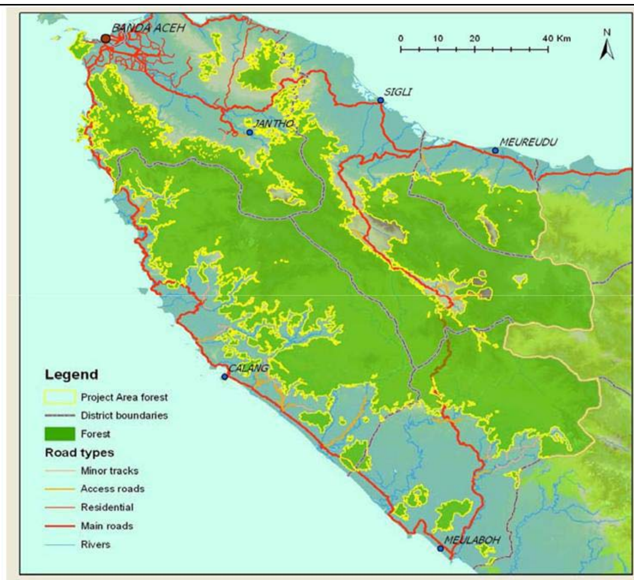
Reducing carbon emissions from deforestation in the Ulu Masen Ecosystem, Aceh, Indonesia

Source(s): *Project design note for CCBA Audit (December 29, 2007)*

Project location

Aceh Province, Sumatra, Indonesia

The project area is situated between 4''20'3 N and 5''30'0 N, between 95''20'0 E and 96''30'0 E.



Project area (p. 5)

Source: http://www.travelblog.org

Forest area and types

Forest area: 750,000 ha of forest (p. 5).

Forest types: Lowland broadleaf forest, pine forest, submontane broadleaf forest, montane broadleaf forest, and other forest types. In most areas above 500 meters there are still substantial areas of high quality forest (p. 8).

The Bukit Barisan Mountains comprise several different geological formations, the differing characteristics of each determining differences in the overlying soils, the hydrology, the vegetation cover and biological productivity. Extensive limestone areas, including karst formations, are typically porous, retaining little surface water and having relatively low productivity (pp. 5-6).

The climate of Aceh is described as tropical with high humidity (80-90%) and little variation in mean daily temperature (25-27 °C) throughout the seasons. Mean annual temperature varies with elevation, decreasing from about 26°C at sea level by approximately 0.52°C per 100m rise in elevation. While the steamy hot lowlands have a mean annual soil temperature of above 22°C, the mountain tops have a mean between 0-8°C (3000m and above) (p. 6). Mean annual rainfall in Aceh varies widely, caused partly by the complex inter-relationship between topography and precipitation. The region of highest rainfall is along the west coast and inland as far as the Barisan mountain range, with amounts between 3000 mm and 5000 mm per annum. In contrast, mean annual rainfall ranged from 1000 mm to 1500 mm in small areas along the north and east coast, with totals as low as 1500 mm in the inter-montane basin between Takengon and Owaq in Aceh Tengah (p. 7).

Forest management and use context

Aceh today remains one of Indonesia's poorest provinces. Almost 50% of the population lives below the poverty line, compared with about 10% in 1996 and 20% in 1999. In 2002, 48% of the population had no access to clean water, 36% of children under the age of five were undernourished, and 38% of the Acehnese had no access to health facilities. Aceh Province is typical of many resource-rich regions, in that wealth from exploitation of resources has not greatly improved the welfare of the majority of the population. Rural communities in particular have been alienated from resources to which they can claim traditional rights. Much of this failure to convert resource wealth into community development results from policies that override customary tenure often facilitated by corruption (p. 12).

The province is divided into 21 districts, 5 of which (Aceh Besar, Aceh Jaya, Aceh Barat, Pidie and Pidie Jaya) encompass the Project Area (see Table below). Approximately 130,000 people live in communities adjacent to forest areas of the Ulu Masen ecosystem (p. 13).

Population statistics of districts that form project area as of 2005 (p. 13)

District	Population	% Of Total Aceh Population
Aceh Besar	296,541	7.4
Aceh Jaya	60,660	1.5
Aceh Barat	150,450	3.7
Pidie	474,359	11.8

Source: Aceh Population Census 2005. Central Statistics Agency

61 *Mukim*s surround the Ulu Masen ecosystem (as shown in the Table below) (p. 13). A *mukim* (sometimes known as *kemukim*an) consist of a number of communities or villages with a common ethnic and cultural background under the leadership of the *mukim* (or more correctly the *Imeum mukim*), a religious leader who also had secular functions. Under the *Imeum mukim* were specialist community leaders such as the *Kejrun blang* (responsible for agricultural matter), the *Pawang Uteun* (controlling forest use) and the *Panglima Laot* (fisheries in coastal areas) (p. 2). The new autonomy roles have strengthened the role of *mukim*s and within the structure of these customary 'adat' institutions, people are assigned to oversee agriculture, forestry and fisheries. *Mukims* are democratically elected and approved by government in their position as traditional leaders (p. 14).

***Mukim*s surrounding Ulu Masen Ecosystem** (p. 13)

District	No of *Mukims*	*Mukim*
Aceh Besar	12	Reukih, Jruek, Lamteuba, Gunung Biram, Jantho, Glee Yeung, Leupueng, Cot Jumpa, Lhoong, Glee Bruek, Lam Lhom, Lam Lheu
Aceh Jaya	15	Paya Baro, Sarah Raya, Keude Teunom, Panga Pucok, Panga Pasie, Krueng Sabee, Rigah, Lageun, Lam Teungoh, Pante Purba, Kulam Mutiara, Keude Unga, Pante Cermin, Lamno, Kaluang
Aceh Barat	11	Manjeng, Lango, Menuang Kinco, Gunong Meuh, Mugo, Meuko, Tanjung Meulaboh, Babah Krueng Manggi, Tungkop, Darul Ihsan, Woyla Tunong
Pidie	14	Geumpang, Mane, Pulo Mesjid, Layan, Tanjong Bungong, Beungga, Rubee, Blang Keudah, Metareum, Andeue Lala, Ujong Rimba, Keumala Dalam, Keumala Raya, Kunyet
Pidie Jaya	9	Peulandok, Peuduek Tunong, Paya Seutui, Blang Rheue, Cubo, Jalan Rata, Manyang, Beuriweueh, Ulee Gle Tunong

The vast majority of the project site is designated as national forest land (*Hutan Negara*) but as is common elsewhere in Indonesia, there is potential for conflict over land status where local communities regard adjacent forest lands as traditional / customary lands. For example when *Mukim* leaders are asked about the extent of the area under their management, they routinely claim that the adjacent forests are managed by the *Mukim* (p. 14).

Typical boom-bust agricultural trends occurred in many areas at various times driven by market trends, such as the rush to produce patchouli (*nilam*) in the 1990's. Wildlife trade has been used as an income supplement in several locations (for example several bird collectors in Geumpang capture song birds in surrounding forests when they need cash). Illegal logging has been prevalent in various locations in the project area for at least several decades. This has traditionally been highly selective, targeting locally preferred hardwood species and small scale, with no mechanization other than the use of chainsaws. Rough lumber is often extracted from the forest manually or using water buffalo. Thus, although degradation of accessible forests has occurred around Jantho, Leupung and Lhoong in Aceh Besar, Geumpang, Tangse and Jimzim in Pidie, and Pante Cermin, Meudang Ghon, Krueng Sabe, Panga and Teunom in Aceh Jaya, there has been little conversion of forests to other land uses. There are no historical data on volumes of timber extracted illegally (p. 14).

There are currently 6 logging licenses in the project area, comprising 404,704 hectares. These licenses, though currently inactive due to the conflict and the 2004 tsunami, could be reactivated by the Ministry of Forestry with support from local governments (p. 23).

The primary non-timber forest products extracted from forests prior to the peak conflict period included rattan, *jerenang* (a rattan fruit used for production of a traditional dye), honey, bird nests and a variety of bush meat. These may represent important incomes sources for individuals of different communities, and are often seasonal and market-dependent. In the past there was poaching of rhinoceros horn by specialist local hunters, but the decimation of the accessible populations means that there is probably no active rhino poaching at present. The conflict situation has also effectively prevented specialist tiger and elephant ivory hunters from other parts of Sumatra operating in northern Aceh (p. 14).

Rates and drivers of deforestation and degradation

Project proponents estimate an average annual deforestation rate (from 2008 to 2038) of **1.28%** per year. This corresponds to an annual loss of 9,630 hectares per year in Ulu Masen (p. 28).

Forests of Aceh are rich in tropical hardwood trees like semaram, merbau, kruing, and meranti, which fetch a high price on international markets and make logging a lucrative business. This and conversion of forested areas for new development projects such as roads and other infrastructure, and plantation crops are the major factors driving deforestation and fragmentation. Official government estimates suggest forests of Aceh continue to disappear at a rate of approximately 21,000ha per year.… habitat loss and fragmentation are the major threats to biodiversity, particularly the mega-fauna that require large areas of contiguous suitable habitat. Poaching, which is projected to accelerate following the improved security situation in the province, also represents a serious threat for target species (p. 20).

Forests now face significant threats from resurging illegal logging, renewed potential for unsustainable logging practices, and conversion to plantations and farm land following the ending of the civil conflict and the post-tsunami reconstruction process (p. 21).

In the year prior to the tsunami, 47 companies in Aceh were granted logging licenses. This was a rise of more than 150% over previous years. Since the tsunami and the end of conflict, there has been a dramatic increase in illegal and unsustainable logging, land clearance and applications for land for clearance. On October 13th,2005, the Department of Forestry and Plantation applied a policy on maximum annual allowable cut (RKT) for concessions(HPHs) in Aceh up to 500,000 m^3 for year 2006, while it was only 47,000 m^3 in year 2005 (p. 21).

Ulu Masen Ecosystem Forest, classifications and conditions in 2006 (pp. 24-25)

	Legal Classification	Forest (Intact)	Forest (Disturbed)	Forests Not Classified as Forest	Total
Protected	Protected Nature Reserve (Federal)	13,086	147	2,632	15,865
	Semi-Protected Forest (Watershed)	279,727	3,598	9,316	292,641

Forests	Protected Area (Province or District)	1,536	197	752	2,485
	TOTAL, PROTECTED	**294,349**	**3,942**	**12,700**	**310,991**
Unprotected Forests	Zoned for Logging	183,949	76,994	13,245	274,188
	Zoned for Logging: Timber and Pulp	43,028	19,532	4,711	67,271
	Community Development Zones (Can be logged)	3,313	1,317	651	5,281
	Unprotected Forest (Province and District)	21,634	50,032	10,351	82,017
	TOTAL UNPROTECTED	251,924	147,875	28,958	428,757
	TOTAL FOREST ESTATE	**546,273**	**151,817**	**41,658**	**739,748**

New threats are also emerging with the ending of the state of emergency and the opening of the economy for much needed investment. Rapidly developing new markets for palm oil for use as bio-fuel is fuelling a surge in demand for land to establish oil palm plantations. Aceh will be a natural target for allocation of land for this purpose. In addition, various estate crop companies are actively seeking new land clearing permits to plant fibre-board trees and rubber trees in Ulu Masen (p. 22).

In addition to the concessions already granted, almost 60% of the total forest area can be legally logged, whether or not they have been assigned a logging concession. A report by WWF Indonesia noted some of the high threats for conversion in the Aceh are the districts of Aceh Jaya, Aceh Besar, and Aceh Barat, provinces that comprise the majority of the Ulu Masen forests (p.23).

The post-tsunami Aceh economy has largely been fuelled by official development assistance (ODA). With this generosity has come a competition to complete projects and increasing social expectations for a cash economy. Much of the ODA work was financed with cash-for-work payments. Illegal logging is usually done on a cash basis and with minimal wait between work (logging) and payment. It is thus a natural employment option for individuals that seek new work once the ODA finance begins to end (p. 27).

Project proponents (p. 44)

- The Provincial Government of Aceh Nanggroe Darussalam (Aceh)
- Fauna and Flora International (FFI)
- Carbon Conservation Ltd, PTY

Implementation timeframe (p. 40)

Project proponents use a timeframe of 30 years for accounting for changes in carbon emissions between the baseline and project scenario. However, the project will insure permanence of avoided emissions for a period of 100 years. This bifurcation of time intervals is done to:

a) Allow for reasonable estimates of medium term (30 years) of a baseline and carbon accounting, while;

b) Also ensuring the longevity of carbon credits for a period of time that is relevant for climate change and atmospheric CO2 levels.

The project will store a significant amount of carbon credits in a buffer account that will be used after the 30 years of the project period to continue implementing and funding core project activities, notably conservation and restoration of forests. The 30 year project accounting period will also be divided into two stages, a pre-REDD credit stage (from 2008 to 2012) where fungible early-action REDD credits may or may not be available, and a second stage after 2012. The first stage will build on and extend foundations established by FFI and its partners under AFEP [World Bank Multi-Donor Fund's Aceh Environment and Forest project]. This 2008-2012 stage will focus on (in addition to project design and implementation) procuring finance from bilateral and multilateral funds, philanthropic sources, and voluntary credits.

Project goals

- Reduce deforestation in the project area by 85% (p. 2)
- Conserve biodiversity (p. 2)
- Maintain ecosystem services (hydrological normality, soil retention, pollinators, river fisheries) (p.16)
- Generate 27,546,438 ton of avoided carbon credits over 30 years (p. 49)

Implementation activities

- Prevention of legal logging via land re-classification

The Governor of Aceh has made a commitment to reduce the areas of forest for logging and clearing in return for carbon finance. Thus the most important immediate activity is to revise provincial and district spatial plans, reduce the forest area classified as conversion forest, and increase the area under a range of formal permanent forest estate categories. The Government of Aceh will establish an institutional framework at provincial, district and *Mukim* levels to oversee and advise forest classification and project implementation. The ongoing Aceh forest sector review process will determine the institutional structure for this and the composition of a steering committee. The steering committee will provide overall supervision of the project and will include representation from national, provincial and district governments, civil society organizations, and FFI and its partners. Carbon finance funds will provide incentives to communities, districts and the province to re-classify lands currently slated for logging (p. 37).

- Prevention of illegal logging

The project will help curb illegal logging through support for enhanced enforcement, community agreements, increased employment and income for local people, recruiting forest wardens, conducting forest monitoring and patrols, and improving synergies through law enforcement and other relevant agencies. The project will also provide alternative livelihoods to forest-adjacent communities that commit to protecting the forest. In return for funding and technical assistance, communities will agree to protect the forest. The government of Aceh has recently hired almost 1,000 new forest wardens (many whom are community-based) and plans to expand this initiative with additional project finance (p. 38).

- Reforestation, agro-forestry, mangrove restoration, fruit and coffee microplantations, orchards and sustainable forestry

The project will use carbon finance to assist reforestation and restoration of mangroves, fruit tree gardens, coffee plantations and woodlots. These will be developed based on needs and priorities identified in the spatial planning and community outreach process of the project. Some programs, such as mangrove restoration, have already been initiated and proponents will seek to partner with and build off existing programs. Other initiatives, such as native tree nurseries, technical assistance, and green marketing support will be developed as requested by participating communities, organizations and individuals. Where possible, project proponents will seek to enable activities that restore degraded areas and build long-term sustainable tree incomes and livelihoods in project areas. (p. 38).

The project is expected to be implemented in four overlapping phases (pp. 40-41):

- **Phase 1**: Information gathering, technology and skills transfer and development of project proposal and structures, institutional framework and financing (6 months, July 2007 to December 2007).
- **Phase 2**: Develop benefit sharing mechanisms, implement planning processes, implement legislative and regulatory changes, set up a system for forest and carbon stock monitoring, preparation for community forestry, reforestation and agro-forestry projects, re-evaluate and improve the ‘baseline’ rates of deforestation for the project area, move toward IPCC (Intergovernmental Panel on Climate Change) Tier 2 carbon stock measures, and synthesize understanding of current biodiversity and

livelihoods, enhanced efforts to control illegal logging in combination with forest monitoring and assessment (18 months, January 2009 to July 2009).

- **Phase 3**: Ongoing forest and carbon monitoring including movement as practical toward IPCC Tier 3 understanding of forest carbon stocks, promotion of sustainable community forest management, forest product value adding, reforestation and community agro-forestry, monitoring 'virtual' carbon funding (ODA funds) disbursed through incentive mechanism, financed through the sale of voluntary Verified Emissions Reductions (VERs) or early-action credits (Three years, January 2009 to December 2011)
- **Phase 4**: Continuing implementation of project activities and transfer to 2nd commitment period REDD credits or appropriate outcome of UNFCCC negotiations (2012).

Actors' roles and responsibilities

In the first stage of the project, allocation of responsibilities will primarily be as follows (pp. 46-47):

Aceh Government	Responsible for overall direction, management and supervision of project. Lead partner on spatial planning and provincial law, implementation of illegal logging controls, facilitation with Government of Indonesia, management of Ulu Masen Implementation Board (UMIB)
FFI	Responsible for community-based conservation and spatial planning in select districts and areas, capacity building, GIS, biodiversity expertise, relationships with ODA
Carbon Conservation	Responsible for project design, carbon stock and flux estimates, carbon finance and sales, and assistance with legal structures and partner relations, engagement of private sector

- Early on in the project implementation, the oversight body (Ulu Masen Implementation Board, UMIB) will begin a series of workshops and meetings to better define how stakeholders should be defined, identified, engaged and encouraged to fully engage project design and implementation. Preliminary categories of relevant stakeholders and definitions of these categories include:
  - Private actors, defined as persons or institutions engaged in commercial activities. These stakeholders will be essential for bringing additional resource to bear on a positive project outcome.
  - Traditional avenues, defined here as *mukim*s, associations, and other customary organizations that already exist in the project area and can be a forum for dialogue and involvement in project design and activities.
  - Traditionally under-represented individuals or groups, defined here as any person or constituency that has been or is likely to be marginalised in decision making. Groups could include women and women's' groups, illiterate and destitute people, and people whom are discriminated against. A clear emphasis will be placed on engaging individuals who are most reliant on forest resources and most likely to be negatively impacted. Governor Irwandi has devoted substantial efforts to helping tsunami orphans.
  - Government agencies, including relevant national, provincial, district, subdistrict and village agencies, including law enforcement, planning, forestry, and others.
  - Civil society, non-governmental and academic constituencies, including wherever possible groups that are constructively critical of the project. These groups may be formally incorporated (groups such as Telapak, CIFOR, universities) or informal organizations.
  - National and international groups as appropriate.

Community participation

The project has been conceived to ensure that stakeholder confidence and commitment will be built through a participatory and transparent process. All levels of government and civil society have been invited to contribute to the design and implementation of project activities and initial community consultations have begun. In particular, traditional *Mukim* leaders have a critical role in the management of land and natural resources in Aceh's rural communities, typically being responsible for between three and eight villages. Though their authority was undermined during the years of conflict, *Mukim* leaders are now formally recognised under Aceh's Special Autonomy Law (p. 2).

While there is potential for conflicts of forest resources within the project area, these can be avoided by involving communities and *Mukim* leaders in participatory land use planning processes, establishing jointly agreed boundaries and land use patterns, and developing a multi-stakeholder management structure. This process has already been initiated by FFI. As an example the participatory land use planning process has been completed in the district of Aceh Jaya and the resulting spatial is in the final public consultation process before being approved by district parliament (pp.14-15).

Project financing

Project development, design and initial implementation will be initially funded from official development aid (ODA) funds (p. 2).

Project costs between 2007 and 2012 are estimated around $48,392,316. In terms of revenues, project proponents anticipate around 48% will come through ODA, 5% from a strategic first partner, and 47% from the sales of VERs (pp. 47-48).

After the initial phase of the project, carbon finance from sale of VERs must be secured to provide immediate and substantial incentive payments to all relevant stakeholders who help the project area arrest deforestation and increase forest protection (pp. 2-3).

The ability of this project to succeed is contingent on (p. 3):

- Emergence of a real market for REDD credits that allow sustainable forest land uses to out-compete unsustainable logging and forest conversion
- Independent review and approval of this project's baseline land use and carbon emission scenario
- Successful design and implementation of project activities
- Development of robust forest monitoring and carbon accounting systems
- Actual reductions in deforestation in the project area
- Measures to adequately address possible leakage and permanence concerns

The project will provide financial incentives through four funds (p. 59):

- Sustainable timber production fund
- Financial support to individuals and groups through deposition accounts
- Revolving loan fund for small scale enterprise development
- Monitoring and law enforcement deposition accounts

Benefit sharing

All project proponents are committed to ensuring that benefits are equitably shared among stakeholders, including forest dependent communities and those with customary (*adat*) rights to forest land (p. 2).

The Law on the Governance of Aceh (UUPA 11/2006) provides special autonomy over the use and allocation of benefits from natural resource management and formally recognizes the position of the *Mukim* in local governance. The new provincial Government has moved strongly towards the recognition of customary forest resource rights and lands and has formalized the traditional *Mukim* authority structure which provides a political and legal basis for equitable benefit sharing (p. 15).

Carbon-finance funds will be established to offset all, or most, of the opportunity costs of avoiding deforestation as well as support project activities and operations. A substantial portion of carbon finance will be deposited into these funds and will directly benefit local communities and forest guardians. By preventing deforestation, project proponents will help Aceh achieve a sustainable future that also preserves critical and highly-threatened habitat for biodiversity and develop a sustainable community model for the use and conservation of forest (p. 35).

The full, active and informed support of all stakeholders will be critical for the successful development of carbon finance distribution systems, especially as these will be new, innovative, and will require flexibility in design to accommodate changes in their development and operation. FFI and its partners will facilitate a consultative process to reach agreement on mechanisms for the distribution of benefits (p. 37).

The development of equitable carbon financial distribution mechanisms requires certain key issues be addressed through a collaborative stakeholder dialogue:

- Indigenous people, local communities and civil society organizations must be encouraged and supported to participate fully and actively in the development of distribution mechanisms for avoided deforestation finances.
- Prior informed consent based on customary land tenure arrangements and resource access rights of local communities must be sought prior to the establishment of carbon forests or other substantive changes in land use.
- Robust, transparent and accountable systems for the allocation and tracking of distributed funds.

Emissions and removals with and without project

Project carbon stock estimates

The most commonly accepted way to estimate forest carbon stocks over large areas is to apply carbon values to broad forest classes, the “biome-average approach”. This is the approach required by Tier 1 of the IPCC’s National Greenhouse Gas Inventories. Biome averages are freely available in the published literature and provide a source of globally consistent information. Despite limitations, biome averages continue to be the most routinely used method for a first approximation of forest carbon stock and for estimating emissions from large-scale deforestation (p. 8).

Relevant IPCC 2006 National Guidelines for Greenhouse Gas Inventories (p. 9)

350	IPCC Default value for tons of above ground biomass tropical moist forest, insular Asia, (Figure 4.7 of AFOLU Chapter 4)
0.47	IPCC Default value for carbon fraction of above ground biomass (tropical and subtropical), table 4.3
164.5	Tons of above ground carbon per hectare
1.37	Tropical rainforest conversion from above ground to total biomass (table 4.4)
225.4	IPCC Estimate of Per Hectare Carbon in Insular Asia (appropriate for Ulu Masen)

The above values are what project proponents believe to be the most appropriate IPCC values for the project area. The Ulu Masen Ecosystem is located in the geographic area which prescribes all of northern Sumatra as “tropical rainforest” (labelled as *Tar* in Figure 4.1 of IPCC AFOLU Chapter 4). The value of 350 tons of above ground biomass for the project area is the value for insular Asia (Figure 4.7 of AFOLU Chapter 4). Use of IPCC default values is considered Tier 1 work (very low confidence), but these values have been adopted as the best practices for estimating forest carbon stocks given limited information. Use of IPCC Tier 1 default values is not without ambiguities. For instance, for areas above 1,000 meters, Table 4.7 lists insular Asia's aboveground forest biomass ranging from 50t/ha to 260t/ha, a variation of more than 5-fold. In the design document and calculations, project proponents felt that such a wide range of default values without corroborating field measurements left too much room for subjective (and possibly biased) reporting. As is discussed next, a more conservative and nuanced method is adopted to estimate carbon stocks in the project area than the IPCC default values, that project proponents feel is more constrained (p. 9).

In addition to the IPCC default table values, four other prominent biome-average models are available to estimate carbon stocks in forests throughout the world. These models include: 1- Houghton, 2- Olson, 3- Achard, and 4- Brown/Gibbs. The Olson model is based on a large compilation of literature studies and has three models for estimating carbon -high, medium and low carbon stocks per area. The Houghton model includes above ground, below ground, and ground cover carbon stocks. Values were obtained from summaries of global vegetation and from regional studies. The Achard model weighted the country biomass figures from Brown by the FAO 1990 forest area country figures. The Gibbs and Brown model estimated forest carbon stocks for Southeast Asia using a rule-base GIS analysis to spatially extrapolate forest inventory data archived by the FAO based on climate, soils, topographic, population, and land use information (p. 9).

Project proponents commissioned research to estimate forest carbon in Ulu Masen using IPCC default values and these other four biome average models to see how they compared. The five models were all run using the widely-accepted 2000 Global Land Cover Map (GLC 2000). This work is the first example of a multi-model calculation of the prominent carbon biome-average models run on a standardized map to generate a range of forest carbon stock estimates at a scale of 1 km^2 (pp. 9-10).

Like the IPCC values, non-IPCC models are based on a limited number of forest classes, though most models are marginally more detailed than IPCC Tier 1 default values. Thus, the aggregation of models can be thought of as a collection of "reasonably accurate" initial estimates. By averaging the four non-IPCC models and the IPCC model, project proponents estimated 188 tons of carbon on average per hectare in the Ulu Masen ecosystem, of which 20% is assumed to be below ground (150 tC above ground and 38 tC below ground). Project proponents felt that to be truly conservative, the average of the five models calculated for Ulu Masen should be used since this figure is lower (by 15%) than the carbon stock value generated using IPCC values. Of the five forest carbon models evaluated, the IPCC carbon stock values were the highest for Ulu Masen forests.

Project proponents made three other key assumptions to improve the initial forest carbon estimates (pp. 10-11).

1st Assumption

They estimate that disturbed forests have 75% of the carbon stocks as intact forests. One remote-sensing study found that logging in Indonesia resulted in a 25% reduction in carbon densities, although other reports suggested greater declines. Degradation in Ulu Masen tends not to be as destructive as other Indonesian forests. The evidence to support this was based on an expert meeting held in July, 2007 in Banda Aceh.(…) Meeting participants collectively estimated, based on their field-experience and training, that the average decline in forest carbon between intact and disturbed forests in Ulu Masen was 25%. In the absence of an IPCC value for degraded forests, project proponents felt that to be conservative in estimating potential emission reductions associated with project activities, disturbed forests should be adjusted for their lower carbon stock initial values. This approach is conservative since the difference between the baseline scenario and the project scenario using a lower carbon value for degraded forests generates fewer carbon credits than not adjusting for degradation (p. 10).

2nd Assumption

They estimate 74% (558,382 ha) of the forests in Ulu Masen are intact and 26% are degraded (192,146 ha). To determine areas of intact versus degradation, FFI used 2006 SPOT imagery at 10 meter resolution for the entire project area. These images were evaluated with three techniques to assess areas of disturbance. First, the images were visually interpreted to identify areas where crown cover was diminished. Second, ground-truthing exercises were conducted that visited forest areas identified from SPOT image analysis as either intact or disturbed. Field conditions were visually observed to see if the area was either intact or degraded. This was an iterative process and though imperfect, gave project proponents a more robust understanding of where forests are intact and where they are degraded. Finally, several transects were conducted after the ground-truthing and image interpretation were complete. These transects confirmed that the classification system used was far more accurate at describing biomass with the two classes of forests compared to a carbon forest model that did not differentiate between intact and disturbed forests. The output of this analysis is incorporated into project calculations (p. 11).

3rd Assumption

To add a final level of detail that is both conservative and transparent, project proponents used a simple elevation approach to model variability of carbon with elevation. Project proponents assumed the 500-1000 meter altitudinal band would have the average carbon levels (200 tC/ha and 150 tC/ha for intact and disturbed forests). Then they assumed that the 0-500 meter band would be 10tC/ha higher (a total of 210tC/ha and 160tC/ha) and that higher elevations would decline slightly (see **Table below**). Using these two simple assumptions on top of five global carbon estimates, a forest carbon model that produces unique carbon stocks estimates for forest classes based on elevation and disturbance was populated (p. 11).

Elevation and condition: Ulu Masen Carbon stock values (tC/ha)

Forest Condition	Intact	Disturbed	Area-Weighted Average
Elevation			
0-500	210	160	182
500-1000	200	150	194
1000-1500	190	140	189
>1500	180	130	180

Using these assumptions, project proponents estimate the original project area contains 140,771,670 tons of carbon in forest carbon (above-ground and below-ground) distributed in the following classes:

Area and Carbon in Ulu Masen Forest Clases

Forest Type		Hectares	Total Carbon	Average tC/ha
Elevation (m)	Condition			
0-500	Intact	132,547	27,834,870	210
	Disturbed	162,759	26,041,440	160
500-1000	Intact	220,814	44,162,800	200
	Disturbed	28,078	4,211,700	150
1000-1500	Intact	143,732	27,309,080	190
	Disturbed	1,309	183,260	140
>1500	Intact	61,289	11,028,520	180
	Disturbed	0	0	n/a
TOTAL		**750,528**	**140,771,670**	**188**

Deforestation scenarios in the project area (pp. 25-29)

Project proponents used three deforestation scenarios: a low deforestation scenario (0.86% annual forest loss), a high deforestation scenario (2.3% annual forest loss) and a moderate rate (1.28% annual forest loss).

The low deforestation scenario (0.86%) is described by unpublished work by Conservation International. Although there is no way to discuss the merits of the work, project proponents believe the work will soon be published or available and that the work is based on sound science. Project proponents believe this is a legitimate lower boundary because Aceh was in a state of civil conflict until August 2005. Until this time, without any real political or economic certainty, Aceh was not a place for investment. This results in a low historic deforestation rate in part driven by a condition (civil conflict) which no longer exists.

Regarding the high deforestation rate (2.3%), Sumatra, for the most part, has witnessed a massive amount of forest loss, fragmentation and degradation. During the period 1985 to 1997, Sumatra had the highest rate of deforestation for any island in Indonesia. In a widely-cited study by the Government of Indonesia/World Bank, Sumatra lost an estimated 28% of forest during that time. This works out to an average annual loss of 2.3%.... Applying this deforestation rate of 2.3% to the project area is likely an overestimate of a probable deforestation scenario. For one, much of the terrain in the project area is steep and difficult to access. Second, Aceh has had time to witness the devastating impacts of widespread deforestation on surrounding ecosystems and communities and would be unlikely to allow such a massive amount of forest loss. Still, from a historical perspective, extremely high deforestation rates have occurred in Sumatra in the recent past. It is plausible therefore to assume that the largest remaining unprotected bloc of Sumatran forests will experience a substantial amount of deforestation.

Project proponents believe the most likely scenario for deforestation in the project area is a moderate conservative rate of 1.28%. Their model results in a deforestation rate only 0.42% higher than the lowest rate ever suggested for Aceh (during a period of armed conflict when industry could not operate). Their deforestation land use scenario is 1% lower than the rates of deforestation in other parts of Sumatra. The model was derived using locally-derived, nuanced classes of forests that are built from legal status, threat, level of degradation and elevation. Using this model, project proponents estimate forest loss based on local conditions such as access, terrain, current logging activity and land clearing (p. 29).

The average annual deforestation rate (from 2008 to 2038) of **1.28%** per year corresponds to an annual loss of 9,630 hectares per year in Ulu Masen, resulting in approximately 289,000 hectares of forest loss in the project area. Under this scenario, 38% of the forests in the project area are assumed to be deforested if no project activities are implemented (pp. 28-29).

For areas estimated to experience forest loss, the loss was partitioned into three land use outcomes – palm oil, mixed forests, and scrub. For these replacement systems, carbon stocks were estimated which allowed an estimate of the total greenhouse gas benefits the project anticipates generating (p.29).

Baseline scenario – Carbon emissions (pp. 29-31)

Based on literature review and unpublished information, project proponents assigned carbon values for "replacement" land use categories. "Without-project" emissions are estimated to be the difference between the carbon content of existing forests and the carbon content of land use systems likely to replace these natural forests. Unlike our model for estimating forest carbon, the values for these replacement systems do not vary with elevation. The uncertainty surrounding these carbon values is driven more by the range of systems (e.g., what types of crops, trees, etc) that would replace the forest, rather than elevation.

Palm Oil Plantations

The carbon content for palm oil was based on the Alternatives to Slash & Burn 2000 Climate change working group report, Appendix 3C, information on Indonesian carbon calculations. We use the ASB report's carbon value for palm oil rather than an IPCC value, since the information was extremely well-documented and specific to Indonesia (rather than the more generalized Asia, or "tropical rainforest" ecological zones reported in IPCC default tables). This report estimates 63.2 tons of above ground carbon in Indonesian palm oil plantations. We added a 20% factor to account for palm oil roots, so as to be consistent with all other forest carbon stock estimates (for a total of **76 tC/ha**). In our scenario, almost 73,000 hectares of palm oil "replace" forests over the 30 year project period, representing about ¼ of the overall 288,907 hectares deforested.

Mixed Forests

Project proponents define mixed forests as all types of forests that replace natural forests, except for palm oil. Mixed forests can include forests that retain some trees that were part of the natural ecosystem as well as entirely new types of forests. Presently, in Ulu Masen forests converted to anything except palm oil, the dominant replacement species are mixed plantations, agroforestry, coconut, chocolate, kememyan, fruit trees (durian, jack fruit) and rubber.

Project proponents based the carbon content of "mixed forests" on 85 t C/ha, based on the IPCC aboveground biomass value for forest plantations in the Ulu Masen ecological zone (Table 4.12 from AFOLU Chapter of IPCC). This reported value in IPCC Table 4.12 is 150 tons of above ground biomass. Making the same assumptions as above (0.47 carbon density and a 20% correction for belowground biomass), we reach **84.6tC/ha** in carbon…. In our baseline land-use scenario, "mixed forests" replace 58,271 hectares of current natural forests.

Scrub

By scrub, project proponents mean anything that is not a forest. This all-encompassing term consists of shrubs (bushes and other low-lying vegetation), subsistence and commercial nonforest crops (agriculture, rice) grasslands, and agroforest systems that may have some trees such as coconut, rubber, coffee or fruit but can't be considered "forest". This replacement system is the most widespread in our project scenario, accounting for 54% of the total 288,907 hectares lost over the 30 year period. Non-forests is also the most diverse outcome and the value for which there is the least IPCC guidance…. Project proponents felt that the value used for encompassing all conversions from forest to non-forest, had to be exceptionally conservative…. To derive a credible estimate of the carbon stocks for scrub in the model, project proponents used the central value for a range of observed carbon reductions reported from natural forests to other land cover types (14-63%)…. Given some of the areas that would replace forests in our project area contain very little carbon (such as clearings)…the variable was reduced with an additional 10% decline correction factor. The carbon content of "scrub" was estimated as **65 tC/ha**. This was derived from 188tC/ha average in natural forests X 0.385 X 90% (to account for cleared areas).

Summary

Based on the estimated land use model and the estimated carbon per unit area, it is calculated that at the end of 30 years, the Ulu Masen forests will contain 108,364,096 tons of carbon. This compares to an estimated 140,771,670 tons currently. This corresponds to an **annual *net* loss** – after regrowth – of **1,080,252 tons of carbon**.

Under the project scenario, where 85% of all deforestation is stopped, there would be 135,910,534 tons of carbon.The net carbon emission reductions from the project are conservatively estimated to be 27,546,438 over 30 years as depicted in the following table (p. 49):

Forest carbon in Ulu Masen, Aceh (2008-2038; baseline and project scenarios)

	2008 Current stocks	2038 Stocks	Emissions	Project emissions reductions	Project's worksheet reference
Baseline	140,771,670	108,364,096	32,407,574	N/A	H134 and T134
Project	140,771,670	135,910,534	4,861,136	27,546,438	U134 and V134

Project emissions

The predominant project emissions are international flights for project staff and consultants, emissions from the project's monitoring aircraft. Lesser emissions come from domestic flights from project staff and consultants, project vehicles and motorbikes, and other activities. Over the project period of 30 years, we estimate these emissions will not exceed 29,448 tons of CO_2. To be conservative, this estimate was derived by estimating all obvious projected activity data and emission factors, and then adding 200% more emissions to be highly conservative. All documentation and calculations are referenced either in the appropriate part of this document (for example in carbon stocks and baseline sections) or are cited in the noted worksheets (p. 50).

Estimating leakage

Estimating leakage is difficult with current uncertainty in academic and policy spheres regarding forest leakage understanding and methodologies. Thus, at this stage we cannot provide a scientific quantitative estimate of the amount of leakage we anticipate. We believe the two most critical types of leakage caused by the project will be out-migration of illegal loggers (activity-shifting) and possible increases in forest products for the short-term (until reforestation and sustainable forest management programs are at sufficient scale. It is estimated that these two types of leakage will occur in the first five years of the project. As a first order approximation, we do not believe negative leakage from activity-shifting or markets will exceed 10%. As stated in the section on risk management, a credit reserve comprising 20% of credits generated by the project will be held pending reconciliation of the project level accounts against the national baseline. Project proponents believe this is a responsible way to ensure they can "cover" any detected leakage as the project matures.

Monitoring

Monitoring in the mountains of Aceh is difficult because of the frequent presence of clouds and the size of the area. Experience in Kalimantan has shown that radar imagery can overcome these difficulties. Radar imagery, likely to be available through GOI from the Australian Government, will be used to assess changes that have taken place over time as a result of forest felling, road building, or even landslides and natural tree falls. Appropriate technical assistance and training will be provided for forest service staff seconded to the GIS Units. The project will equip and train the airborne monitoring teams that are being established by FFI with support from AFEP. This will allow the employment of 'Ultra Light' aircraft and high resolution photography in the assessment and monitoring of carbon stocks, both in the pilot areas and in surrounding forest blocks. This approach will provide even more reliable and timely monitoring capability than radar data, and has been used in Kalimantan over the last few years under the EU-funded "Illegal Logging Response Centre" project. It has proven effective in identifying locations of forest change and assisting government agencies' forest protection efforts (p. 63).

For carbon stocks and other non-CO2 gases, project proponents plan and have budgeted to develop IPCC Tier 2 estimates by the end of 2009 and move toward IPCC Tier 3 estimates by 2012. This is an ambitious timeframe and field conditions are rugged in the project area.

To initiate an improved understanding of carbon stocks, project proponents, through a monitoring-task force of the ULIB, will develop and implement:

- Use of best practice methods for carbon and biomass measurement, including remote sensing and field based methods for measuring carbon in above- and below-ground tree biomass, soil, litter, dead biomass, and understory vegetation (to see if these are likely to be significant sources of emissions);
- Forest stratification systems based on remotely sensed data to facilitate forest carbon estimates;
- Undertake forest sampling along with data from literature to develop appropriate allometric relationships/equations and area-based biomass estimates of standing and below ground biomass;
- Continued development of allometric equations, partitioning ratios and expansion factors to directly and/or indirectly estimate biomass (from total volume) for forests;
- Development of carbon leakage monitoring, including establishment of off-site representative permanent plots;
- Identify gaps in the information required for measurement and modelling of carbon stocks in forests.

Based on these results, the Ulu Masen Implementation Board (UMIB) will decide how and if to proceed to Tier 3 levels which provide understanding of statistical confidence intervals. Project proponents expect there to be more developed international baseline methodologies as well as Government of Indonesia modalities developed over the next years. As part of the monitoring program, project proponents will continue to watch fire rates in the project area, likely to be the most discernible evidence of climate change impacts in the project area (pp. 64-65).

Reporting

Formal reporting formats and communication channels will be established through discussions with appropriate forest management and protection agencies (p. 66).

Verification

Independent verification of emission abatement is expected (p. 45).

Risks and risk management

The project's most pressing risks include: the loss of some project benefits through improved measurement (e.g. that conservative estimates can become overestimates with improved measurement techniques), identification of leakage, and baseline/REDD credit adjustment as national and project accounts and reference emission scenarios are reconciled. To manage these immediate risks, 20% of annual VERs will be reserved from sale pending such reconciliation. This number may be increased if the project's risk management model and insurance partners consider it necessary (see below). Leakage is likely to be strongest earlier in the project period (e.g., the first 5-10 years) although leakage will be monitored for the 30 year project lifetime. Measurement risks are likely to be largely resolved by the end of year five (2012), when the project is expected to have completed IPCC Tier 3 biomass and carbon estimates (p. 41).

Risk management arrangements to protect the stored forest carbon in the long term have two elements. The first will be a "risk management buffer" of reserved credits, proposed to be 10% of the stream of VERs. The second will direct 20% of the stream of VERs into a revolving fund which will invest in other sustainable development projects which generate further emission reductions or sequestration. These revenues will be used to develop (p. 42):

- Mini and micro hydro projects
- Sustainable biofuel production and use
- Sustainable biomass power generation
- Other renewable energy projects
- Energy efficiency projects
- Reforestation with sustainable plantations
- Community based agroforestry

Reforestation and agroforestry will be particularly important in areas degraded by illegal logging carried out over the past several years and will be complimented by initiatives implemented under the World Bank Multi-Donor Fund's Aceh Environment and Forest project as part of its sustainable post-tsunami reconstruction support.

Acehnese communities will be the beneficiaries of these benefits, while VERs and/or CERs (Certified Emissions Reductions) generated will be reapplied to risk management function through the revolving fund. It is expected that the total amount of verified emission reductions will increase over time. These arrangements will be implemented in addition to the core project activity of ensuring forests in the project areas are legally protected and that applicable forest law is enforced. To the extent that current legal arrangements need strengthening, negotiations will be undertaken with those responsible for relevant legislation at the provincial and national levels (p. 42).

Carbon Conservation has also engaged a global reinsurance company to help estimate risks to carbon storage in some of its projects area and insure credits for 100 years. This process is an innovative program to address questions related to permanence using a combination of risk analysis for calculating probabilities of carbon stores being reversed (e.g. project failure to meet activities, fires, political instability, natural events such as volcanoes, floods), creation of risk management buffers to escrow portions of carbon credits generated, registration, monitoring of credits, and retirement of credits once they are used or sold (p. 42-43).

Progress and plans

The CCBA validated and approved the project under its standards (silver level) on February 8, 2008. According to Joe Heffernan (FFI)*, the project needs to conduct an additional validation process under the Voluntary Carbon Standard guidelines to be able to generate VERs.

To date, an endorsement of the project from the Government of Indonesia is still pending.

*See:
http://www.redd-monitor.org/2010/01/20/interviews-about-ulu-masen-indonesia-a-redd-labelled-protected-area/#more-3133

Links:

Project-related documents

SmartWood: *Validation Audit Report for Provincial Government of Nanggroe Aceh Darussalam, Fauna & Flora International Carbon Conservation in Ulu Masen Ecosystem, (Aceh Province, Indonesia)*

Project worksheets

Others

Forest Peoples Programme: ACEH:The Ulu Masen REDD+ Pilot Project (Rights, forests and climate briefing series-October 2011)

CIFOR: *Defining Baseline for REDD Ulu Masen, Aceh (Bogor, 25-26 August 2009)*