rehabilitated or reforested.

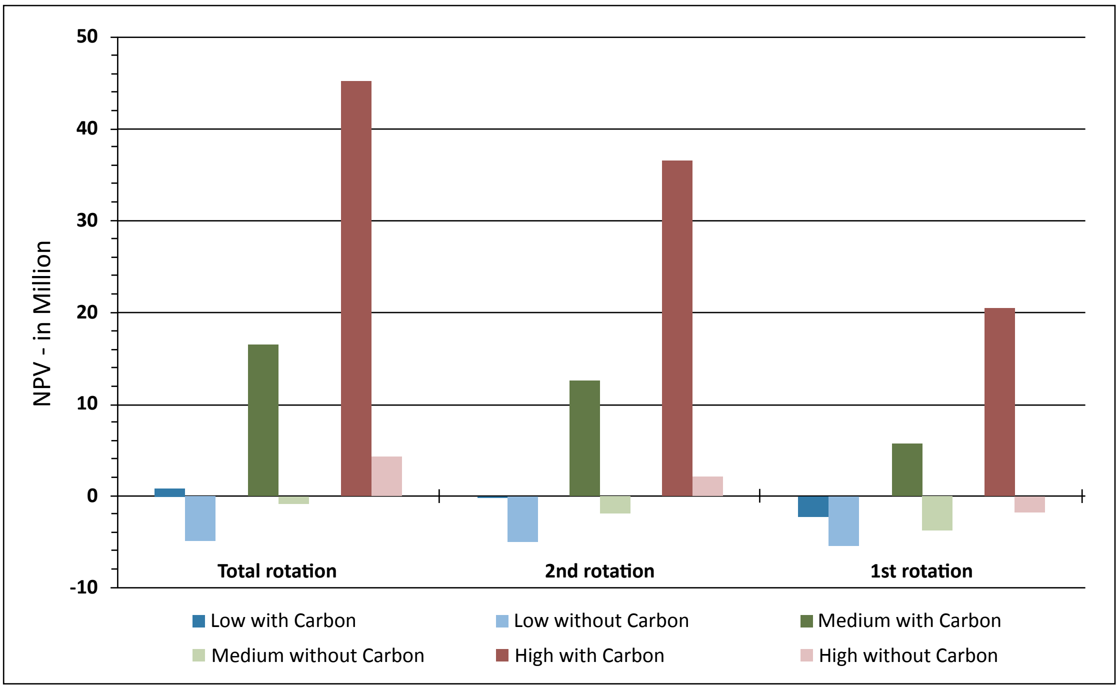
From the PIN financial analysis, the forecasted FIRR for the project shows that without carbon revenue the FIRR is 3.4%, whereas FIRR with carbon revenue reaches a value of 9.0%. In addition, the project will provide socio-economic benefits to local community through: creation of direct employment of about 500 people per year, supplying wood products to local markets and potential for value-added processing, as well as community development program.

A further analysis of the return on investment from three different plantation schemes on the degraded land in Indonesia shows that without carbon revenues the internal rate of return (IRR) for short rotation plantations (8 years) ranged from -5.7 to 6.5%. We analyzed the IRR for the same plantation schemes with different costs and variables at Low, Medium, and High input levels and prices (see Annex 1 for assumptions). Plantation IRR with carbon revenues ranged from 3 to 33% for the first rotation and from 10 to 36% for the total project length of 22 years (Table 6).

Table 6. HTI Concessions - IRR analysis per hectare for 3 rotations

Cost category		Internal Rate of Returns	
		Without carbon	***With carbon***
Low	Total rotation, 22 years	10.0%	2.1%
	2nd rotation, 15 years	8.6%	0.2%
	1st rotation, 8 years	3.2%	-5.7%
Medium	Total rotation, 22 years	22.6%	8.2%
	2nd rotation, 15 years	22.0%	6.7%
	1st rotation, 8 years	18.3%	1.8%
High	Total rotation, 22 years	36.2%	12.0%
	2nd rotation, 15 years	35.9%	10.8%
	1st rotation, 8 years	33.5%	6.5%

HTI Concessions - NPV analysis per hectare for 3 rotations



At the lowest carbon price ($2 per t CO_2e), IRR per hectare for long rotation of 22 years with carbon revenues ranged from 3.3 to 10% for an absolute difference of -5.7 to 2.1% with "business as usual" scheme. At carbon price $5 per t CO_2e the range was 18.3 to 22.6%, whereas at the highest carbon price ($10 per t CO_2e) the IRR was 33.5 to 36.2%. For a hypothetical site of 20,000 ha plantable area this would mean increase net revenue as described in the Table 7. At the Low imput/price level net revenue with carbon benefits increased by 5 to 22 times over *"business as usual"* without carbon benefits from the total project and second rotation, respectively. Whereas, with Medium and High input/price levels the net revenue ranged from 3 to 10 and 3 to 6 times higher than without carbon benefits.

Table 7. Net revenue analysis for a hypothetical site of 20,000 hectare HTI Plantation

Category		***With carbon benefits*** *(in million Rp)*			***Without carbon benefits*** *(in million Rp)*		
		Cost	***Revenue***	***Net revenue***	***Cost***	***Revenue***	***Net revenue***
Low	All rotation	(1,292,565)	1,695,240	402,675	(1,285,440)	1,368,000	82,560
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These increased revenues would need to be used to eliminate the constraints to planting. So, if the main constraint is inadequate revenue to meet community partnership needs – the revenues could be used there, if to improve soil fertility to improve yields to an adequate level, it could be used for those purposes.

As an example, costs of social engagement are estimated to range from 10 to 40 percent of the total cost for HTI plantation development (IFC 2010b) which would more than be covered under most of the increased revenue scenarios described above. Likewise for increased weeding and fertilization, the costs on the 20,000 hectare site might range from Rp 523.6 to 988.7 million during first rotation and ranged between Rp 1,292.6 and Rp 2,551.9 million for total rotation in 22 years - with carbon revenues adequate to cover the costs and provide additional net revenue.

CONCLUSION

Indonesia is a large GHG emitters that looks to improvements in the landuse sector to find net reductions in emissions. While one means of reducing these emissions is to call for a halt to the conversions, the reality may be that by reducing the area of production forest will inevitably result in the increase gap of legal wood supply and wood consumption. This will increase the profitable incentives for illegal logging. Efforts to reduce emissions by avoided deforestation will be most effective when accompanied by adequate increases in legal wood supplies from other resources - namely industrial forest plantations on degraded lands.

However, plantations development on degraded lands do not happen often due to higher production costs, lower soil fertility, lower timber yield, as well as high risk of social conflict with local community. Opportunities to improve the viability of degraded land can be initiated by providing a new source of revenue to enhance plantation performances with carbon finance based for forest-based climate change mitigation through trading carbon credits. However, it suggests the larger and well-established plantations will be in a better position to earn revenues from carbon trading than the small plantations. Dual-purpose plantations can conceptually meet the additionality tests required for all of the forest carbon registration standards in the international carbon market. Degraded land sites that have not been planted are most often too costly or too risky – costs that might be overcome by carbon project revenues.

An analysis of project costs with and without carbon revenues clearly demonstrates significant improvements in the internal rate of return. In some cases the returns are dramatically improved – certainly enough to cause investors to look seriously at degraded land plantations that would otherwise be uneconomical to plant.

REFERENCES

Ekadinata, A., van Noordwijk, M., Dewi, S. and Minang, P.A. 2010 Reducing emissions from deforestation, inside and outside the 'forest'. ASB Policy Brief 16, ASB Partnership for the Tropical Forest Margins, Nairobi, Kenya.

Hartono, Bambang Tri 2002 Can Tree Plantations Alleviate Pressures on Natural Rainforests? An Efficiency Analysis in Indonesia. In: A summary of EEPSEA Research Report 2002-RR1 Planting to Protect: Can Forest Plantations Alleviate Pressure on Natural Forest?. College of Forest Resources, North Carolina State University - Raleigh, NC, USA.

IFC 2010 Using Degraded Lands to Help Meet Indonesian Demand for Wood and Climate Change Mitigation. International Finance Corporation. Jakarta, Indonesia

IFC 2010b Developing a Sustainable Plantation Wood Supply Through Successful Community - Company Partnerships in Indonesia. International Finance Corporation. Jakarta, Indonesia.

Ministry of Forestry (MoF) 2008 Forestry Statistic of Indonesia. Forestry Production Development, Ministry of Forestry, Jakarta, Indonesia.

Ministry of Forestry (MoF) 2009 Eksekutif Data Strategis Kehutanan. Ministry of Forestry, Jakarta, Indonesia.

Murdiyarso, D., Puntodewo, A., Widayati, A., van Noordwijk, M. 2006 Determination of Eligible Lands for A/R CDM Project Activities and of Priority Districts for Project Development Support in Indonesia. CIFOR. Bogor, Indonesia.

Otsamo, R. 1998 Effect of nurse tree species on early growth of *Anisoptera marginata* Korth. (Dipterocarpaceae) on an *Imperata cylindrica* (L.) Beauv. grassland site in South Kalimantan, Indonesia. Forest Ecology & Management 105, 303-311.

Sari, A.P., Maulidya, M., Butarbutar, R.N., Sari, R.E. and Rusmantoro, W. 2007 Executive Summary: Indonesia and climate change – Working paper on current status and policies. PT Pelangi Energi Abadi Citra Enviro (PEACE), Jakarta, Indonesia.

Soekardi M., Retno M.W. and Hikmatullah 1993 *Inventarisasi dan karakterisasi lahan alang-alang* [Inventory and characterisation of Imperata grassland] In: D.P. Garrity, M. Soekardi, M. van Noordwijk, R. de la Cruz, P.S. Pathak, H.P.M Gunasena, N. Van So, G. Huijun and N.M. Majid 1997 The Imperata grasslands of tropical Asia: area distribution and typology. Agroforestry systems 36: 3-29, 1997.

Sudomo, Sudarsono 2010 *Karbon dalam Rantai Suplai Kayu*. In: *Prosiding Seminar Dampak Perubahan Peruntukan dan Fungsi Kawasan Hutan dalam Revisi RTRWP Terhadap Neraca Karbon dalam Kawasan Hutan*. Direktorat Jenderal Planologi Kehutanan. Kementerian Kehutanan, Bogor, Indonesia.

Verchot, L.V., Petkova, E., Obidzinski, K., Atmadja, S., Yuliani, E.L., Darmawan, A., Murdiyarso, D. and Amira, S. 2010. Reducing Forestry Emissions in Indonesia. CIFOR. Bogor. Indonesia.

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