LULUCF CLIMATE CHANGE MITIGATION PROJECTS IN THE PHILIPPINES: A PRIMER

R.D. Lasco, F.B. Pulhin, J. Roshetko and M.R.N. Banaticla
ICRAF-Philippines

OUTLINE

1. Why this primer?

2. What's wrong with our climate?

3. What is the role of forest ecosystems in climate change?

4. What are the different ways to mitigate climate change through LULUCF?

5. Where can projects be implemented in the Philippines? /Project types

6. What types of projects are eligible under the CDM?

    6.1 What is the CDM?
    6.2 What projects are eligible under the first commitment?

7. How much carbon can be sequestered by trees and forests in the Philippines?

8. How to ensure that the climate benefits of projects are genuine?

    8.1 Is the baseline scenario credible?
    8.2 Are the benefits additional?
    8.3 Is leakage being eliminated/mitigated?
    8.4 Is permanence addressed?
    8.5 Is there a credible C monitoring plan?

9. How can sustainable development benefits be promoted through LULUCF projects?

    9.1 What are the environmental benefits of LULUCF projects?
    9.2 What are and how to assure the socio-economic benefits of LULUCF projects?

References

Glossary (Demystifying terms used in climate change)

Annexes

PDD document

Helpful websites

LULUCF CLIMATE CHANGE MITIGATION PROJECTS
IN THE PHILIPPINES: A PRIMER

R.D. Lasco, F.B. Pulhin, J.M. Roshetko and M.R.N. Banaticla
ICRAF-Philippines

1. WHY THIS PRIMER?

This primer is written for people who are interested in mitigating climate change through planting of trees, conserving existing forests, or what is collectively known as LULUCF (land use, land use change, and forestry) projects. These projects are also more popularly known as carbon sequestration projects or "sinks" projects.

Policy makers, project developers, NGOs, researchers, community organizations, donors and students will principally benefit from this document. Because of the wide range of intended users, the language and style of the primer has been adapted accordingly.

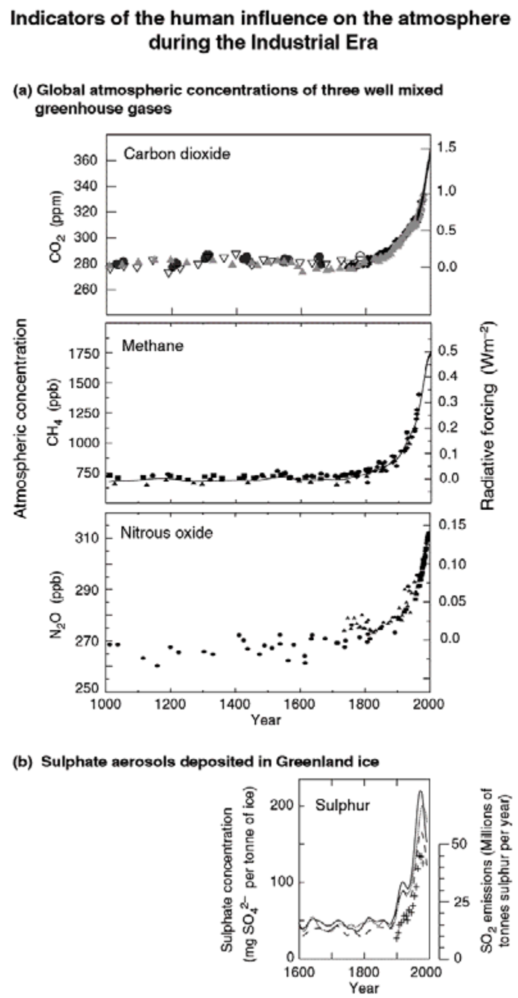
It should be noted that, while the so-called *'Clean Development Mechanism (CDM)'* projects are tackled here, the primer is for more than just CDM projects. It is intended to provide a general introduction for all types of "sinks" projects. Its goal is to help ensure that projects are environmentally, technically and socio-economically sound. It is unavoidable that much of the terminology used in this primer has unique meaning specific to the context LULUCF, CDM and climate change. To assist those readers for whom this terminology may be unfamiliar, a glossary is provided in the back of the primer.

2. WHAT'S WRONG WITH OUR CLIMATE?

Climate change or more popularly known as global warming is one of the primary concerns of humanity today. The United Nations Framework Convention on Climate Change (UNFCCC) defines climate change as "a change of climate which is *attributed directly or indirectly to human activity* that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods". In contrast, the Intergovernmental Panel on Climate Change (IPCC) defines it more broadly as "any change in climate over time, whether due to natural variability or as a result of human activity".

The earth's climate has been stable for about 10,000 year (mean T not changing by > 1°C per century). However, since the advent of the industrial revolution, the IPCC Third Assessment Report (TAR) concludes that there is strong evidence that human activities have affected the world's climate (IPCC 2001). The rise in global temperatures has been attributed to emission of greenhouse gases (GHG), notably CO_2 (Schimell *et al*. 1995).

The concentration of CO_2 in the atmosphere has increased by more than 30% since pre-industrial times and is still increasing at an unprecedented rate of on average 0.4% per year, mainly due to the combustion of fossil fuels and deforestation (**Figure 1**). This is true for other GHG as well. The increased concentration of GHG in the atmosphere enhances the absorption and emission of infrared radiation. This effect is called the "enhanced greenhouse effect" which leads to warming of air temperature. In the next 100 years, it is projected that the concentration of GHG will further increase as a result mainly of fossil fuel emissions (**Figure 2**).



Influence of industrialization on GHG and aerosol emissions (IPCC WG 1, 2001)

Figure 1. Increase in the concentration of major greenhouse gases since the industrial revolution in the late 1800s

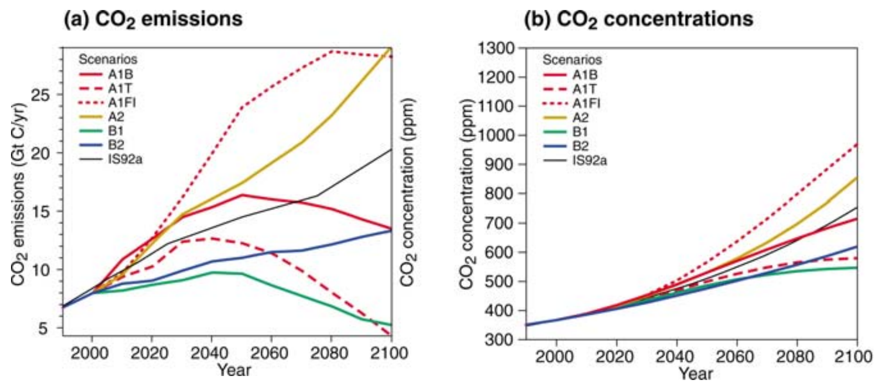


Figure 2. Projected increase in CO_2 emissions and atmospheric concentration in the next 100 years (Source: IPCC WG 1, 2001)

The IPCC TAR (2001) provides compelling evidence that the Earth's climate is indeed changing as a result of human influence. Its major conclusions are:

- The global average surface temperature has increased over the 20th century by about 0.6°C (**Figure 3**). Globally, it is very likely that the 1990s was the warmest decade and 1998 the warmest year in the instrumental record, since 1861.

- Temperatures have risen during the past four decades in the lowest 8 km of the atmosphere. Since the late 1950s (the period of adequate observations from weather balloons), the overall global temperature increases in the lowest 8 km of the atmosphere and in surface temperature have been similar at 0.1°C per decade. Since the start of the satellite record in 1979, both satellite and weather balloon measurements show that the global average temperature of the lowest 8 km of the atmosphere has changed by +0.05 ± 0.10°C per decade, but the global average surface temperature has increased significantly by +0.15 ± 0.05°C per decade.

- Snow cover and ice extent have decreased. Satellite data show that there are very likely to have been decreases of about 10% in the extent of snow cover since the late 1960s. There has been a widespread retreat of mountain glaciers in non-polar regions during the 20th century. Northern Hemisphere spring and summer sea-ice extent has decreased by about 10 to 15% since the 1950s. It is likely that there has been about a 40% decline in Arctic sea-ice thickness during late summer to early autumn in recent decades and a considerably slower decline in winter sea-ice thickness.

- Global average sea level has risen and ocean heat content has increased. Tide gauge data show that global average sea level rose between 0.1 and 0.2 m during the 20th century. Global ocean heat content has increased since the late 1950s, the period for which adequate observations of sub-surface ocean temperatures have been available.

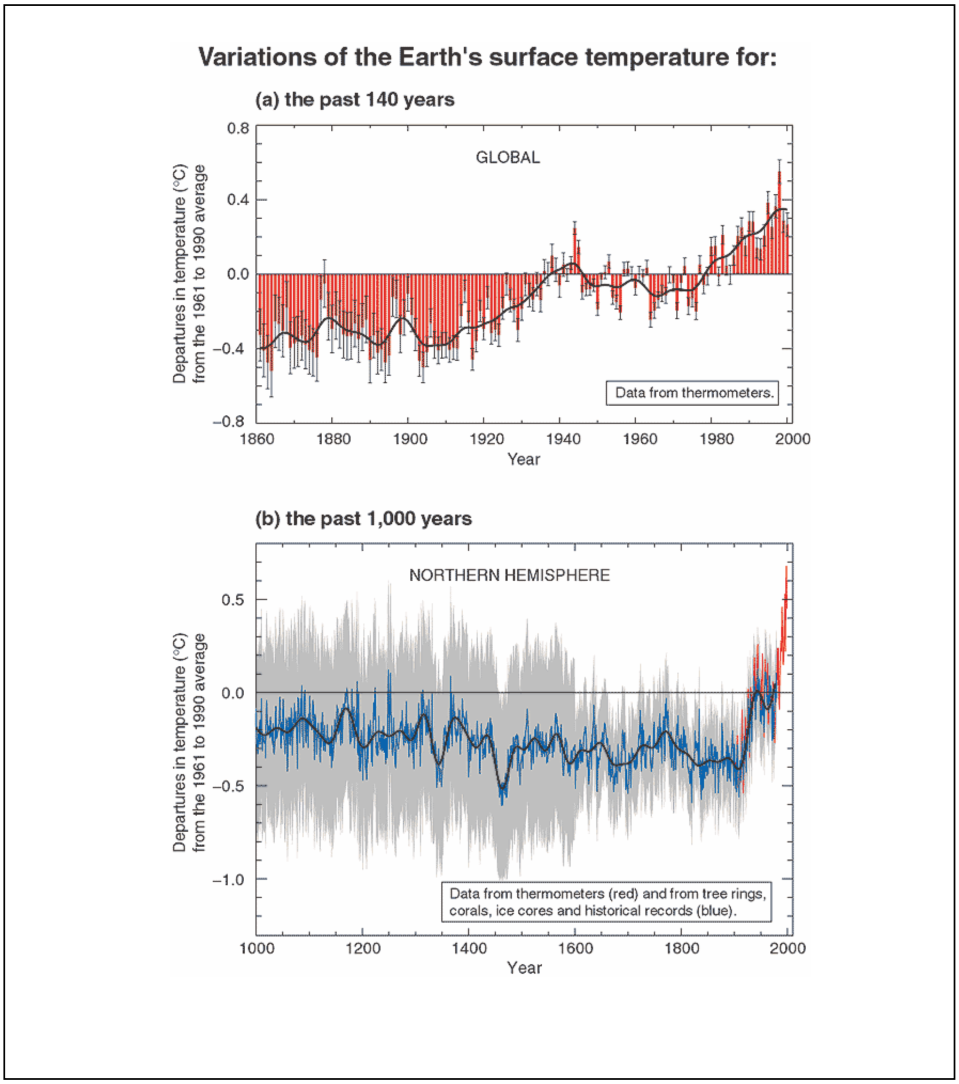
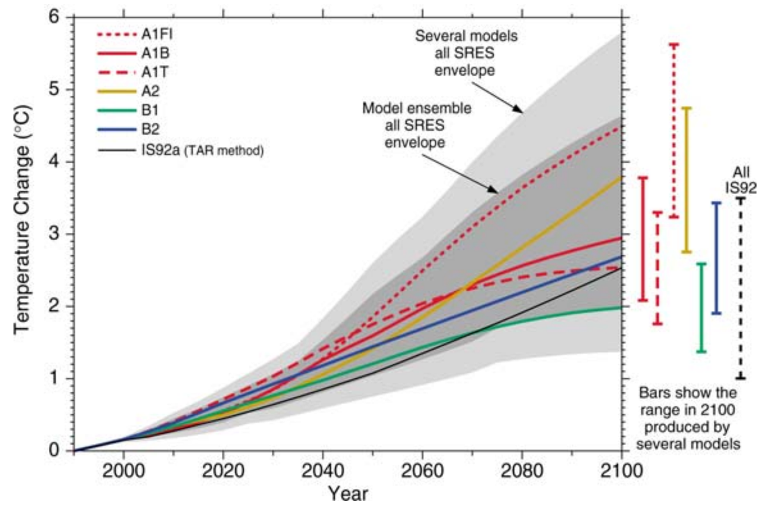


Figure 3. Variations of the Earth's surface temperature over the last 140 years and the last millennium (IPCC WG 1 2001)



Projected temperature rise in the 21st century (IPCC WG 1, 2001)

Figure 4. Projected rise in temperature from the present to the year 2100 (IPCC WG1, 2001)

In the future, the IPCC TAR (2001) projects the following changes in the world's climate:

- The globally averaged surface temperature is projected to increase by 1.4 to 5.8°C over the period 1990 to 2100 (**Figure 4**). The projected rate of warming is much larger than the observed changes during the 20th century and is very likely without precedent during at least the last 10,000 years, based on palaeoclimate data.

- Global average water vapour concentration and precipitation are projected to increase during the 21st century. At low latitudes there are both regional increases and decreases over land areas. Larger year-to-year variations in precipitation are very likely over most areas where an increase in mean precipitation is projected.

- There is still a lot of uncertainty in projections of changes in future frequency and spatial pattern of El Niño events in the tropical Pacific. Current projections show little change or a small increase in amplitude for El Niño events over the next 100 years. However, even with little or no change in El Niño amplitude, global warming is likely to lead to greater extremes of drying and heavy rainfall and increase the risk of droughts and floods that occur with El Niño events in many different regions.

- It is likely that warming associated with increasing GHG concentrations will cause an increase of Asian summer monsoon precipitation variability. Changes in monsoon mean duration and strength depend on the details of the emission scenario.

- Global mean sea level is projected to rise by 0.09 to 0.88 m between 1990 and 2100. This is due primarily to thermal expansion and loss of mass from glaciers and ice caps.

3. WHY ARE TROPICAL FORESTS IMPORTANT IN CLIMATE CHANGE?

There is considerable interest on the role of terrestrial ecosystems in the global carbon cycle. The world's tropical forests covering 17.6 M km^2 contain 428 Gt C* in vegetation and soils. It is estimated that about 60 Gt C is exchanged between terrestrial ecosystems and the atmosphere every year, with a net terrestrial uptake of 0.7 ±1.0 Gt C (**Figure 5**). However, LULUCF activities, mainly tropical deforestation, are also significant net sources of CO_2, accounting for 1.6 Gt C yr^{-1} of anthropogenic emissions (Houghton *et al*. 1996; Watson *et al*. 2000).

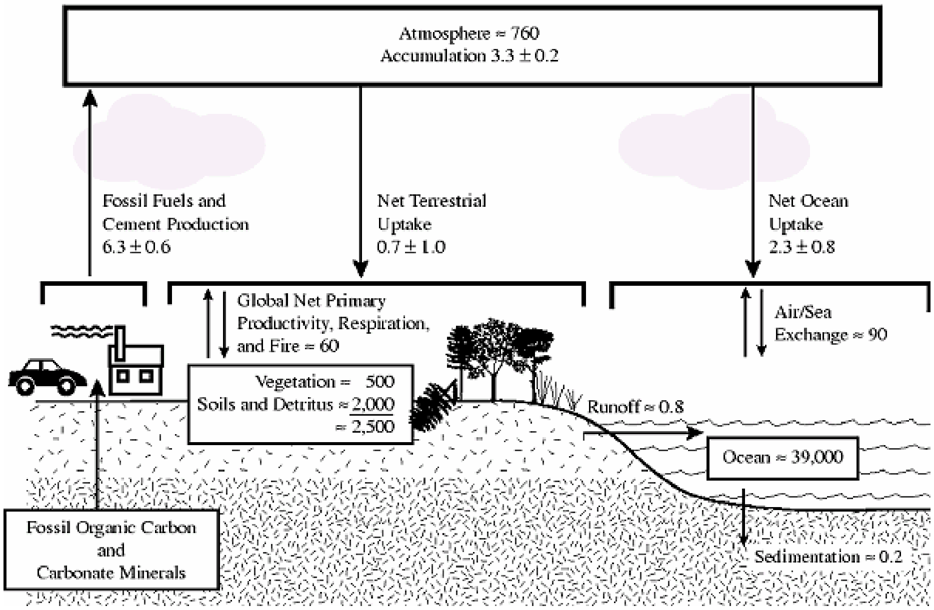


Figure 5. The global carbon cycle (from Bolin and Sukumar 2000)

In the last few decades there have been massive deforestation and landuse/cover change in the tropics. Annual deforestation rates in tropical Asia were estimated to be 2.0 M ha in 1980 and 3.9 M ha in 1981-1990 (Brown 1993). In Southeast Asia, the 1990 annual deforestation rate was about 2.6 M ha yr^{-1} (Trexler and Haugen 1994). A recent review showed that natural forests in South East Asia typically contain a high carbon density, more than 200 t C ha^{-1} (Lasco 2002). However, logging activities could reduce carbon stocks by at least 50% while deforestation could result in C density of less than 40 t C ha^{-1}.

On the other hand, tropical forests have the largest potential to mitigate climate change amongst the world's forests through conservation of existing carbon pools (e.g. reduced impact logging), expansion of carbon sinks (e.g. reforestation, agroforestry), and substitution of wood products for fossil fuels. In tropical Asia, it is estimated that forestation, agroforestry, regeneration and avoided deforestation activities have the potential to sequester 7.50, 2.03, 3.8-7.7, and 3.3-5.8 billion tons C between 1995-2050 (Brown *et al.* 1996).

---

* Some units of measure commonly used in climate change literature: 1 Gt (gigaton)= 1 billion metric tons or 10^9 tons; 1 Mg= 1 metric ton or 10^6 g.

4. WHAT ARE THE DIFFERENT WAYS TO MITIGATE CLIMATE CHANGE THROUGH LULUCF PROJECTS?

Mitigating carbon emission through forestry in tropical countries like the Philippines provides a promising way of reducing CO_2 in the atmosphere. Tropical forestry for mitigation is receiving much attention because of its cost effectiveness, high potential rates of carbon uptake, and associated environmental and social benefits (Brown *et al*. 2000; Brown *et al*. 1996; Moura-Costa 1996). In this section, we discuss the ways by which forest lands could help mitigate GHG emissions.

(a) Conservation of existing carbon stocks

The goal of this strategy is to maintain or improve existing carbon pools in forests by protecting forest reserves, by the use of appropriate silvicultural practices and by controlling deforestation. Tropical forest ecosystems in Asia contain substantial amounts of carbon (Table 1). Activities that destroy forests such as slash-and-burn farming, logging and conversion to other land uses (deforestation) could significantly reduce the stored carbon in the forest. For example, logging of tropical forests in Mindanao could reduce carbon stocks by about 50% (Figure 6). Similarly, land use change such as converting forests to agricultural plantations could decrease total carbon stocks.

Table 1. Above ground biomass and carbon density of forest land cover in the Philippines (from Lasco and Pulhin 2003).

Land Cover	Age (yr)	Carbon content, %	Biomass (t/ha)	Carbon (t/ha)	Location	Source of data
A. Protection Forests						
1. Old growth		50	370-520	165-260		IPCC default (Houghton *et al*. 1997)
2. Mossy		45.0	408.5	183.8	Makiling	Lasco *et al*. 2000
3. Pine		48.8	184.6	90.1	Baguio	Lasco *et al.* 2000
4. Submarginal				0.0		
5. Mangrove		44.0	401.8	176.8	Quezon	Lasco *et al.* 2000
B. Secondary Forest		45.0	262.0	117.9	Mindanao	Kawahara *et al.* 1981
		44.0	547.0	240.7	Makiling	Lasco *et al.* 2001a
		44.7	446.0	199.4	Leyte	Lasco *et al.* 1999

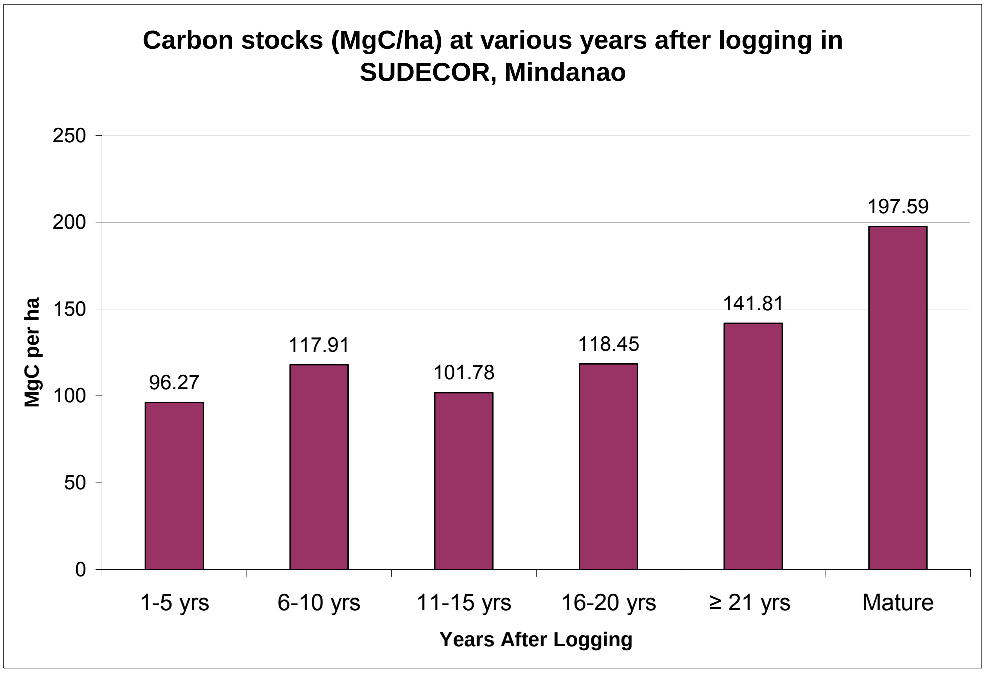


Figure 6. Change in carbon stocks over time after logging in SUDECOR concession, Mindanao, Philippines (Lasco *et al*. 2000)

Activities that promote the conservation of the remaining forest cover, or that reduce deforestation, will help mitigate carbon emissions by preventing the release of stored carbon to the atmosphere.

Certain silvicultural practices such as enrichment planting of sparse forests may also lead to increased carbon sequestration in existing forests. As a general rule, the more biomass produced the greater the amount of carbon sequestered.

Another way of minimizing carbon emission from forest lands is by preventing fire which is common in grassland areas of the country. The exact area affected by burning is not known but is likely to have been substantial especially in drier zones. Aside from CO_2, other GHG such as methane are also released to the atmosphere during fires. Programs aimed at fire prevention would result in conservation of carbon in plant biomass.

While much of the attention is focused on plant carbon storage, tropical forest soils are also significant sinks of carbon. It is estimated that up to 30% of carbon in the forest ecosystem is tied up in the soil (Moura-Costa 1996). Consequently, practices that help maintain or improve soil organic carbon will have positive benefits. Examples of these practices are: soil erosion control measures, improving soil fertility, and reducing shifting agriculture (Dixon *et al*. 1994).

(b) Expansion of carbon stocks

The goal of this strategy is to expand the amount of carbon stored in forest ecosystems by increasing the area and/or carbon density of natural and plantation forests and increasing storage in durable wood products.

Since carbon sequestration is a function of biomass accumulation, the simplest way to expand carbon stocks is to plant trees. For example, in Mindanao the rate of carbon sequestration of two plantation species was estimated to be 1.4 to 7.8 t C ha^{-1} yr^{-1} (Table 2).

Table 2. MAI of biomass and carbon of tree plantations in Mindanao, Philippines

Species	Age (yr)	Biomass MAI t ha^{-1} yr^{-1}	C MAI t C ha^{-1} yr^{-1}
Paraserianthes falcataria 1	4	20.20	7.82
P. falcataria 2	5	11.20	6.80
P. falcataria 3	7	8.40	6.20
	7	2.20	0.52
P. falcataria 4	9	5.30	5.41
	9	3.70	1.44
Gmelina arborea 1	7	11.30	5.51
G. arborea 2	9	10.50	4.37
G. arborea 3	9	9.60	6.04
Swietenia macrophylla	16	19.60	7.33
Natural forest*	100	4.90	1.19
			% C = 45%

* Harvested 20 years assumed to be ago; 100 years old
Paraserianthes falcataria was formerly *Albizia falcataria*.
Biomass data obtained by destructive sampling (Kawahara *et al*. 1981)

The choice of species to be planted will affect the potential to sequester C (Moura-Costa 1996). Fast-growing species such as *Paraserianthes falcataria* and *Casuarina equisitifolia* are commonly used. They accumulate more biomass and carbon than slow growing species for the same period of time. However, fast-growing species typically have lower wood density and thus contain less carbon per unit volume than wood of slow-growing species.

(c) Substitution of wood products for fossil fuels-based products

Substitution aims at increasing the transfer of forest biomass carbon into products (e.g. construction materials and biofuels) that can replace fossil-fuel-based energy and products, cement-based products and other building materials (Brown *et al*. 1996). This approach is considered to have the greatest mitigation potential in the long term (> 50 years). For instance, the substitution of wood grown in plantations for coal in power generation can avoid carbon emissions by an amount up to four times that of carbon sequestered in the plantation (Brown *et al*. 1996).

5. WHERE CAN PROJECTS BE IMPLEMENTED IN THE PHILIPPINES?

This section describes briefly what are the potential project areas and project types in the Philippines. Note that these apply more broadly to climate change mitigation projects and not just to CDM projects.

In general, those areas that need to be permanently forested for legal, ecological or social reasons are the most likely candidate areas for climate mitigation projects. These include the following areas:

- critical watersheds
- forest reserves (including those under the management of government agencies and government controlled corporations such as Philippine National Oil Company and National Power Corporation, academic institutions and the military)
- forest lands under the National Integrated Protected Area System (NIPAS) including those with 50% slope and 1,000 m asl altitude.

The total area of the forest lands discussed above is about 5 million ha (FMB 2001), of which a large portion needs to be either protected or rehabilitated.

Another way of estimating potential areas for climate projects is to look at the extent of degraded areas needing rehabilitation. Grasslands and brushlands in the uplands cover over 3.5 M ha (Lasco and Pulhin 1998; Garrity *et al.* 1997). In addition, many of the supposed agroforestry lands (5.7 M ha) are actually shifting cultivation areas or simply degraded farmlands that need stabilization most likely through some form of agroforestry and soil conservation practices.

There are several potential project types which can be implemented in these areas.

(1) Tree plantation establishment

There are two strategies that can be used in this type of project: (a) reforestation/plantation and (b) agroforestry/community forestry.

a. Reforestation/tree plantation

Perhaps the simplest type of project that could easily meet the requirements of a carbon offset project is the establishment of trees in a denuded area as part of a reforestation or tree plantation establishment. The baseline scenario can be established in many upland areas in the Philippines which have been historically unable to recover due to a grass-fire-grass cycle. The carbon sequestered could also be readily quantified as a function of the biomass accumulation of trees over time. Many reforestation and tree plantation projects have failed in the past because of top-down design and management (Carandang and Lasco 1998). Evidence indicates that success is enhanced by implementing projects with active community participation to assure transparency and local benefits.

b. Agroforestry and community forestry

Community or social forestry projects typically promote a shift to agroforestry practices from unsustainable farming practices. The increased planting of trees and the use of soil conservation techniques help reduce carbon in the atmosphere. The development of tree farms at either the individual or communities level contributes directly to sustainable development, a specific objective of the CDM. The computation of carbon benefits is straightforward.

(2) Conservation of protected areas

These are projects that aim to conserve existing carbon stocks in protected forests by slowing down deforestation and degradation. One possible difficulty is showing that under a baseline scenario such forests are indeed under pressure and at what rate are they being destroyed. In addition, it must be shown that preserving a tract of forest does not lead to increased cutting in adjacent stands thereby negating the carbon benefits of the project (See below for leakage issue).

(3) Improved silvicultural and harvesting practices

Any activity that increases the biomass of forest stand also increases the carbon sequestration. Thus silvicultural practices such as fertilization and timber stand improvement could have positive effects. Harvesting practices that lessens damage could also reduce carbon emissions from decaying plant parts. For example, in a carbon project in Sabah, Malaysia it has been shown that reduced-impact logging practices led to increased carbon sequestration at the rate of 0.9 t C ha^{-1} yr-1 for a total of 707,000 t C over its lifetime (Putz and Pinard 1993).

(4) Bioenergy

The use of tree biomass to produce energy has been explored in the Philippines during the 1970s using *Leucaena leucocephala*. The project did not prosper but this is mainly because of management problems rather than technical problems. By substituting renewable biomass to fossil fuels, there is less carbon released to the atmosphere. The technology is already available for this type of project but the cost-effectiveness is still uncertain.

6. WHAT TYPES OF LULUCF PROJECTS ARE ELIGIBLE UNDER THE CLEAN DEVELOPMENT MECHANISM (CDM)?

6.1 What is the CDM?

The Kyoto Protocol sets emission limits for six GHG for the developed nations, mostly industrialized countries and economies-in-transition, known as “Annex 1” or “Annex B” countries. These countries committed to collectively reduce GHG emissions by at least 5% relative to their 1990 emissions. At the time of this writing, the Kyoto Protocol has yet to enter into force. To enter into force, 55 countries must ratify the Protocol and it must include 55% of emissions of Annex 1 Parties for 1990. The Philippines has ratified the protocol on October 2003.

The Clean Development Mechanism (CDM) is one of the three flexibility mechanisms established to meet the goals of the Kyoto Protocol (see Annex A for Article 12 of the protocol). The dual goal of the CDM shall be to assist Parties not included in Annex I to achieve sustainable development and to assist Parties included in Annex I to achieve compliance with their quantified emission limitation and reduction commitments through projects in developing countries.

The CDM essentially offers many opportunities for financing sustainable development projects in developing countries that could generate Certificates of Emission Reduction (CERs). It specifically presents opportunities for a developing country to host projects that rehabilitate degraded lands, among others.

Figure 7 shows the project cycle under the CDM. The first step is the preparation of a project design document (PDD) which will have to be approved at the national and international level. The national approving body is called the Designated National Authority (DNA). The Philippines is currently working on the identification and development of its DNA.

Eligible participants of the CDM are individuals, groups of individuals, private companies, and NGOs that belong to a country that is a Party (signed and ratified) to the Kyoto Protocol.

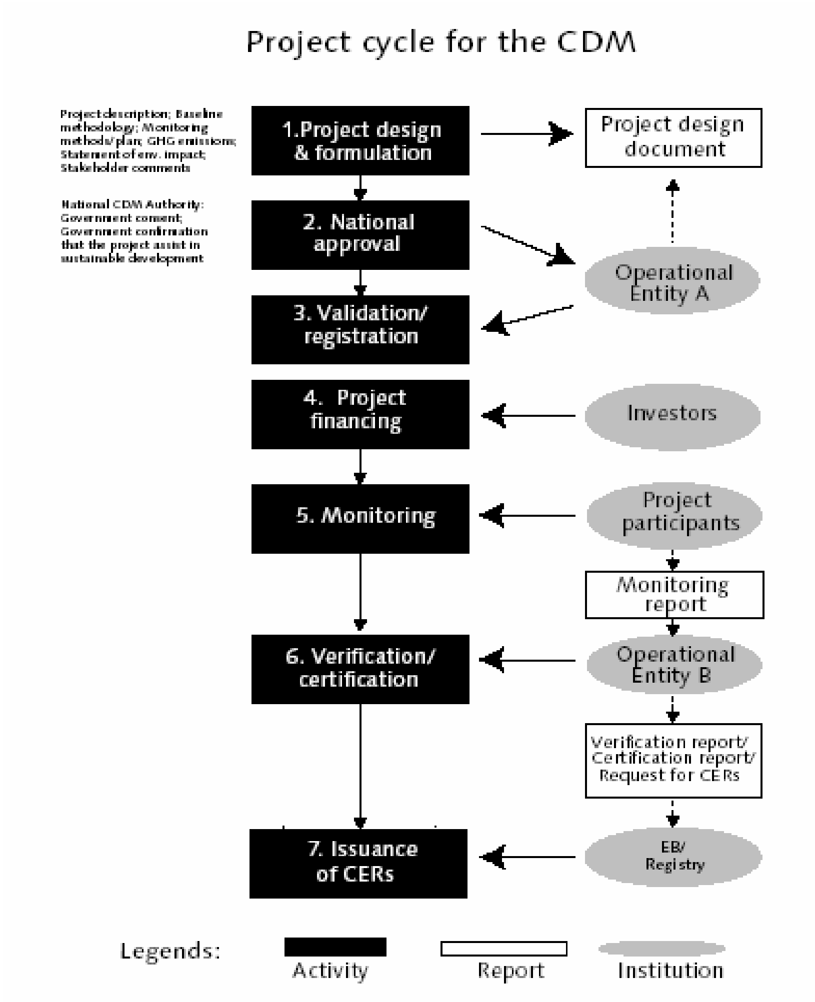


Figure 7. The CDM project cycle

6.2 What LULUCF Projects are Eligible Under the CDM?

At the Conference of the Parties-6 (COP-6), the parties agreed to include LULUCF projects under the CDM but limited projects to afforestation and reforestation (A/R). A key output of COP-9 at Milan in December 2003 was the modalities and procedures for A/R CDM projects (Decision 19/CP9) that could serve as a workable basis for project development. The key conclusions of COP-9 relevant to LULUCF projects are as follows:

- *Only afforestation and reforestation are eligible; agricultural sink projects are excluded* (e.g. soil organic matter enhancement projects). Thus, certain types of agroforestry systems that do not meet the definition of forests are not included (e.g. hedgerow cropping with less than 10% tree cover).

- *Definitions of "forest", "afforestation", "reforestation" for domestic activities apply under the CDM*, i.e. those used for reporting under Articles 3.3 and 3.4 of the Kyoto Protocol in the

UNFCCC decision 11/CP.7 for the first commitment period. This implies that non-Annex I countries that wish to host A/R projects need to choose ranges of potential project area sizes, tree densities and tree heights, derived from their reporting standards to FAO (see section 1.3.4 above).

- *"Reforestation" can only be done on lands that were not forests prior to 1990*. The main implication of this decision to many countries, such as Indonesia, is that it reduced the area of land potentially available to CDM because significant deforestation occurred since 1990.

- *Permanence of carbon sequestration ensured via two options*:
    - tCER's: temporary carbon emission reduction units, which expire after at most 10 years
    - lCER's: longterm carbon credits which are valid for the crediting period of the project or the project lifetime

  Both CER's need to be replaced after their expiration date; in addition lCER's need to be replaced if reversal of sequestration has occurred during crediting period.

- *Leakage* refers to the increase of all greenhouse gases outside the project boundary that are measurable and attributable to the project. These must be subtracted from project sequestration.

- *"Actual net greenhouse gas removal by sinks" is defined as the difference between actual project net greenhouse gas removal minus baseline net carbon stock changes minus leakage*. This essentially simplifies procedures for project developers.

- *Small-scale forestry projects are now eligible i.e. those with maximum annual sequestration of 8,000 t CO2 or 2,180 t C*; such projects will enjoy simplified and special facilitating conditions to be decided by COP-10, based on submissions by countries and observers until the end of February 2004. The participation of low-income individuals or communities was set as a precondition. Depending on the agro-ecological conditions and the species selected, the maximum project area is estimated to be 500 to 1,000 ha.

- Bundling of individual parcels of land is allowed, but subject to certain conditions. This is especially important in reducing transaction costs associated with small projects.

- If significant, socio-environmental impacts in and outside project boundary must be formally assessed according to host country procedures.

- Project lifetimes are a maximum of 30 years or 3 times 20 years

- Potentially invasive alien species and genetically modified trees are treated according to the rules of the host and investor country.

There are still issues that need further elaboration. On June 14, 2004 during its 14th meeting, the CDM Executive Board established a working group on afforestation and reforestation project activities under the CDM (CDM A/R Working Group). The A/R Working Group had its first meeting on July 12-13, 2004 in Bonn, Germany. Among its significant outputs are the: (a) draft guidelines for PDD preparation for AR projects, and (b) outline and guidelines for submission of proposed new methodology for baselines and monitoring. The draft PDD outline is in Annex B.

As indicated earlier, for the first commitment period (2008-2012), only reforestation and afforestation activities are qualified under the CDM. These are officially defined by the UNFCCC as follows (Decision 11/CP7 2001):

- "Afforestation" is the direct human-induced conversion of land that has not been forested for a period of at least 50 years to forested land through planting, seeding and/or the human-induced promotion of natural seed sources;

- "Reforestation" is the direct human-induced conversion of non-forested land to forested land through planting, seeding and/or the human-induced promotion of natural seed sources, on land that was forested but that has been converted to non-forested land. For the first commitment period, reforestation activities will be limited to reforestation occurring on those lands that did not contain forest on 31 December 1989.

It should be noted that how a country defines a forest is very important in determining which activities qualify. Under the CDM, a *"forest"* is a minimum area of land of 0.05-1.0 hectares with tree crown cover (or equivalent stocking level) of more than 10-30 per cent with trees with the potential to reach a minimum height of 2-5 metres at maturity in situ. A forest may consist either of closed forest formations where trees of various storeys and undergrowth cover a high proportion of the ground or open forest. Young natural stands and all plantations which have yet to reach a crown density of 10-30 per cent or tree height of 2-5 metres are included under forest, as are areas normally forming part of the forest area which are temporarily unstocked as a result of human intervention such as harvesting or natural causes but which are expected to revert to forest". Depending on how a party chooses its definition, certain type of agroforestry systems may not be eligible for CDM. For example, if a low cover is selected (e.g. 10%), then many agroforestry systems such as tree farms will be classified as forest already and are thus not eligible for "reforestation or afforestation".

7. HOW MUCH CARBON CAN BE SEQUESTERED BY TREES AND FORESTS IN THE PHILIPPINES?

The Philippines being a humid tropical country has ideal conditions for tree growth. This is reflected on the high carbon storage and rate of sequestration of forests and trees in the country. Data generated from various parts of the country show that Philippine old growth and second growth forests can have more than 250 t C ha^{-1} (Table 3). By conserving existing forests, their carbon stocks will be kept intact. Conversely, when forests are cleared and burned, the carbon will be released to the atmosphere contributing to the rise in GHG concentration.

Planted trees in the Philippines have a high rate of carbon sequestration with some reaching more than 7 t C ha^{-1} yr^{-1} (Table 4). This augers well for CDM proponents since reforestation projects are allowed in the first commitment period.

Table 3. Above ground biomass and carbon density of forest land cover in the Philippines

Land Cover	Age (yr)	Carbon content %	Biomass (t ha-1)	Carbon (t ha-1)	Location	Source of data
A. Protection Forest						
1. Old growth		50	370-520	165-260		IPCC default (Houghton *et al.* 1997)
2. Mossy		45.0	408.5	183.8	Makiling	Lasco *et al.* 2000
3. Pine		48.8	184.6	90.1	Baguio	Lasco *et al.* 2000
4. Submarginal				0.0		
5. Mangrove		44.0	401.8	176.8	Quezon	Lasco *et al.* 2000
B. Secondary Forest		45.4	672.8	305.5	Makiling	Lasco *et al.* 2000
		45.0	262.0	117.9	Mindanao	Kawahara *et al.* 1981
		44.0	547.0	240.7	Makiling	Lasco *et al.* 2004
		44.7	446.0	199.4	Leyte	Lasco *et al.* 1999
Mean		44.6	465.9	207.9		
C. Brushlands		45.4	63.8	29.0	Leyte	Lasco *et al.* 1999
D. Tree Plantation				0.0		
S. macrophylla	44	41.60	590.40	245.6	Makiling	Racelis 2000
Tree legumes		43.10	530.70	228.7	Makiling	Lasco *et al.* 2000
Dipterocarps	66	45.4	541.4	245.8	Makiling	Racelis 2000
A. auriculiformis	16	46.60	164.83	76.8	N. Ecija	Lasco *et al.* 2000
Tectona grandis		45.70	74.82	34.2	N. Ecija	Lasco *et al.* 2000
S. macrophylla		45.00	17.00	7.7	Leyte	Lasco *et al.* 1999
Gmelina arborea		45.00	124.00	55.8	Leyte	Lasco *et al.* 1999
A. mangium		45.00	195.80	88.1	Leyte	Lasco *et al.* 1999
G. arborea	7	45.00	120.70	54.3	Mindanao	Kawahara *et al.* 1981
G. arborea	9	45.00	85.70	38.6	Mindanao	Kawahara *et al.* 1981
G. arborea	9	45.00	87.40	39.3	Mindanao	Kawahara *et al.* 1981
P. falcataria	4	45.00	69.50	31.3	Mindanao	Kawahara *et al.* 1981
P. falcataria	5	45.00	75.60	34.0	Mindanao	Kawahara *et al.* 1981
P. falcataria	7	45.00	96.40	43.4	Mindanao	Kawahara *et al.* 1981
P. falcataria	7	45.00	8.10	3.6	Mindanao	Kawahara *et al.* 1981
P. falcataria	9	45.00	108.20	48.7	Mindanao	Kawahara *et al.* 1981
P. falcataria	9	45.00	28.70	12.9	Mindanao	Kawahara *et al.* 1981
S. macrophylla	16	45.00	261.00	117.5	Mindanao	Kawahara *et al.* 1981
*A. auriculiformis**	6	45.00	7.39	3.3	N. Ecija	Lasco 2001
*A. auriculiformis 2**	6	45.00	9.97	4.5	N. Ecija	Sakurai *et al.* 1994
*A. auriculiformis 3**	9	45.00	42.51	19.1	N. Ecija	-do-
*A. auriculiformis 4**	9	45.00	32	14.4	N. Ecija	-do-
*A. auriculiformis 5**	9	45.00	46.11	20.7	N. Ecija	-do-
*A. auriculiformis 6**	9	45.00	39.73	17.9	N. Ecija	-do-
*T. grandis 1**	13	45.00	8.7	3.9	N. Ecija	-do-
*T. grandis 2**	13	45.00	22.3	10.0	N. Ecija	-do-
*G. arborea 1**	6	45.00	17.22	7.7	N. Ecija	-do-
*G. arborea 2**	6	45.00	7.71	3.5	N. Ecija	-do-
*Pinus kesiya**	13	45.00	107.83	48.5	N. Ecija	-do-
P. kesiya + broadleaf spp.*	13	45.00	83.24	37.5	N. Ecija	

Comment: 240.38, as indicated in the publication

*Acacia mangium**	4	45.00	56.9	25.6	Leyte	Buante 1997; Lasco 2001
*G. arborea**	4	45.00	70.2	31.6	Leyte	Buante 1997; Lasco 2001
*A. auriculiformis**	4	45.00	63.5	28.6	Leyte	Buante 1997; Lasco 2001
*Acacia neriifolia**	4	45.00	87.13	39.2	Iloilo	Lasco 2001
*A. holosericea**	4	45.00	34.4	15.5	Iloilo	Lachica-Lustica 1997
*A. crassicarpa**	4	45.00	155.79	70.1	Iloilo	-do-
*A. aulacocarpa**	4.0	45.00	56.36	25.4	Iloilo	-do-
*Leucaena diversifolia**	4.0	45.00	0.66	0.3	Iloilo	-do-
*Casuarina cuminghiana**	4	45.00	3.21	1.4	Iloilo	-do-
*C. equisitifolia**	4	45.00	15.55	7.0	Iloilo	-do-
*Eucalyptus citrodora**	4	45.00	52.41	23.6	Iloilo	-do-
*E. cloeziana**	4	45.00	48.27	21.7	Iloilo	-do-
*E. pellita**	4	45.00	33.99	15.3	Iloilo	-do-
*E. tereticornis**	4	45.00	49.87	22.4	Iloilo	-do-
S. macrophylla	80	45.00	564.92	254.2	Makiling	Lasco 2001
S. macrophylla	80	45.00	634.99	285.7	Makiling	Sakurai *et al.* 1994
Dipterocarps	80	45.00	536.12	241.3	Makiling	-do-
Dipterocarps	80	45.00	279.14	125.6	Makiling	-do-
Mean			132.3	59.0		
E. Grasslands						
Imperata cylindrica		44.5	20.1	8.9	Leyte	Lasco *et al*. 1999
Saccharum spontaneum		41.3	36.9	15.2	Leyte	Lasco *et al*. 1999
Mean		42.9	28.5	12.1		
F. Agroforestry						
Fallow system*		45.0	32.0	14.4	Cebu	Lasco and Suson 1989
Coconut + coffee		44.0	99.2	43.6	Makiling	Zamora 1999
Narra + cacao		44.0	191.6	84.3	Makiling	Zamora 1999
Alley cropping		45.0	3.8	1.7	Makiling	Lasco *et al.* 2001c
Gmelina + cacao		44.0	257.7	113.4	Makiling	Lasco *et al.* 2001c
Homegarden		45.0	32.7	14.7	Isabela	Castro 2000
Mean			102.8	45.4		

Source of area: FMB 1998 except tree plantations. Grasslands and agroforestry which are estimates from various literature sources.
% carbon of trees only
Carbon content assumed to be 45% for all data from Kawahara *et al.* 1981
* Carbon content assumed to be 45%

Table 4. MAI of above ground biomass and carbon in the Philippines.

Land Cover	Age (yr)	Biomass MAI (t ha-1)	Carbon MAI (t ha-1)	Location	Source of Data
A. Protection Forests	nd	Nd	nd		
B. Secondary Forest	nd	2.1	0.9	Leyte	Lasco *et al.* 1999
	nd	4.9	1.19	Mindanao	Kawahara *et al.* 1981
Mean		3.5	1.1		
C. Brushlands		9.5	4.3	Leyte	Lasco *et al.* 1999
D. Tree Plantation					
S. macrophylla	44	14.24	6.4	Makiling	Racelis 2000
Dipterocarps	66	7.369001	3.3	Makiling	Racelis 2000
A. auriculiformis	16	9.08	4.1	N. Ecija	Lasco *et al.* 2000
S. macrophylla		8.39	3.3	Leyte	Lasco *et al.* 1999
G. arborea		18.84	8.2	Leyte	Lasco *et al.* 1999
G. arborea	7	11.3	5.51	Mindanao	Kawahara *et al.* 1981
G. arborea	9	10.5	4.37	Mindanao	Kawahara *et al.* 1981
G. arborea	9	9.6	6.04	Mindanao	Kawahara *et al.* 1981
P. falcataria	4	20.2	7.82	Mindanao	Kawahara *et al.* 1981
P. falcataria	5	11.2	6.8	Mindanao	Kawahara *et al.* 1981
P. falcataria	7	8.4	6.2	Mindanao	Kawahara *et al.* 1981
P. falcataria	7	2.2	0.52	Mindanao	Kawahara *et al.* 1981
P. falcataria	9	5.3	5.41	Mindanao	Kawahara *et al.* 1981
P. falcataria	9	3.7	1.44	Mindanao	Kawahara *et al.* 1981
S. macrophylla	16	19.6	7.33	Mindanao	Kawahara *et al.* 1981
*A. auriculiformis**	6	1.231766	0.6	N. Ecija	Lasco 2001
*A. auriculiformis 2**	6	1.661289	0.7	N. Ecija	Sakurai *et al.* 1994
*A. auriculiformis 3**	9	4.723807	2.1	N. Ecija	
*A. auriculiformis 4**	9	3.555892	1.6	N. Ecija	
*A. auriculiformis 5**	9	5.123389	2.3	N. Ecija	
*A. auriculiformis 6**	9	4.414571	2.0	N. Ecija	
*T. grandis 1**	13	0.669576	0.3	N. Ecija	
*T. grandis 2**	13	1.71554	0.8	N. Ecija	
*G. arborea 1**	6	2.869172	1.3	N. Ecija	
*G. arborea 2**	6	1.285075	0.6	N. Ecija	
*Pinus kesiya**	13	8.29455	3.7	N. Ecija	
P. kesiya + broadleaf spp*.	13	6.403308	2.9	N. Ecija	
*Acacia mangium**	4	14.225	6.4	Leyte	Buante 1997; Lasco 2001
*G. arborea**	4	17.55	7.9	Leyte	Buante 1997 ; Lasco 2001
*A. auriculiformis**	4	15.875	7.1	Leyte	Buante 1997 ; Lasco 2001
*Acacia neriifolia**	4	21.78127	9.8	Iloilo	Lasco 2001
*A. holosericea**	4	8.599975	3.9	Iloilo	Lachica-Lustica 1997
*A. crassicarpa**	4	38.94815	17.5	Iloilo	
*A. aulacocarpa**	4	14.09045	6.3	Iloilo	
*Leucaena diversifolia**	4	0.164304	0.1	Iloilo	
*Casuarina cuminghiana**	4	0.802636	0.4	Iloilo	
*C. equisitifolia**	4	3.886252	1.7	Iloilo	

*Eucalyptus citrodora**	4	13.10143	5.9	Iloilo	
*E. cloeziana**	4	12.06799	5.4	Iloilo	
*E. pellita**	4	8.498015	3.8	Iloilo	
*E. tereticornis**	4	12.46637	5.6	Iloilo	
S. macrophylla	80	7.061438	3.2	Makiling	Lasco 2001
S. macrophylla	80	7.937386	3.6	Makiling	Sakurai *et al.* 1994
Dipterocarps	80	6.701469	3.0	Makiling	
Dipterocarps	80	3.489233	1.6	Makiling	
Mean		9.1	4.2		
E. Grasslands	nd	Nd	nd		
F. Agroforestry					
Fallow system**	nd	10.6	5.3	Cebu	Lasco and Suson 1989

Source of area: FMB 1998 except tree plantations. Grasslands and agroforestry which are estimates from various literature sources.
% Carbon of trees only
Carbon content assumed to be 45% for all data from Kawahara *et al.* 1981
* Carbon content assumed to be 45%
** Carbon content assumed to be 50%

8. HOW CAN WE ENSURE THAT CLIMATE BENEFITS OF LULUCF PROJECTS ARE GENUINE?

This section describes the key factors that should be taken into account to ensure that LULUCF projects actually result to the mitigation of climate change.

8.1 Is the Baseline Scenario Credible?

A prerequisite to a credible offset project under the CDM is accurately estimating the situation without the project or the "*business-as-usual*" scenario which will serve as the basis for claiming credit of any project or activity. There is a whole range of possible cases and complexity involved in this. On one end of the spectrum is a small reforestation project in a denuded grassland area where historical records are clear that without any intervention there is little chance for the area to recover. In this case, the baseline is the carbon content of a grassland area. On the other end is a project designed to conserve a large protected area which is threatened with destruction by shifting cultivators. Without accurate data on the local historical rate of destruction, it will be hard though not impossible to determine how much benefits the project will be able to generate in terms of carbon-emission avoided.

In a developing country like the Philippines, the persistent lack of data in specific sites could hamper baseline case determination. In this case, regional analysis which is an accepted tool for establishing a benchmark for an area using available data from another but similar area can be used. Another option is to avoid projects where the baseline is not clear and concentrate on those projects where baselines could be easily measured and verified.

8.2 Are the Benefits Additional?

Carbon projects must be able to demonstrate that it is adding value (either by preventing carbon emission and/or by carbon sequestration) over and above what would be expected under the baseline scenario. If the baseline case can be accurately measured, it would be easier to show additional benefits.

8.3 Is Leakage Eliminated/Mitigated?

One of the most critical concerns about forestry projects under the CDM is leakage (CIFOR 2001). The IPCC Special Report on LULUCF defines leakage as the "decrease or increase in greenhouse gas benefits outside the project's accounting boundary as a result of project activities" (Watson *et al.* 2000; Brown *et al*. 2000). It is more commonly understood in its negative sense, i.e. an anticipated loss of net carbon benefits (Brown *et al.* 1997). For example, a forest protection project may lead to the cutting of trees in an adjacent forest resulting to minimal net carbon sequestration. Bass *et al*. (2000) consider leakage as an externality of a project and they differentiated between leakage and slippage. The former occurs when "a project's activities and outputs create incentives to increase GHG emissions from processes taking place elsewhere". Slippage occurs when the estimated GHG benefits are negated by an increase in GHG emissions in another area from similar processes. Aukland *et al*. (2001) divided leakage into two categories: primary and secondary leakage. Primary leakage is synonymous to "slippage" while secondary leakage occurs when the project creates incentives to increase GHG emissions elsewhere.

Experience in other projects shows that land areas with many competing and dynamic land uses are more prone to negative leakage. For example, converting low-biomass ecosystems to a tree farming system may provide 'negative leakage' by preventing deforestation or forest degradation through the establishment of on-farm sources of trees (Smith and Scherr 2002; Sanchez 1994; Schroeder 1994). Additionally, the opportunity costs of converting low-biomass lands is low as no competing landuse systems have developed in many areas were degraded lands are common.

8.4 Is Permanence Addressed?

Under energy projects, switching from a coal-fired power plant to a geothermal plant will mean that the carbon in the unused coal deposit will be permanently conserved. In contrast, in forestry projects, the carbon conserved or sequestered could more easily be released, e.g. by burning or harvesting.

Forestry projects especially in developing countries could fail for a number of reasons. Lack of participation of local communities could lead to conflict over the use of the land. For example, forest fires in the Philippines have been known to be intentionally started by disgruntled workers. Government policies may also be uncertain or could suddenly change. While the above risks apply also to the Philippines, it has a long history of collaboration with Annex I countries on forestry projects. For example, there are existing projects being supported by the USA, Japan, New Zealand and Germany through multilateral and bilateral organizations. In addition, many non-government organizations are recipients of support from developed countries. Thus, the level of risk may be manageable.

As mentioned earlier, for CDM reforestation/afforestation projects, COP-9 approved the use of two approaches to address permanence, i.e. the use of temporary CER (tCER) or long term CER (lCER). Which of these two modes will be more popular remains to be seen.

8.5 Is There a Credible Carbon/GHG Monitoring Plan?

The major carbon pools in forestry projects are: aboveground biomass, belowground biomass, litter, dead wood, and soil organic carbon (IPCC 2003). The selection of which pools to measure and monitor depends on several factors, such as expected rate of change, magnitude and direction of the change, availability and accuracy of methods to quantify change, and cost to measure. Tables 5 shows how to determine which carbon pools need to be measured in LULUCF projects.

Credible sampling and measurement techniques for forestry projects have been developed based on well-established statistical and biometric principles (MacDicken 1997; Hairiah *et al.* 2001).

Table 6. Decision matrix for choosing which carbon pools to measure in LULUCF projects (from IPCC 2003).

Project Type	Carbon Pools					
	Live Biomass			Dead Biomass		Soil
	Trees	Ground vegetation/ understorey	Roots	Fine	Coarse	
Afforestation/reforestation	Y1	M2	R4	M5	M5	Y6
Forest management	Y1	M2	R4	M5	Y5	M6
Agroforestry	Y1	M2	R4	M5	N	Y6
Crop management	N	M2	M4	M5	N	Y6
Grazing land management	M3	Y2	M4	M5	N	Y6
Revegetation	Y1	Y1/2	M4	M5	N	M6

Source: modified from Brown et al. 2000

Legend:
Y= Yes - the change in this pool is likely to be large.
R = Recommended - the change in the pool could be significant but measuring costs to achieve desired levels of precision could be high.
N = No - the change is likely small to none.
M = Maybe - the change in this pool may need to be measured depending upon the forest type and/or management intensity of the project.

9. HOW CAN SUSTAINABLE DEVELOPMENT BENEFITS BE PROMOTED THROUGH LULUCF PROJECTS?

Sustainable development is a key concern of developing countries like the Philippines. This is the reason why there is such strong emphasis on sustainable development of non-Annex 1 countries in the CDM. Whether in the context of the CDM or not, LULUCF mitigation projects should not only reduce GHG emissions but should also promote sustainable development.

9.1 What are the Environmental Benefits of LULUCF Projects?

(a) Trees produce oxygen and absorb carbon dioxide (CO_2)

LULUCF projects provide a wide range of environmental benefits. One of the most significant contributions of forestry projects is the ability of the trees to produce oxygen and improve air quality. Also, trees help moderate the amount of greenhouse gases particularly carbon dioxide from the atmosphere. Through the process of photosynthesis, trees use water and carbon dioxide to produce sugar and oxygen. Thus, growing trees continue to absorb carbon dioxide from the atmosphere and fix carbon in their biomass. This results to a reduction of the concentration of carbon dioxide in the atmosphere, the most abundant among greenhouse gases. Such reduction of CO_2 consequently helps in the mitigation of global climate change. A number of studies of agroforestry systems and tree plantations (possible strategies allowed in CDM) in the Philippines prove that these systems store huge amount of carbon. For instance, Lasco *et al.* (1998a, 1998b) found that 13-year-old multistorey and 1-year-old alley cropping systems in Luzon store 236 t C ha^{-1} and 68 t C ha^{-1}, respectively. Kung'u (1993) on the other hand found that a 5-year-old fallow system in the Visayas contains 32 t C ha^{-1}. For tree plantation, carbon density depends on the species present in the area. Based on the 21 tree plantation species studied in the Philippines, average carbon density is 59 t ha^{-1} (Table 1). Work in Indonesia, where agroforestry systems are very similar to the Philippines, shows that while small size limits the amount of carbon stored by individual farmer's agroforestry systems, on a per area and per time basis these systems can store as much carbon as some secondary forests (Tomich *et al.* 1998; Roshetko *et al.* 2003; van Noordwijk *et al.* 2003).

(b) Conserving forests means maintaining their biodiversity

LULUCF projects also promote biological diversity because forests are home to a wide variety of trees, plants and wildlife. Worldwide, around 70 percent of all land-based plants and animals live in forests (http://www.usaid.gov). In the Philippines, thousands of animal and plant species are supported by its forests. Assessment of the DENR shows that Philippine forests consist of at least 13,500 plant species representing 5% of the world's flora. The ferns and allies, gymnosperms and angiosperms constitute 22.5% of the Malesian and 3.9% of the world's vascular flora. In terms of endemism, about 25 genera of the plants are endemic in the Philippines (DENR/UNEP 1997).

As regards faunal diversity, it is estimated that about 1,090 species of terrestrial vertebrates are found in Philippine forests, of which 45% are endemic. Millipedes and centipedes constitute around 54 and 44 species, respectively, while insects have more than 20,000 species. Spiders compose of 341 species that represent about 2% of the world's total spider diversity; while mollusks consist of 2,782 species with an estimated endemism of high to very high. Birds have 576 species and about 196 species are endemic. Mammals on the other hand, constitute 204 species, of which 110 species are unique in the country. Amphibian and reptile species are no exception as a large number of both species is also endemic to the Philippines. Around 79 species of the 101 amphibian species and 170 species of the 258 reptile species are endemic to the country.

Many of these species however are threatened as their habitats are being wantonly destroyed. Each species of plants and animals have specific habitat requirement, thus degradation of the forest resources are likely to lead to at least a reduction of their population, or worst their extinction. From around 27 million in 1521, forest cover shrunk to 6.1 M ha in 1996 (Lasco and Pulhin 2000). Based on current estimates, there are less than a million hectares of old growth forests remaining (FMB 2001).

Through the years, the government has embarked on many forms of reforestation activities to put back the cover of the once lush forests. Despite these efforts however, there still remain large tracts of denuded land in the country. Based on recent estimates, there are around 2-10 million ha of grassland areas that need immediate rehabilitation in the Philippines to save its diverse species of plants and animals. With the very limited funds available for reforestation activities, the government will not have the capacity to rehabilitate all these degraded lands. Thus, involvement to LULUCF projects is very desirable and will certainly favor biodiversity conservation. Properly done, LULUCF projects will serve as habitats to threatened species of plants and animals.

(c) Forests prevent soil erosion

LULUCF projects also prevent the occurrence of excessive soil erosion. Areas that are bare of trees are prone to excessive soil erosion because there is nothing to protect the soil from heavy rains. Water detaches soil particles from the soil surface thus causing transfer of soil particles from upland areas to lowland areas or even to the rivers and streams that consequently causes siltation and sedimentation. The canopy of a forest or tree farm protects the soil from the impact of falling raindrops as they intercept and absorb the kinetic energy of the raindrops. Consequently, the time over which the rain reaches the soil is prolonged resulting to less surface runoff. Likewise, the presence of organic materials in the soil prevents the raindrops from detaching and transporting soil particles. A study by Gintings (1988) on surface run off, soil erosion and nutrient status of various cover crops in Mt. Makiling Forest Reserve show that agroforestry systems have low surface run-off values compared with cultivated areas.

(d) Trees improve soil quality

One of the distinct characteristics of a forest ecosystem is its ability to cycle nutrients. Nutrients are transferred between the forest floor-soil and the associated plant and animal communities. Trees withdraw nutrients from the soil, and in return huge quantities of nutrients are added to the soil via litterfall. Hence, a large and dynamic portion of the nutrient cycling in forest ecosystem is contributed by litterfall inputs and litter decomposition.

Roots of trees penetrate deeply into the soil to draw nutrients, and most of the nutrients extracted by the trees from the soil are in the leaves and only a relatively small percentage is retained in the growing biomass. Leaves of trees as recipients of these nutrients accumulate various essential nutrients for plant growth and development, such as nitrogen, potassium, calcium, magnesium and phosphorus. As a result, when leaves fall along with other litterfall and undergo the process of decomposition, organic matter and bioelements are released to the soil and re-utilized and recycled by the plants. Based on estimates, more than 80% of the nutrients taken by trees from the soil are returned back to the soil through litterfall production and decomposition.

9.2 What are the Socioeconomic Benefits of LULUCF Projects?

LULUCF projects should promote sustainable development by creating opportunities and capacities for improving the quality of life of the local communities. This is important as, typical to most developing nations, the rural Philippines is inhabited by many people, most of whom are poor. Currently, there are around 18-20 million people living in upland areas who are either directly or indirectly dependent on forest resources for their livelihood.

In areas where agroforestry and community forestry are used as strategies, a wide range of benefits can be obtained by the local communities: food, fuel, construction materials, medicines, farm inputs (i.e. such as animal fodder, green manure and climbing poles), and aesthetic and cultural values. Likewise, they can generate income from the sale of the fruits of the trees they planted (Smith and Scherr 2002).

Socio-economic benefits derived by the local communities from LULUCF projects will vary depending on the type of project that is implemented as well as local biophysical and socioeconomic conditions. In areas where large-scale tree plantations are established, local communities can be hired as laborers in establishing and maintaining tree plantations. There will be continuous requirements for labor to plant trees since LULUCF projects such as this could involve harvesting on a rotation basis. Rotational harvesting will enable project managers (possibly communities) to maintain the level of carbon that they have committed to the buyer. Aside from the direct employment that the tree plantation owners provide to the local communities, they also give health, education and social services (Smith and Scherr 2002).

LITERATURE CITED

Aukland *et al*. (2001)

Aukland, L., P. Moura Costa, and S. Brown. 2001. A conceptual framework and its application for addressing leakage on avoided deforestation projects. Draft Paper. Winrock International. 29pp.

Bass *et al*. (2000)

Bass, S., O. Dubois, P. Moura-Costa, M. Pinard, R. Tipper, and C. Wilson. 2000. Rural Livelihoods and Carbon Management. IIED Natural Resources Issues Paper No.1. International Institute for Environment and Development. London, UK. 94pp

Bolin, B. and R. Sukumar. 2000. Global perspective. In: R.T. Watson, I.R. Noble, B. Bolin, N.H. Ravindranath, D.J. Verardo and D.J. Dokken (eds). *Land Use, Land-use Change, and Forestry: A Special Report of the IPCC.* Cambridge, U.K. Cambridge University Press, 377pp.

Brown *et al.* 1997

Brown, P., B. Cabarle, and R. Livernash. 1997. Carbon Counts: Estimating Climate Change Mitigation in Forestry Projects. World Resources Institute, Washington DC, USA. 25pp.

Brown, S., O. Masera and J. Sathaye. 2000. Project-based activities. In: R.T. Watson, I.R. Noble, B. Bolin, N.H. Ravindranath, D.J. Verardo and D.J. Dokken (eds). *Land Use, Land-use Change, and Forestry: A Special Report of the IPCC.* Cambridge, U.K. Cambridge University Press, 377pp.

Brown, 1993 (deforestation rates in tropical Asia, 1981,1990)

Brown, S., L.I. Iverson, A. Prassad, and D. Liu. 1993. Geographical distribution of carbon in biomass and soils of tropical Asian forests. Geocarto International 4: 45-59.

Brown, S., J. Sathaye, M. Cannel, and P. Kauppi. 1996. Management of forests for mitigation of greenhouse gas emissions. In: R.T. Watson, M.C. Zinyowera, and R.H. Moss (eds.) *Climate Change 1995: Impacts, Adaptations, and Mitigation of Climate Change: Scientific-Technical Analyses, Contribution of Working Group II to the Second Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge and New York, Cambridge University Press, pp. 775-797.

Buante, C.R. 1997. Biomass production of *Acacia mangium* Willd., *Gmelina arborea* Roxb., and *Acacia auriculiformis* A. Cunn. Ex Benth. as fuelwood species in Leyte. In: *Developments in Agroforestry Research*. Philippine Council for Agriculture, Forestry and Natural Resources Research and Development, Los Baños, Laguna. pp. 224-246.

Castro, L.G. 2000. *Carbon Storage Potential of an Agroforestry Farm in Bayombong, Nueva Vizcaya, Philippines*. Unpublished MSc Thesis. University of the Philippines at Los Baños, College, Laguna, Philippines.

Carandang, W.M. and R.D. Lasco. 1998. Successful reforestation in the Philippines: technical considerations. In: *Mega Issues in Philippine Forestry: Key Policies and Programs*. Forest Development Center, UPLB, Philippines. pp. 49-59.

CIFOR, 2001

CIFOR. 2001. A shared research agenda for landuse, landuse change, forestry and the Clean Development Mechanism. Center for International Forestry Research. Bogor, Indonesia. 74pp.

DENR/UNEP (Department of Environment and Natural Resources/United Nations Enviornment Programme). 1997. *Philippine Biodiversity: Assessment and Action Plan*. Bookmark, Inc. Makati City, Philippines. 298 pp.

Dixon et al. 1994 (practices improving soil C)

Dixon, R., S. Brown, R.A. Houghton, A.M. Solomon, M.C. Trexler, and J. Wisniewski. 1994. Carbon pools and flux of global forest ecosystems. Science 263: 185-190.

FMB (Forest Management Bureau). 2001. Forestry Statistics (2000). Forest Management Bureau, Quezon City Philippines. ___ pp.

FMB (Forest Management Bureau). 1998. Forestry Statistics (1997). Forest Management Bureau, Quezon City Philippines. 253 pp.

Garrity, D.P., 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* grassland of tropical Asia: area, distribution and typology. *Agroforestry Systems*, 36:3–29.

Gintings, (1988)—pls check with Yayay; she cited this I think (or Forestry Lib as this is a PhD thesis)

Hairiah, K., S.M. Sitompul, M. van Noordwijk and C. Palm. 2001. *Methods for Sampling Carbon Stocks Above and Below Ground*. International Center for Research in Agroforestry, ASB Lecture Series Note 4B, Bogor, Indonesia, 23 pp.

Houghton, J.T., L.G. Meira Filho, B.A. Callander *et al.* (eds). 1996. *Climate Change 1995: the Science of Climate Change*. New York: Cambridge University Press, 572 pp.

Houghton, J.T., L.G. Meira Filho, B. Lim, K. Treanton, I. Mamaty, Y. Bonduki, D.J. Griggs and B.A. Callander (eds). 1997. *Greenhouse Gas Inventory Workbook*. Intergovernmental Panel on Climate Change (IPCC), Organization for Economic Co-operation and Development (OECD) and the International Energy Agency (IEA), Paris, France, __ pp. pp. 5.1-5.54.

http://usaid.gov-- pls check website

IPCC, 2001

IPCC Working Group III. 2001. *Climate Change 2001: Mitigation. Contribution of Working Group III to the Third Assessment Report of the Intergovernmental Panel on Climate Change* [J.T. Houghton, Y. Ding, D.J. Griggs, M. Noguer, P.J. van der Linden, X. Dai, K. Maskell and C.A. Johnson (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, __ pp.

IPCC, 2003 (major C pools in forestry projects, decision matrix)
IPCC. 2003. Good Practice Guidance for Land Use, Land-Use Change and Forestry (Jim Penman, Michael Gytarsky, Taka Hiraishi, Thelma Krug, Dina Kruger, Riitta Pipatti, Leandro Buendia, Kyoko Miwa, Todd Ngara, Kiyoto Tanabe and Fabian Wagner, Eds). IPCC National Greenhouse Gas Inventories Programme Technical Support Unit C/o Institute for Global Environmental Strategies
Kanagawa, Japan. Pp 4.91-4.112.

IPCC WG 1, 2001
IPCC Working Group I. 2001. *Climate Change 2001: Science of Climate Change. Contribution of Working Group I to the Third Assessment Report of the Intergovernmental Panel on Climate Change* [J.T. Houghton, Y. Ding, D.J. Griggs, M. Noguer, P.J. van der Linden, X. Dai, K. Maskell and C.A. Johnson (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, __ pp. – see at ENFOR LIb

IPCC Working Group I. 2001. *Climate Change 2001: The Scientific Basis. Contribution of Working Group I to the Third Assessment Report of the Intergovernmental Panel on Climate Change.* [J.T. Houghton, Y. Ding, D.J. Griggs, M. Noguer, P.J. van der Linden, X. Dai, K. Maskell and C.A. Johnson (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, 881pp.

IPCC TAR 2001
IPCC. 2001. Climate Change 2001: Impacts, Adaptation and Vulnerability. Summary for Policy Makers and Technical Summary of the Working Group II Report. World Meteorological Organization (WMO), Geneva, Switzerland and UN Environmental Programme (UNEP), Nairobi, Kenya. 89pp.

Kawahara, T., Y. Kanazawa and S. Sakurai. 1981. Biomass and net production of man-made forests in the Philippines. *J. Jap. For. Sci.,* 63(9):320-327.

Kung'u, J.B. 1993. *Biomass Production and Some Soil Properties under a Leucaena leucocephala Fallow System in Cebu, Philippines.* Unpublished MSc Thesis. University of the Philippines at Los Baños, College, Laguna, Philippines.

Lachica-Lustica, A. 1997. Trial planting of ntroduced reforestation species in Dumarao, Capiz. In: *Developments in Agroforestry Research*. Philippine Council for Agriculture, Forestry and Natural Resources Research and Development, Los Baños, Laguna. p.270-281.

Lasco, R.D., J.S. Lales, I.Q. Guillermo and T. Arnuevo. 1999. CO_2 Absorption Study of the Leyte Geothermal Forest Reserve. Final report of a study conducted for the Philippine National Oil Company (PNOC). UPLB Foundation, Inc. Los Baños, laguna.

Lasco, R.D., R.F. Sales, R. Estrella, S.R. Saplaco, A.S.A. Castillo, R.V.O. Cruz and F.B. Pulhin. 2001. Carbon stocks assessment of two agroforestry systems in the Makiling Forest Reserve, Philippines. *Philippine Agricultural Scientist*, 84(4):401-407.

Lasco, R.D. 2001. Carbon budgets of forest ecosystems in Southeast Asia following disturbance and restoration. Review paper prepared for the GCTE-APN project "Land Use Change and the Terrestrial Carbon Cycle in Asia". Environmental Forestry Programme, CFNR, University of the Philippines, College, Laguna, Philippines.

Lasco, R.D. 2002. Forest carbon budgets in Southeast Asia following harvesting and land cover change. *Science in China,* 45, 55-64.

Lasco *et al* (1998a, 1998b) (C stocks, alley cropping, multistory in Makiling)—this is also Lasco et al 2001 (Phil Ag 84)

Lasco, R.D. 1998. Management of Philippine tropical forests: implications to global warming. *World Resource Review*, 10:410-418.

Lasco, R.D., F.B. Pulhin, R.G. Visco, D.A. Racelis, I.Q. Guillermo and R.F. Sales. 2000. Carbon stocks assessment of Philippine forest ecosystems. Paper presented at the Science-Policy Workshop on Terrestrial Carbon Assessment for Possible Carbon Trading. Bogor, Indonesia. 28-20 February 2000.

Lasco, R.D., I.Q. Guillermo, R.V.O. Cruz, N.C. Bantayan and F.B. Pulhin. 2004. Carbon stocks assessment of a secondary forest in Mount Makiling Forest Reserve, Philippines. *Journal of Tropical Forest Science*, 16(1):35-45.

Lasco, R.D. and F.B. Pulhin. 1998. *Philippine Forestry and CO_2 Sequestration: Opportunities for Mitigating Climate Change*. Environmental Forestry Programme (ENFOR). UPLB College of Forestry and Natural Resources, Laguna, Philippines.24 pp.

Lasco, R.D. and F.B. Pulhin. 2000. Forest land-use change in the Philippines and climate change mitigation. *Mitigation and Adaptation Strategies to Global Change Journal,* 5, 81-97.

Lasco, R.D. and F.B. Pulhin. 2003. Philippine forest ecosystems and climate change: Carbon stocks, rate of sequestration and the Kyoto Protocol. *Annals of Tropical Research,* 25(2):37-51.

Lasco, R.D. and P.D. Suson. 1989. A Lecaena-leucocephala-based indigenous fallow system in central Philippines: The Naalad system. *International Tree Crops Journal,* 10(2):161-174.

MacDicken, K.G. 1997. *A Guide to Monitoring Carbon Storage in Forestry and Agroforestry Projects*. Winrock International Institute for Agricultural Development. Virginia, USA. 87pp.

Moura-Costa, P. 1996. Tropical forestry practices for carbon sequestration. In: Schulte A. and D. Schione (eds). *Dipterocarp Forest Ecosystems: Toward Sustainable Management*. Singapore: World Scientific, pp.308-344.

Putz, F.E. and M.A. Pinard. 1993. Reduced impact logging as carbon-offset method. *Conservation Biology*, 7(4):755-758.

Racelis. M.E. 2000. *Carbon Stocks Assessment of Large-leaf Mahogany (Sweitenia macrophylla) and Dipterocarp Plantations in the Mt. Makiling Forest Reserve*. Unpublished MSc Thesis. University of the Philippines at Los Baños, College, Laguna, Philippines.

Roshetko, J.M., M. Delaney, K. Hairiah and P. Purnomosidhi. 2002. Carbon stocks in Indonesian homegarden systems: Can smallholder systems be targeted for increased carbon storage? *American Journal of Alternative Agriculture,* 17:138-148.

Sakurai, S., R.S.B. Ragil and L.U. dela Cruz. 1994. Tree growth and productivity in degraded forest land. In: *Rehabilitation of Degraded Lands in the Tropics*. JIRCAS International Symposium Series No.1, Japan International Research Center for Agricultural Sciences (JIRCAS), Tsukuba, Japan. pp. 64-71.

Sanchez, P.A. 1994. Alternatives to slash and burn: A pragmatic approach for mitigating tropical deforestation. In: J.R. Anderson (ed.) *Agricultural Technology, Political Issues for the International Community*. Centre for Agriculture and Biosciences International (CABI), Wallingford, UK. pp. 451–480.

Schimell, D., I.G. Enting, M. Heimann, T.M.L. Wigley, D. Rayneud, D. Alves and U. Seigenthler. 1995. CO_2 and the carbon cycle. In: J.T. Houghton, L.G. Meira Filho, B.A. Calander, E. Haites, N. Harris and K. Maskell (eds). *Climate Change 1994: Radiative Forcing of Climate Change and an Evaluation of the IPCC IS92 Emission Scenarios*. Cambridge: Cambridge University Press. pp. 35-71.

Schroeder, P. 1994. Carbon storage benefits of agroforestry systems. *Agroforestry Systems*, 27: 89–97.

Smith, J. and S. Scherr. 2002. Forest Carbon and Local Livelihoods. Policy Report. Center for International Forestry Research (CIFOR) and Forest Trends. Bogor, Indonesia.

TAR (2001)—this is also IPCC 2001 above

Tomich, T.P., M. van Noordwijk, S. Budidarsono, A. Gillison, T. Kusumanto, D. Murdiyarso, F. Stolle and A.M. Fagi (eds.). 1998. Alternatives to Slash-and-Burn in Indonesia, Summary Report and Synthesis of Phase II, ASB-Indonesia Report No. 8. Alternatives to Slash and Burn Project (ASB-Indonesia) and International Centre for Research in Agroforestry (ICRAF), Bogor, Indonesia.

Trexler, M and .C. Haugen. 1994. *Keeping it Green: Tropical Forestry Opportunities for Mitigating Climate Change*. Washington D.C.L World Resources Institute. 52pp.

van Noordwijk, M, S. Rahayu, K. Hairiah, Y.C. Wulan, Fariada and B. Verbist. 2002. Carbon stock assessment for a forest-to-coffee conversion landscape in Sumber-Jaya (Lampung, Indonesia): from allometric equations to landuse change analysis. *Journal of Science in China*, 45:75-86.

van Noordwijk M, J.M. Roshetko, Murniati, M. delos Angeles, Suyanto, C. Fay and T.P. Tomich. 2003. Agroforestry is a form of sustainable forest management: Lessons from South East Asia: ICRAF Southeast Asia Working Paper 2003_1. ICRAF. 20 p.

Watson, R.T., I.R. Noble, B. Bolin, N.H. Ravindranath, D.J. Verado and D.J. Dokken (eds). 2000. *Land Use, Land-use Change, and Forestry: A Special Report of the IPCC.* Cambridge, U.K. Cambridge University Press, 377pp.

Zamora, D. 1999. *Carbon Dioxide (CO_2) Storage Potential of Multistorey Agroforestry Systems in Mt. Makiling*. Unpublished MSc Thesis.University of the Philippines at Los Baños, College, Laguna, Philippines.

GLOSSARY OF TERMS

Aboveground biomass This includes the biomass of tree, understorey and herbaceous vegetation. (See also Biomass)

Additionality According to the Kyoto Protocol, gas emission reductions generated by Clean Development Mechanism and Joint Implementation project activities must be additional to those that otherwise would occur. Additionality is established when there is a positive difference between the emissions that occur in the baseline scenario, and the emissions that occur in the proposed project.

The Kyoto Protocol establishes the requirement that Clean development Mechanism (CDM) projects may only count emissions reductions that are "additional to what otherwise would have occurred in the absence of the certified project activity" (environmental additionality). These reductions must be "real" and "measurable", and must be quantified against a project baseline.

Afforestation The establishment of forest on land that has been without forest for a period of time and was previously under a different land-use.

The direct human-induced conversion of land that has not been forested for a period of at least 50 years to forested land through planting, seeding and/or the human-induced promotion of natural seed sources.

Agroforestry A dynamic, ecologically based natural resources management system that, through the integration of trees in farmland and rangeland, diversifies and sustains production for increased social, economic and environmental benefits for land users at all levels

A management system that integrates trees on farms and in the agricultural landscapes.

Alley cropping An agroforestry model in which shrubs and trees are planted on contour rows and managed by periodic cutting and pruning, often for green manure. A crop is grown between the rows. The row species grown may include fruit trees and other multi-purpose species as promoted in the Sloping Land Agricultural Technology (SALT).

Annex I Parties Industrialized countries that, as parties to the Framework Convention on Climate Change, have pledged to reduce their greenhouse gas emissions by the year 2000 to 1990 levels. Annex I Parties consist of countries belonging to the Organization for Economic Cooperation and Development (OECD) and countries designated as Economies-in-Transition.

Anthropogenic Human made. In the context of greenhouse gases, emissions that are produced as the result of human activities.

Baseline A reference scenario against which a change in GHG emission or removals is measured.

Baseline Emissions The emissions that would occur without policy intervention (in a business-as-usual scenario). Baseline estimates are needed to determine the effectiveness of emissions reduction programs (often called mitigation strategies).

Belowground biomass This includes the biomass of the soil and roots. (See also Biomass)

Biodiversity The variability among living organisms from all sources including, *inter alia*, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems.

Bioenergy This covers all energy forms derived from organic fuels of biological origins that are used for energy production.

Biofuels Gas or liquid fuel made from plant material (biomass). Includes wood, wood waste, wood liquors, peat, railroad ties, wood sludge, spent sulfite liquors, agricultural waste, straw, tires, fish oils, tall oil, sludge waste, waste alcohol, municipal solid waste, landfill gases, other waste, and ethanol blended into motor gasoline.

Biomass The total amount of living organic matter in organisms. For determining carbon storage in forest land uses, biomass is expressed in terms of 'biomass density', or oven-dry mass per unit area (e.g. tons per hectare).

Brushland Land which is predominantly covered with shrub growth or short, stunted tress or shrubs.

Carbon benefits The difference between the amount of carbon in Project case and Reference case.

Carbon cycle The term used to describe the exchange of carbon (in various forms, e.g. as carbon dioxide) between the atmosphere, ocean, terrestrial biosphere and geological deposits.

Carbon dioxide A colorless, odorless, non-poisonous gas that is a normal part of the ambient air. Carbon dioxide is a product of fossil fuel combustion. Although carbon dioxide does not directly impair human health, it is a greenhouse gas that traps terrestrial (i.e. infrared) radiation and contributes to the potential for global warming.

Carbon offset A mechanism by which the impact of emitting a ton of CO_2 can be negated or diminished by avoiding the release of a ton elsewhere, or absorbing a ton of CO_2 from the air that otherwise would have remained in the atmosphere.

Carbon pool A reservoir. A system which has the capacity to accumulate or release carbon. Examples are forest biomass, wood products, soils, and atmosphere.

Carbon sequestration The process of increasing the carbon content of a carbon pool other than the atmosphere.

The biochemical process through which carbon in the atmosphere is absorbed by biomass such as trees, soils and crops.

Carbon sink Natural features that absorb CO_2, such as forests or seas.

Carbon stock/storage The absolute quantity of carbon held within a pool at a specified time.

CDM Executive Board The CDM Executive Board supervises the Clean Development Mechanism, under the authority and guidance of the COP/MOP. The CDM Executive Board is authorized to approve methodologies for baselines, monitoring plans and project boundaries; accredit operational entities; and develop and maintain the CDM registry.

CER (Certified Emission Reduction) A unit of greenhouse gas emission reductions issued pursuant to the Clean Development Mechanism of the Kyoto Protocol, and measured in metric tons of carbon dioxide equivalent.

Certificate of Emission Reduction (CER) Investors in Clean Development Mechanism projects can earn CER credits for the amount of greenhouse emission reductions achieved by their CDM projects. CERs are equal to one metric ton of carbon dioxide equivalent (CO_{2e}).

Clean Development Mechanism (CDM) The mechanism provided by Article 12 of the Kyoto Protocol, designed to assist developing countries in achieving sustainable development by permitting industrialized countries to finance projects for reducing greenhouse gas emission in developing countries and receive credit for doing so.

Climate The average weather, usually taken over a 30-year time period, for a particular region and time period. Climate is not the same as weather, but rather, it is the average pattern of weather for a particular region. Weather describes the short-term state of the atmosphere. Climatic elements include precipitation, temperature, humidity, sunshine, wind velocity, phenomena such as fog, frost, and hailstorms, and other measures of the weather.

Climate change (1) UNFCC definition: A change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods. (2) IPCC definition: Climate change as referred to in the observational record of climate occurs because of internal changes within the climate system or in the interaction between its components, or because of changes in external forcing either for natural reasons or because of human activities. It is generally not possible clearly to make attribution between these causes. Projections of future climate change reported by IPCC generally consider only the influence of anthropogenic increases in greenhouse gases and other human-related factors.

Commitment Period Covers the years 2008-2012 where Annex 1 countries must reduce their GHG emission to an average of approximately 5.2% below their 1990 levels.

Community forestry projects Forestry projects developed in areas marginal to agriculture, with many of members of the community being landless or small-scale farmers, often characterized by ecological and cultural diversity and the employment of traditional technologies. Communal land development is basic to this type of forestry

COP (Conference of Parties) The supreme body of the United Nations Framework Convention on Climate Change (UNFCCC) and an association of all countries that have ratified or acceded to the convention. Its first session was held in Berlin, Germany, in 1995 and it is expected to continue meeting on a yearly basis. The COP's role is to promote and review the implementation of the Convention. It will periodically review existing commitments in light of the Convention's objective, new scientific findings, and the effectiveness of national climate change programs.

Deforestation The conversion of forest land to non-forest land.

DENR (Philippines Department of Environment and Natural Resources) The primary government agency responsible for the conservation, management, development and proper use of the country’s environment and natural resources, including those in reservations, watershed areas and lands of the public domain, as well as the licensing and regulation of all natural resources utilization as may be provided by law.

Designated National Authority (DNA) The official body representing the Government in the arrangement of CDM/JI projects. For CDM host countries, the DNA issues a non-objection letter necessary for the project approval.

Acts as the primary national contract for Activities Implemented Jointly (AIJ), and authorized to accept, approve or endorse activities implemented jointly and to report them to the secretariat.

Ecosystem (1) Any unit that includes all the organisms in a given area interacting with the physical environment, so that a flow of energy leads to a clearly defined trophic structure, biotic diversity and cycling of materials within the system. (2) System that includes both living and non-living units to produce an exchange between them.

EIA (Environmental Impact Assessment) A process that involves evaluating and predicting the likely impacts of a project (including cumulative impacts) on the environment during construction, commissioning, operation and abandonment. It also includes designing appropriate preventive, mitigating and enhancement measures addressing these consequences to protect the environment and the community's welfare. The process is undertaken by, among others, the project proponent and/or EIA Consultant, EMB (Philippines Environmental Management Bureau), a Review Committee, affected communities and other stakeholders.

El Niño A climatic phenomenon occurring irregularly, but generally every 3 to 5 years. El Niños often first become evident during the Christmas season (El Niño means Christ child) in the surface oceans of the eastern tropical Pacific Ocean. The phenomenon involves seasonal changes in the direction of the tropical winds over the Pacific and abnormally warm surface ocean temperatures. The changes in the tropics are most intense in the Pacific region. These changes can disrupt weather patterns throughout the tropics and can extend to higher latitudes, especially in Central and North America. The relationship between these events and global weather patterns are currently the subject of much research in order to enhance prediction of seasonal to interannual fluctuations in the climate.

Endemic Species characteristic of or prevalent in a particular or restricted locality or region.

Enhanced greenhouse effect The increase in the world's average temperature due to increasing concentrations of the GHGs in the atmosphere.

Enrichment planting Introduction of valuable species to degraded forests without the elimination of valuable individuals already present. It may be used in areas where natural regeneration is not sufficient, or as a technique to establish forest species that cannot grow in open plantations. The species planted may include valuable timber species, fruit trees or other species with commercial or local value.

The improvement of the percentage of desirable species or genotypes or increasing the biodiversity by interplanting.

Exotic Commonly used to refer to a plant or other organism introduced from a foreign country. Strictly defined, the term refers to a plant grown anywhere outside its natural range.

Externality By-product of activities that affect the well-being of people or the environment, where those impacts are not reflected in market prices. The costs (or benefits) associated with externalities do not enter standard cost accounting schemes.

Fast-growing tree A tree species that matures quickly and is usually not long-lived. Can often be highly productive on fertile sites: 15-20 t ha^{-1} of wood products or more. Examples include species belonging to the genera *Alnus*, *Leucaena*, *Gliricidia* and *Sesbania*.

Plant species of rapid growth characteristics that require higher nourishment for its development.

Forest An ecosystem in which the dominant plants are trees covering a vast tract of land.

A minimum area of land of 0.05-1.0 hectares with tree crown cover (or equivalent stocking level) of more than 10-30% with trees with the potential to reach a minimum height of 2-5 metres at maturity *in situ*. A forest may consist either of closed forest formations where trees of various storeys and undergrowth cover a high proportion of the ground, or open forest. Young natural stands and all plantations which have yet to reach a crown density of 10-30% or tree height of 2-5 m are included under forest, as are areas normally forming part of the forest area which are temporarily unstocked as a result of human intervention such as harvesting or natural causes but which are expected to revert to forest.

Forestation A generic term for establishing forest by reforestation and afforestation.

Fossil fuel A general term for buried combustible geologic deposits of organic materials, formed from decayed plants and animals that have been converted to crude oil, coal, natural gas, or heavy oils by exposure to heat and pressure in the earth's crust over hundreds of millions of years.

Global warming The progressive gradual rise of the earth's surface temperature thought to be caused by the greenhouse effect and responsible for changes in global climate patterns. An increase in the near surface temperature of the Earth. Global warming has occurred in the distant past as the result of natural influences, but the term is most often used to refer to the warming predicted to occur as a result of increased emissions of greenhouse gases.

GMO (Genetically Modified Organism) An organism produced from genetic engineering techniques that allow the transfer of functional genes from one organism to another, including from one species to another. Bacteria, fungi, viruses, plants, insects, fish, and mammals are some examples of organisms the genetic material of which has been artificially modified in order to change some physical property or capability.

Grassland Land covered with grasses and other herbaceous species. Woody plants may be present, but if so, they do not cover more than 10% of the ground.

Greenhouse effect The effect produced as greenhouse gases allow incoming solar radiation to pass through the Earth's atmosphere, but prevent part of the outgoing infrared radiation from the Earth's surface and lower atmosphere from escaping into outer space. This process occurs naturally and has kept the Earth's temperature about 59ºF warmer than it would otherwise be. Current life on Earth could not be sustained without the natural greenhouse effect.

Greenhouse gas Any gas that absorbs infrared radiation in the atmosphere. Greenhouse gases include water vapor, carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), halogenated fluorocarbons (HCFCs), ozone (O_3), perfluorinated carbons (PFCs) and hydrofluorocarbons (HFCs).

Include carbon dioxide (CO_2), methane (CH_4), nitrous oxide (NO_2), and chlorofluorocarbons (CFCs) that accumulate in the atmosphere, absorb and re-emit infrared radiation causing a gradual increase to global mean temperature.

Hedgerow cropping (*see* **Alley cropping**)

Indigenous Native to a specified area, not introduced.

Industrial forestry/tree plantation Large-scale, commercial tree planting for timber and other wood products (for example, wood chips).

Invasive alien species An alien species, which becomes established in natural or semi-natural ecosystems or habitat, is an agent of change, and threatens native biological diversity.

IPCC (Intergovernmental Panel on Climate Change) Jointly established in 1988 by the World Meteorological Organization (WMO) and the United Nations Environment Program (UNEP), the IPCC provides an authoritative international assessment of scientific information on climate change. It also provides, on request, scientific/technical/socioeconomic advice to the Conference of Parties to the UNFCCC.

Kyoto Protocol Adopted at the Third Conference of the Parties to the United Nations Convention on Climate Change held in Kyoto, Japan in December 1997, the Kyoto Protocol commits industrialized country signatories to reduce their greenhouse gas (or “carbon”) emissions by an average of 5.2% compared with 1990 emissions, in the period 2008-2012.

This provides the mechanism by which Annex1 Parties (Developed Countries) can meet their emission limits other that domestic activities.

Leakage The net change of anthropogenic emissions by sources of greenhouse gases that occurs outside the project boundary and that is measurable and attributable to the CDM project activity.

The failure to capture GHGs changes outside the accounting system that result from GHG changes within the system.

Litter Dead plant material that lies on top of the mineral soil.

Litterfall Leaves, twigs, and other plant material that falls to the ground.

Long-term CERS CER issued for an afforestation or reforestation project activity under the CDM which expires at the end of the crediting period of the afforestation or reforestation project activity under the CDM for which it was issued. Temporary carbon credits which are valid for the crediting period of the project or the project lifetime.

MAI (mean annual increment) In forestry, for a particular stand, the total increment of wood up to a given stand age (in years) divided by that age. The mean annual increment for a whole rotation is termed the final men annual increment.

Mitigation Measures added to a project or activity to reduce, prevent or correct its impact.

Anthropogenic intervention to reduce the emission or enhance the sinks of GHGs.

Monitoring Plan (MP) A set of requirements for monitoring and verification of emission reductions achieved by a project.

Monsoon Periodic wind, especially in the Indian Ocean and southern Asia. The word is also used to refer to the season in which this wind blows southwest in India and adjacent areas that is characterized by very heavy rainfall, and specifically the rainfall that is associated with this wind.

Multistorey cropping Multispecies crop combinations involving both annuals and perennials with an existing stand of perennials. An association of tall perennials with shorter statured crop species.

Old-growth forest Forest which has never been subject to human disturbance, or has been so little affected by hunting and gathering that its natural structure, functions and dynamics have not undergone any unnatural change.

Operational Entity A legal entity designated by the Executive Board to oversee and validate CDM projects (same as DOE – Designated Operational Entity)

Opportunity Cost The cost of an economic activity foregone by the choice of another activity.

Paleoclimate Climatic conditions in the geological past reconstructed from a direct or indirect data source.

Permanence The longevity of a carbon pool and the stability of its stocks, given the management and disturbance of environment in which it occurs.

Plantation forest Type of forest that is artificially established and cultivated for industrial, conservation and agroforestry purposes (usually fast-growing species planted).

Project Design Document (PDD) A project-specific document required under the CDM rules which will enable the Operational Entity to determine whether the project (i) has been approved by the parties involved in a project, (ii) would result in reductions of greenhouse gas emissions that are additional, (iii) has an appropriate baseline and monitoring plan.

A necessary element of the CDM project cycle. In order to register a CDM project with the Executive Board, the project participants must prepare a PDD which provides documentation that the project activity meets the requirements of the CDM. The PDD is then submitted to a designated Operational Entity (OE) for the purpose of project validation.

Reduced-impact logging Intensively planned and carefully controlled implementation of harvesting operations to minimize the impact on forest stands and soils. It is an approach used to reduce unwanted side effects and increase the efficiency of the logging operation.

Low-impact harvesting method that have been developed and executed to provide minimum disturbance to soil, remaining vegetation and extracted trees.

Reforestation The establishment of forest on land previously under a forest land-use.

The direct human-induced conversion of non-forested land to forested land through planting, seeding and/or the human-induced promotion of natural seed sources, on land that was forested but that has been converted to non-forested land. For the first commitment period, reforestation activities will be limited to reforestation occurring on those lands that did not contain forest on 31 December 1989

Regeneration The renewal of a stand of trees through either natural means (seeded on-site or adjacent stands or deposited by wind, birds, or animals) or artificial means (by planting seedlings or direct seeding).

Scenario A plausible description of how the future may develop, based on a coherent and internally consistent set of assumptions about key relationships and driving forces (e.g., rate of technology changes, prices). Note that scenarios are neither predictions nor forecasts.

Sink Any process or mechanism which removes a greenhouse gas , an aerosol, or a precursor of a greenhouse gas from the atmosphere. A given pool can be a sink for atmospheric carbon if during a given time interval, more carbon is flowing into it than is flowing out

Sink Project Establishment of reservoir (pool) that will enhance absorption of GHGs from the atmosphere though biochemical processes.

Silvicultural practice This comprises the planting and tending activities for growing tree.

Slash-and-burn (1) A pattern of agriculture in which existing vegetation is cut, stacked and burned to provide space and nutrients for cropping. Also called 'swidden cultivation' and "shifting cultivation'. (2) A method of clearing and preparing land, an activity common among shifting cultivators.

Agricultural system that involves rotation between cropping and includes clearing, burning and planting the land with agricultural crops.

Slippage The amount of time a task has been delayed from its original baseline plan.

Social forestry The planting of trees and shrubs for the well-being and betterment of local communities.

Soil organic carbon The relevant carbon in the soil particularly in the humified layer but excludes soil biomass (roots, bulbs, etc.)

Source Opposite of sink. A carbon pool (reservoir) can be a source of carbon to the atmosphere if less carbon is flowing into it than is flowing out of it.

Surface runoff The portion of precipitation that makes its way toward stream channels, lakes, or oceans as surface flow.

Sustainable Development Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs

The management and conservation of the natural resource-base, and the orientation of technological and institutional change in such a manner as to ensure the attainment of human needs for present and future generation.

Temporary CERS CER issued for an afforestation or reforestation project activity under the CDM which, expires at the end of the commitment period following the one during which it was issued. Temporary carbon emission reduction units expire after at most 10 years.

Temporary emission reduction Maintenance of the carbon sink for only a specified period of time.

Timber stand improvement: This comprises all intermediate treatments made to improve the composition, structure, condition, and increment of either an even- or uneven-aged stand.

Tree farm Privately owned woodland in which the production of wood is a primary management goal.

United Nations Framework Convention on Climate Change (UNFCCC) The international treaty unveiled at the United Nations Conference on Environment and Development (UNCED) in June 1992. The UNFCCC commits signatory countries to stabilize anthropogenic greenhouse gas emissions to "levels that would prevent dangerous anthropogenic interference with the climate system"; The UNFCCC also requires that all signatory parties develop and update national inventories of anthropogenic emissions of all greenhouse gases not otherwise controlled by the Montreal Protocol.

Uplands Steep areas in the Philippines with slopes equal to or greater than 18%.

Watershed Land drained by stream or fixed body of water and its tributaries having a common outlet for surface runoff.

References:

BioCarbon Fund. Glossary of Carbon Finance Terms. http://carbonfinance.org/biocarbon/router.cfm?Page=glossary. September 3, 2004.

Canadian Agricultural Energy End-Use Data and Analysis Centre (CDEEAC). Carbon Offset Glossary. http://www.usask.ca/agriculture/caedac/dbases/glossary.htm. September 10, 2004.

DENR Policy Advisory Group. 1987. DENR Policy and Program Agenda for the Environment and Natural Resources Sector. Quezon City: Department of Environment and Natural Resources.DENR Foreign Assisted Projects Office (FASPO). Glossary of Terms. http://faspo.denr.gov.ph/article/articleprint/413/-1/149. September 9, 2004.

European Commission Directorate General for Agriculture. Economic Impacts of Genetically Modified Crops on the Agri-Food Sector. Glossary. http://europa.eu.int/comm/agriculture/publi/gmo/glossary.htm September 7, 2004

FAO - Food and Agriculture Organization of the United Nations. 2002. Second Expert Meeting on Harmonizing Forest-Related Definitions for Use by Various Stakeholders. Italy: FAO.

Huxley, P. and van Houten, H. eds. 1997. Glossary for Agroforestry. Nairobi: International Centre for Research in Agroforestry.108 p.

IFAD, IDRC, CIIFAD and IIRR. 2001. Shifting Cultivation: Towards Sustainability and Resource Conservation in Asia. International Fund for Agricultural Development, International Development Research Center, Cornell International Institute for Food, Agriculture and Development, International Center for Research in Agroforestry and International Institute of Rural Reconstruction. 421 p.

IPCC. Climate Change: A Glossary of the Intergovernmental Panel on Climate Change. http://www.ipcc.ch/pub/gloss.pdf. September 3, 2004.

Montagnini F., Eibl B., Grance L., Maiocco D., Nozzi D. 1997. Enrichment planting in overexploited subtropical forests of the Paranaense region of Misiones, Argentina. Forest Ecology and Management 99: 237-246.

Prototype Carbon Fund. Glossary of Carbon Finance Terms. http://carbonfinance.org/pcf/router.cfm?Page=glossary. September 3, 2004.

United States Environmental Protection Agency. Glossary of Climate Change Terms. http://yosemite.epa.gov/oar/globalwarming.nsf/content/glossary.html. August 31, 2004.

Watson, R.T., I.R. Noble, B. Bolin, N.H. Ravindranath, D.J. Verado and D.J. Dokken (eds). (2000). *Land Use, Land-use Change, and Forestry*, Published for the Intergovermental Panel for Climate Change, Cambridge University Press, 377pp.

Williams S.A., Gillison, A. and M. van Noordwijk. 2001. Biodiversity: issues relevant to integrated natural resources management in the humid tropics. ASB Lecture Note 5. Bogor: International Center for Research in Agroforestry.

WEBSITES OF INTEREST

http://www.biocarbonfund.org The BioCarbon Fund is a public/private initiative established as a trust fund administered by the World Bank and offers carbon finance for 'bio-carbon' or sinks projects in developing countries that otherwise have few opportunities to participate in the CDM. The BioCarbon Fund will test and demonstrate how LULUCF activities can generate cost-effective emission reductions with local environmental, biodiversity and livelihood benefits.

http://carbonfinance.org/cdcf The Community Development Carbon Fund (CDCF) of the World Bank aims to link small-scale projects seeking carbon finance with companies, governments, foundations, and NGOs that aim to improve local livelihoods and obtain verified emission reductions (ERs). The Fund targets small-scale projects involving poorer rural communities in small and less-developed countries that that tend to be at a disadvantage when competing for carbon finance through the CDM.

http://www.cd4cdm.org CD4CDM (Capacity Development for CDM) is a 4-year project implemented by the United Nations Environment Programme (UNEP) to broaden understanding of the opportunities offered by the CDM, develop the necessary institutional and human capabilities to formulate and implement CDM projects, and ensure the early success and efficacy of the CDM in 12 developing countries, including the Philippines.

http://cdm.unfccc.int The CDM website of the UNFCCC provides official texts and documents on the CDM, meetings of the Executive Board and the project activity cycle.

http://cdmcapacity.org This website provides information and offers guidelines on CDM projects in the land use and forestry sector, mainly in developing countries, and provides insights into the implications and future developments of the CDM.

http://www.cdmwatch.org CDM Watch is a non-profit organization based in Indonesia that acts as information clearing house for CDM and CDM-related issues and developments, and provides analysis of CDM projects.

http://www.cida.gc.ca/climatechange The Canada Climate Change Development Fund (CCCDF) is administered by the Canadian International Development Agency (CIDA) and seeks to assist developing countries in reducing GHG emissions and meeting their sustainable development goals by funding projects falling into its Program Areas, namely, emissions reduction, carbon sequestration, adaptation and core capacity building.

http://www.climateark.org A portal and search engine for climate change, Climate Ark promotes public policy that addresses global climate change through reductions in GHG emissions, renewable energy, energy conservation and ending deforestation.

http://climatechange.unep.net A portal set up by the UNEP to serve as a central source for information resources pertaining to climate change, with an advanced search option for specific types of resources.

http://www.dfait-maeci.gc.ca/cdm-ji/contact-en.asp Canada's Clean Development Mechanism and Joint Implementation (CDM & JI) Office supports investments in CDM activities in developing countries and countries-in-transition that build awareness, promote cost-effective opportunities and lower transaction costs while enabling Canada to meet its own Kyoto target. Details of the Program and criteria for assistance are available from this website.

http://www.enfor.com.ph The Environmental Forestry Programme (ENFOR) is based in the College of Forestry and Natural Resources of the U.P. at Los Baños and is actively involved in global environmental change- and watershed research and advocacy. It has conducted pioneering studies on climate change and LULUCF in the Philippines, including carbon stocks assessment of Philippine forest ecosystems.

http://www.ipcc.ch The source of official documents, news and events and reports from the IPCC. The Special Report on Land Use, Land Use Change and Forestry is a comprehensive assessment of carbon sequestration and the global carbon cycle, and the environmental, socioeconomic and development issues related to carbon sequestration.

http://www.klima.ph Klima Climate Change Center offers a wealth of information on climate change research, mitigation and adaptation strategies, climate-friendly technologies, and policy issues most relevant to the Philippines and the region, and is also a provider of climate change-related products and services.

http://www.prototypecarbonfund.org The Prototype Carbon Fund of the World Bank was created to answer the need to understand and test the procedures for creating a market in project-based GHG emission reductions under the Kyoto Protocol's flexible mechanisms. Since 2000, it has invested in GHG emission reduction projects in developing countries and countries with economies in transition, providing practical learning experience to stakeholders as the final rules and procedures of the market are being negotiated.

http://www.worldagroforestrycentre.org/sea The World Agroforestry Centre (ICRAF) is the global leader in the generation, synthesis and dissemination of knowledge related to agroforestry, and is actively involved in the development of a challenge program for climate change mitigation and adaptation for rural development. ICRAF-Southeast Asia undertakes research on the trade offs between short-term profitability, long-term productivity and the production of environmental services by agroforestry and other forest land use systems. A variety of simulation tools, teaching materials, papers, and links to other networks can be accessed through its website.

Annex A

Article 12 of the Kyoto Protocol

1. A clean development mechanism is hereby defined.

2. The purpose of the clean development mechanism shall be to assist Parties not included in Annex I in achieving sustainable development and in contributing to the ultimate objective of the Convention, and to assist Parties included in Annex I in achieving compliance with their quantified emission limitation and reduction commitments under Article 3.

3. Under the clean development mechanism:

(a) Parties not included in Annex I will benefit from project activities resulting in certified emission reductions; and

(b) Parties included in Annex I may use the certified emission reductions accruing from such project activities to contribute to compliance with part of their quantified emission limitation and reduction commitments under Article 3, as determined by the Conference of the Parties serving as the meeting of the Parties to this Protocol.

4. The clean development mechanism shall be subject to the authority and guidance of the Conference of the Parties serving as the meeting of the Parties to this Protocol and be supervised by an executive board of the clean development mechanism.

5. Emission reductions resulting from each project activity shall be certified by operational entities to be designated by the Conference of the Parties serving as the meeting of the Parties to this Protocol, on the basis of:

(a) Voluntary participation approved by each Party involved;

(b) Real, measurable, and long-term benefits related to the mitigation of climate change; and

(c) Reductions in emissions that are additional to any that would occur in the absence of the certified project activity.

6. The clean development mechanism shall assist in arranging funding of certified project activities as necessary.

7. The Conference of the Parties serving as the meeting of the Parties to this Protocol shall, at its first session, elaborate modalities and procedures with the objective of ensuring transparency, efficiency and accountability through independent auditing and verification of project activities.

8. The Conference of the Parties serving as the meeting of the Parties to this Protocol shall ensure that a share of the proceeds from certified project activities is used to cover administrative expenses as well as to assist developing country Parties that are particularly vulnerable to the adverse effects of climate change to meet the costs of adaptation.

9. Participation under the clean development mechanism, including in activities mentioned in paragraph 3(a) above and in the acquisition of certified emission reductions, may involve private and/or public entities, and is to be subject to whatever guidance may be provided by the executive board of the clean development mechanism.

10. Certified emission reductions obtained during the period from the year 2000 up to the beginning of the first commitment period can be used to assist in achieving compliance in the first commitment period.

ANNEX B

DRAFT PROJECT DESIGN DOCUMENT FORM FOR AFFORESTATION AND REFORESTATION PROJECT ACTIVITIES (CDM-AR-PDD)
(Source: Annex 1, Report of the First Meeting of the Afforestation and Reforestation Working Group, 12-13 July 2004, Bonn, Germany)

SECTION A. General Description Of The Proposed A/R C Project Activity:

A.1. Title of the proposed A/R CDM project activity:

A.2. Description of the proposed A/R CDM project activity:

A.3. Project participants:

A.4. Technical description of the A/R CDM project activity:

A.4.1. Location of the proposed A/R CDM project activity:
A.4.1.1. Host Party(ies):
A.4.1.2. Region/State/Province etc.:
A.4.1.3. City/Town/Community etc:
A.4.1.4. Detail of geographical location and project boundary, including information allowing the unique identification(s) of the proposed A/R CDM project activity:
A.4.1.5. A description of the present environmental conditions of the area,including a description of climate, hydrology, soils, ecosystems, and the possible presence of rare or endangered species and their habitats:

A.4.2. Species and varieties selected:
A.4.3. Specification of the greenhouse gases (GHG) whose emissions will be part of the proposed A/R CDM project activity:
A.4.4. Carbon pools selected:
A.4.5. Compliance with the definition for afforestation or reforestation:
A.4.6. A description of legal title to the land, current land tenure and land use and rights of access to the sequestered carbon:
A.4.7. Type(s) of A/R CDM project activity:
A.4.8. Technology to be employed by the proposed A/R CDM project activity:
A.4.9. Approach for addressing non-permanence:

A.4.10. Duration of the proposed A/R CDM project activity / Crediting period:
A.4.10.1. Starting date of the proposed A/R CDM project activity and of the (first) crediting period, including a justification:
A.4.10.2. Expected operational lifetime of the proposed A/R CDM project activity:
A.4.10.3. Choice of crediting period and related information:
A.4.10.3.1. Renewable crediting period, if selected:
A.4.10.3.1.1. Starting date of the first crediting period:
A.4.10.3.1.2. Length of the first crediting period:
A.4.10.3.2 Fixed crediting period, if selected:
A.4.10.3.2 .1. Starting date:
A.4.10.3.2.2. Length:

A.4.11. Brief explanation of how the net anthropogenic GHG removals by sinks are achieved by the proposed A/R CDM project activity, including why these would not occur in the absence of the proposed A/R CDM project activity, taking into account national and/or sectoral policies and circumstances:

A.4.11.1. Estimated amount of net anthropogenic GHG removals by sinks over the chosen crediting period:

A.4.12. Public funding of the proposed A/R CDM project activity:

SECTION B. Application Of A Baseline Methodology

B.1. Title and reference of the approved baseline methodology applied to the proposed A/R CDM project activity:

B.1.1. Justification of the choice of the methodology and its applicability to the proposed A/R CDM project activity:

B.2. Description of how the methodology is applied to the proposed A/R CDM project activity:

B.3. Description of how the actual net GHG removals by sinks are increased above those that would have occurred in the absence of the registered A/R CDM project activity:

B.4. Detailed baseline information, including the date of completion of the baseline study and the name of person(s)/entity(ies) determining the baseline:

SECTION C. Application Of A Monitoring Methodology And Of A Monitoring Plan

C.1. Title and reference of approved monitoring methodology applied to the project activity:

C.2. Justification of the choice of the methodology and its applicability to the proposed A/R CDM project activity:

C.3. Monitoring of the baseline net GHG removals by sinks and the actual net GHG removals by sinks:

C.3.1. Actual net GHG removals by sinks data:

C.3.1.1. Data to be collected or used in order to monitor the verifiable changes in carbon stock in the carbon pools within the project boundary resulting from the proposed A/R CDM project activity, and how this data will be archived:

C.3.1.2. Data to be collected or used in order to monitor the GHG emissions by the sources, measured in units of CO2 equivalent, that are increased as a result of the implementation of the proposed A/R CDM project activity within the project boundary, and how this data will be archived:

C.3.1.3. Description of formulae and/or models used to monitor the estimation of the actual net GHG removals by sinks:

C.3.1.3.1. Description of formulae and/or models used to monitor the estimation of the verifiable changes in carbon stock in the carbon pools within the project boundary (for each carbon pool in units of CO2 equivalent):

C.3.1.3.2. Description of formulae and/or models used to monitor the estimation of the GHG emissions by the sources, measured in units of CO2 equivalent, that are increased as a result of the implementation of the proposed A/R CDM project activity within theproject boundary (for each source and gas, in units of CO2 equivalent):

C.3.2. As appropriate, relevant data necessary for determining the baseline net GHG removals by sinks and how such data will be collected and archived:

C.3.2.1. Description of formulae and/or models used to monitor the estimation of the baseline net GHG removals by sinks (for each carbon pool, in units of CO2 equivalent):

C.4. Treatment of leakage in the monitoring plan:

C.4.1. If applicable, please describe the data and information that will be collected in order to monitor leakage of the proposed A/R CDM project activity:

C.4.2. Description of formulae and/or models used to estimate leakage (for each GHG, source, carbon pool, in units of CO2 equivalent:

C.4.3. Please specify the procedures for the periodic review of implementation of activities and measures to minimize leakage:

C.5. Description of formulae and/or models used to estimate net anthropogenic GHG removals by sinks for the proposed A/R CDM project activity (for each GHG, carbon pool, in units of CO2 equivalent):

C.6. Quality control (QC) and quality assurance (QA) procedures are being undertaken for data monitored:

C.7. Please describe the operational and management structure(s) that the project operator will implement in order to monitor actual GHG removals by sinks and any leakage generated by the proposed A/R CDM project activity:

C.8. Name of person/entity determining the monitoring methodology:

SECTION D. Estimation of net anthropogenic GHG removals by sinks:

D.1. Estimate of the actual net GHG removals by sinks:

D.2. Estimated baseline net GHG removals by sinks:

D.3. Estimated leakage:

D.4. The sum of D.1 minus D.2 minus D.3 representing the net anthropogenic GHG removals by sinks of the proposed A/R CDM project activity:

D.5. Table providing values obtained when applying formulae above:

SECTION E. Environmental impacts of the proposed A/R CDM project activity:

E.1. Documentation on the analysis of the environmental impacts, including impacts on biodiversity and natural ecosystems, and impacts outside the project boundary of the proposed A/R CDM project activity:

E.2. If any negative impact is considered significant by the project participants or the host Party, a statement that project participants have undertaken an environmental impact assessment, in accordance with the procedures required by the host Party, including conclusions and all references to support documentation:

E.3. Description of planned monitoring and remedial measures to address significant impacts referred to in section E.2. above:

SECTION F. Socio-Economic Impacts of The Proposed A/R CDM Project Activity:

F.1. Documentation on the analysis of the socio-economic impacts, including impacts outside the project boundary of the proposed A/R CDM project activity:

F.2. If any negative impact is considered significant by the project participants or the host Party, a statement that project participants have undertaken a socioeconomic impact assessment, in accordance with the procedures required by the host Party, including conclusions and all references to support documentation:

F.3. Description of planned monitoring and remedial measures to address significant impacts referred to in section F.2 above:

SECTION G. Stakeholders' Comments:

G.1. Brief description of how comments by local stakeholders have been invited and compiled:

G.2. Summary of the comments received:

G.3. Report on how due account was taken of any comments received:

Annex 1
CONTACT INFORMATION ON PARTICIPANTS IN THE PROPOSED A/R CDM PROJECT ACTIVITY

Annex 2
INFORMATION REGARDING PUBLIC FUNDING

Annex 3
BASELINE INFORMATION

Annex 4
MONITORING PLAN