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## **Environmental impacts of community-based forest management in the Philippines**

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**Abstract:** Community-based forest management (CBFM) is a major strategy in managing forest lands in the Philippines. Forest and land management activities implemented in CBFM project sites include management of tropical forests (enrichment planting, timber stand improvement or TSI and limited harvesting), rehabilitation of degraded lands (reforestation, assisted natural regeneration (ANR)) and agroforestry. The environmental effects of CBFM and its technologies are largely positive. CBFM has led to the conservation of natural forests and the associated biodiversity. The planting of trees in farms and landscapes has led to soil and water conservation, carbon sequestration and biomass production.

**Keywords:** community-based forest management; the Philippines; assisted natural regeneration; agroforestry.

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## **1 Introduction**

From being one of the world's biggest exporters of tropical hardwoods in the 1960s, the Philippines has become a net importer of wood. Over the years, Philippine forest resources have degenerated because of massive logging activities, extreme poverty and shifting cultivation. At the end of the 19th century, 70% of total land area (21 Mha) was covered with lush forests (Garrity et al., 1993). At present, only about 20% (6 Mha) of forests remain, of which less than 1 Mha are old-growth forests. There are perhaps 8 Mha of degraded forestland (Lasco and Pulhin, 1998). Current deforestation rate has been estimated at 100,000 ha per year. There are about 20 million Filipinos living in upland watershed areas, half of whom are dependent on shifting cultivation for livelihood (Cruz and Zosa-Feranil, 1988).

In the last two decades, CBFM has become an important lynchpin of the government's programme to address upland poverty and forestland management in the Philippines. CBFM has been declared as the national strategy for forestland management. The main objective of this paper is to assess the environmental impacts of CBFM activities in the Philippines based on a review of existing literature. There are few studies that have directly assessed the environmental effects of CBFM projects as a whole. However, there are many studies that have assessed the environmental effects of individual CBFM technology components.

## **2 Overview of CBFM in the Philippines**

In 1995, an executive order was issued by the then President Fidel V. Ramos, adopting CBFM as the national strategy for sustainable forestry and social equity, thereby institutionalising the practice of community forestry in the country. Under this proclamation, the different programmes and projects that were implemented in the last two decades were 'integrated and unified' into one umbrella programme, otherwise known as the community-based forest management program (CBFMP). The program aims to

- protect and advance the right of the Filipino people to a healthful environment
- improve the socio-economic conditions of the Filipino people through the promotion of social justice and equitable access to and sustainable development of forestlands resources
- respect the rights of indigenous peoples to their ancestral domains by taking into account their customs, traditions and beliefs in the formulation of laws and policies.

The institutionalisation of CBFM was seen as the main government strategy towards the restructuring of the once corporate-controlled timber industry (Ramos, 1993). Timber licensee agreements (TLAs) used to control one-third of the country's total land area of 30 Mha from 1971 to 1977. With the shift in the government's forest management approach in favor of CBFM, starting from the 1980s, TLA areas gradually declined to the present figure of less than a million hectare owing to the cancellation of erring licensees and non-renewal of the expired ones. The 1997 DENR strategic action plan for CBFM envisioned that 9 million hectares of forestlands mostly under the existing and potential open access areas would be placed under community management by the year 2008. This constitutes around 58% of the country's total forestland area. On the other hand, only 0.5 Mha is expected to be allocated for industrial tree plantations and other purposes (DENR, 1990).

To date, close to 6 Mha of forestlands are under some form of community forest management. Of these, about 4.7 Mha have been issued with various forms of land tenure instruments, including around 1.57 Mha issued with community-based forest management agreement or CBFMA (FMB, 2004). CBFMA is an agreement entered between the government and the local community, represented by the People's Organisation, as forest managers, which has a term of 25 years and is renewable for another 25 years. It allows organised communities to harvest timber from plantations and second growth forests subject to existing regulations on timber harvesting, on the condition that the area will be protected and managed according to the principles of sustained-yield forest management. The community must also use a portion of the income derived from harvesting to protect, renew and improve the forest resources and also to engage in alternative sources of livelihood.

The most recent record available at the CBFM division of the forest management bureau of the DENR indicates that 690,687 households are involved in the implementation of the CBFM program. At an average size of about six persons per household in the Philippine uplands, around 4.14 million people are potential direct beneficiaries of the program.

### **3 Forest management in CBFM projects**

The CBFM projects involve forestland development activities covering natural tropical forests, degraded lands and upland farms. The development activities include natural forests management, degraded lands rehabilitation and agroforestry. The main goals of these activities are to promote ecological stability and provide livelihood to local communities.

#### *3.1 Natural forest management*

##### *3.1.1 Conservation and development of natural forests*

There are two types of natural forests within CBFM sites, i.e., primary (old-growth) forests and secondary forests. Primary forests are under permanent protection and could not be logged in the Philippines. These include forests above 50% slope and 1000 m ASL. Under the existing government policy, these areas have been declared as 'protected areas', to be managed solely for biodiversity conservation. The local communities are therefore expected to protect these forests and no utilisation is allowed.

In contrast, secondary forests can be utilised and harvested. This is contingent upon submission of a forest utilisation and development plan. It is expected that income derived from natural forest harvesting can provide capital for other site development activities. The Philippines initiated the Philippine selective logging system (PSLS) as early as 1954, becoming the first country in Southeast Asia to do so. The system involves the cutting of mature, overmature and defective trees, while leaving behind adequate residuals for sustained timber production and site protection. Harvesting is allowed every 35 years (cutting cycle).

### 3.1.2 Enrichment planting

Enrichment planting involves the introduction of valuable species in regions where they are lacking, to improve species composition of forest ecosystems. Traditionally, it is used as a means of introducing economically valuable species to improve harvest in the future.

Areas of enrichment planting are degraded forests, post-swidden secondary forests and regenerating forests that are naturally regenerating in former grassland areas and areas near gullies and riverbanks.

For protection of areas, main objective of which is the conservation of biodiversity, the main criterion is to select species such as *Parashorea plicata*, *Pentacme contorta*, *Dipterocarpus grandiflorus* and *Shorea squamata* to restore the biodiversity of degraded secondary forests. Rare or endangered species, if any, will also be given preference.

### 3.1.3 Timber stand improvement

Timber stand improvement (TSI) involves planting of desirable species (usually commercial) in natural forest stands where they are lacking. Logged-over forests are expected to regenerate naturally. Commercially valuable trees that are harvested are expected to be replaced by seedlings from natural regeneration. However, this does not always happen. Because of a variety of reasons, natural regeneration may not be enough. Through TSI, seedlings or wildlings of valuable species are planted in natural stands.

## 3.2 Rehabilitation of degraded lands

### 3.2.1 Reforestation

Degraded land areas in the Philippines are largely covered with cogon (*Imperata cylindrica*) grass. The total area has not been accurately determined, but estimates vary between 1 Mha to 5 Mha (Friday et al., 1999; Lasco and Pulhin, 1998). This range of values is most likely due to the constantly changing use of the land from idle grasslands to cultivated farms and vice-versa.

Without fire, grassland areas will naturally revert back to secondary forest through the process of plant succession (Friday et al., 1999). However, in the Philippines this may not be a significant process in most grassland areas. Because of the high population density in upland areas, most grassland areas are used for farming or grazing.

The traditional approach of the government to rehabilitating grassland areas is through reforestation by fast-growing, usually exotic species such as *Gmelina arborea*, *Acacia mangium*, *Pterocarpus indicus* and *Swietenia macrophylla*. The main assumption is that after *Imperata* has been shaded out, secondary forest will naturally evolve. However, the success of the country's reforestation program is subject to a lot of

skepticism. A success rate of 30% may already be generous, if success is defined as the proportion of area planted that actually evolved to become secondary forest. The reasons for failure in reforestation efforts are legion, ranging from the technical to the social. Poor species-site matching, inadequate maintenance, corruption and social conflict are just some of the major reasons (Carandang and Lasco, 1998; Carandang and Cardenas, 1991).

Available records of the Forest Management Bureau indicate that about 1.7 Mha were planted over a period of 42 years (from 1960 to 2002) through the various rehabilitation efforts involving the different sectors. Of these, about two-thirds were planted by the government sector while one-third was planted by the non-government sector (Pulhin et al., 2004).

### 3.2.2 *Assisted natural regeneration*

More recently, the government has tried a novel approach through assisted natural regeneration (ANR). As of the end of 1995, about 2,500 ha of ANR areas have been developed mostly in the Bicol region (FMB 1996). ANR is recommended for areas where pioneer trees and patches of shrub and forest areas are mixed with *Imperata* grass (Friday et al., 1999). The basic idea is to accelerate the process of natural regeneration so that a secondary forest can be established sooner.

The key steps in ANR are proper site selection (areas which already have some natural regeneration are preferred), protection from fire and grazing, inhibition of the grass layer and stimulation of new natural regeneration and tree planting to fill open spaces and further shade out *Imperata* (Friday et al., 1999).

Experience in the Philippines has shown that if grassland areas are protected from fires and disturbances, they can regenerate back to tropical forest. ANR seeks to hasten the process of succession by protecting the area from disturbance and planting additional trees. Success of ANR largely depends on how well the community is able to protect the growing seedlings from fires and other damaging agents (e.g., grazing). The implementing PO must organise firefighting crews if fire is a major hazard. Firebreaks may also need to be constructed. After fire prevention, suppressing cogon and other weeds is the most important activity in ANR. This is done through 'pressing'. The grass is pressed low to the ground by trampling or by rolling a weight over it. Pressing bends the base of the cogon culm (stem) like folding a plastic water hose. The weight of the grass helps keep it bent down. Grass in the lower layers die.

### 3.3 *Agroforestry*

In response to the problem of shifting cultivation in the uplands, the government is promoting agroforestry as the main alternative production system (Nera, 1997). The most common agroforestry systems in the Philippines are alley cropping and multistorey systems (Lasco and Lasco, 1989).

Although the basic function of trees in an agroforestry system is to protect the site, they also provide economically valuable products. Some of these products are wood (firewood, timber, pulpwood), fruits, leaf meal, resins, latexes, medicinal parts and food. These products are equally important especially from the perspective of upland farmers.

## **4 Environmental impacts of CBFM projects**

Environmental services (ES) refer to direct or indirect benefits from nature that are usually not valued in the market. These cover supply and regulation of water resources, tourism, climate regulation (including carbon sequestration), biodiversity (gene pool conservation, generation of natural fertility and others), soil conservation and flood control. These services are being provided by upland areas in the Philippines since time immemorial. More recently, there has been an increasing focus on these services, and on how upland communities can be rewarded for ensuring their continuance of services.

The main framework of this paper is that CBFM activities alter the social and production system in the uplands, eventually leading to environmental impacts, which could be positive or negative.

### *4.1 Biodiversity conservation*

Philippine forests have extremely high floral and faunal diversity. They harbor 13,000 species of plants, which comprise 5% of the world's total plant species (DENR/UNEP, 1997). With continued deforestation, some species previously occurring in certain areas are now endangered or even extinct. In fact, the Philippines is one of the biodiversity 'hot spots' of the world (McNeely et al., 1990). The main strategy in biodiversity conservation is through the implementation of the National Integrated Protected Area System (NIPAS) Law. At present, 18 terrestrial and marine reserves have been proclaimed as initial components of NIPAS. However, many of these areas are protected merely on paper because of lack of resources.

A key component in the conservation of biodiversity in the Philippines is the CBFM strategy. This is in recognition with the fact that local communities are present in most, if not all, of the protected areas. The main assumption is that by stabilising the livelihood of upland communities they will become partners in biodiversity conservation in the remaining natural forests. Indeed, in most protected areas and other CBFM sites with rich biodiversity, organised communities have performed important roles in biodiversity conservation, particularly in the aspect of forest protection. This is especially in cases where appropriate livelihood opportunities are provided to these communities to prevent them from engaging in destructive practices such as slash and burn cultivation and illegal timber cutting. In Alcoy CBFM site in Cebu (Central Visayas), for instance, local communities are successful in promoting biodiversity conservation through their active involvement in forest protection and monitoring activities. This has promoted the conservation of valuable habitats of the endemic life found in the area, including 122 species of birds, 27 species of mammals and 27 species of reptiles and amphibians (Fernandez et al., 2004). Box 1 presents a brief description of the CBFM participants' involvement in biodiversity conservation.

A similar situation exists among the Ikalahan indigenous people in Northern Luzon where local communities have organised themselves to protect the natural forest and its rich biodiversity resources, among other activities (Rice, 2004).

Thus, at the landscape level, there is some evidence that CBFM projects help protect existing biodiversity habitat. However, there is very limited information on the effects of CBFM projects on biodiversity at the species level.

#### 4.2 Soil conservation

Soil erosion and degradation are serious problems in the Philippines where it is estimated that 8.3 Mha out of 30 Mha total land area are severely eroded (EMB, 1990). In addition, several million hectares of denuded hilly areas are even more badly eroded. The soil conservation benefits of tree plantations and agroforestry systems are well documented in the Philippines (Cruz, 1982). The ecological impacts of agroforestry systems (the main production system in CBFM sites) are generally positive and include soil conservation, erosion control and water conservation (Palmer, 1996; Cruz, 1982). For example, a comparative study of the Sloping Agricultural Land Technology (SALT), which is a type of alley cropping common in many CBFM sites in the Philippines, showed a generally positive environmental effects relative to the baseline (a farm without SALT) (Table 1).

##### Box 1 Biodiversity conservation in a CBFM site

The participants of the CBFM in Argao Cebu City, in partnership with an NGO, Cebu Biodiversity Conservation Foundation (CBCF), established a forest protection programme to ensure the conservation of valuable endemic habitats found in the area. To date, forest wardens have been trained and equipped to conduct daily patrol of the forest. Initially, the approach was purely for patrolling and protecting the forest against illegal logging and poaching. Currently, however, wildlife monitoring is integrated into the patrolling program.

Conservation efforts have also been strengthened through information education to villages and schools near the forested area, and even among municipal and regional government officials. Signboards, written in local dialect were also installed in strategic locations to remind people not to hunt and exploit resources, particularly birds and their nests, inside the forest. A fine of PhP1,000 or/and imprisonment is meted out to the violator of an existing ordinance. To institutionalize current conservation efforts, various *barangay*, municipal and provincial ordinances have been enacted in support of forest conservation initiatives in the area. As a result, the 122 endemic species of birds, 27 species of mammals and 27 species of reptiles and amphibians found in the area being protected. Moreover, results of monthly monitoring activities indicate an increasing trend in the number of bird nests observed compared to previous years.

Source: Fernandez et al. (2004)

**Table 1** Effect of SALT on soil properties in Bansalan, Davao del Sur

Soil property	SALT farm	Non-SALT farm
Soil erosion (t/ha)	3.4	194.3
N content (kg/ha)	9.2	8.8
P content (kg/ha)	10.9	14.3
K content	1.3	1.7
Earthworm casts (kg)	58	4

No statistical analysis given.

Source: Data from Palmer (1996)

The use of *Leucaena leucocephala* hedgerows has been shown to reduce soil erosion in many parts of the Philippines. Similarly, in Leyte, hedgerows reduced soil erosion to 8 t/ha compared to the control with no soil conservation measure (Dano and Siapno, 1988). Other hedgerow species such as *Gliricidia sepium*, *Acacia villosa* and *Leucaena diversifolia* yielded similar results (Soriano, 1991). These results are supported by empirical observations that terraces are formed a few years after hedgerow planting. In terms of soil fertility, *Leucaena* prunings from alley cropping in Bansalan, Davao del Sur yielded up to 20.37 t/ha of fresh leaves equivalent to (Watson and Laquihon, 1985) 292 kg N or 12.7 bags of urea (45-0-0); 153 kg P or 13.6 bags of solophos (0-20-0); and 102 kg K or 13.4 bags of muriate of potash (0-0-60).

There is also some evidence that introduction of trees improve soil physical properties of the soil. In Pantabangan watershed, areas planted with *Acacia auriculiformis* and *Gmelina arborea* had a lower bulk density (1.32–1.51 g/cc) when compared to grasslands (1.56 g/cc), indicating less compaction of soil (de la Cruz and Luna, 1994).

#### 4.3 Water resources conservation

Like soil conservation, CBFM projects could also lead to water conservation in watershed areas in the Philippines through technological interventions that promote integration of trees on farms and landscapes. A number of studies have shown that agroforestry systems, tree farms and reforested lands have generally lower water surface runoff compared to monoculture cash crop farming. For example, the use of hedgerows in Leyte reduced surface runoff by 15% in the first year and 31% in the second year compared to the control plot with no conservation measure (Dano and Siapno, 1988).

More recently, there have been attempts in the Philippines to reward local communities that protect the watersheds they live in, so that there will be ample supply of water in downstream areas (Boquiren, 2004).

#### 4.4 Carbon sequestration

There is considerable interest in the role of terrestrial ecosystems in the global carbon cycle. CBFM projects in the Philippines typically include a forest protection component and a tree-planting component. Forest protection activities promote conservation of existing carbon stocks in natural forests. These forests contain substantial amount of carbon of up to 200 tC/ha (Lasco and Pulhin, 2003; Lasco, 2002). These forests are always in danger of being cut and burned down by shifting cultivators. Through CBFM, it is hoped that the local communities will actively help protect natural forests within their control.

In addition, CBFM projects involve tree planting through reforestation, agroforestry and assisted natural regeneration. These activities promote carbon sequestration in the biomass of trees. Because the Philippines is a humid tropical country, trees planted here have rapid growth and thus a high rate of carbon sequestration of 8 tC/ha/yr (Lasco and Pulhin, 2003).

More recently, there has been an additional incentive for planting trees in the Philippines through the Clean Development Mechanism (CDM) under the Kyoto Protocol (Lasco and Pulhin, 2003). Already some initiatives are underway in the country to tap the CDM for carbon sequestration projects.

#### 4.5 Biomass production

Natural and man-made forests are important sources of fuelwood for rural communities. In the domestic sector, 78% of the energy comes from biomass, mainly wood. Production of fuelwood including charcoal in 1995 was estimated at 112,000 m<sup>3</sup> valued at about US\$ 590,000 (FMB, 1996). The biomass productivity rate varies with site conditions (Table 2). In good sites, trees can accumulate biomass of up to 20 t/ha/yr, but in degraded areas the rate could be as low as 1 t/ha/yr.

**Table 2** Mean Annual Increment of above ground biomass of trees in the Philippines

<i>Species</i>	<i>Age (yr)</i>	<i>Mean Annual Increment of biomass (t/ha/yr)</i>
<i>Acacia sp.</i>	4	8.6–21.8
<i>Acacia auriculiformis</i>	4–16	1.2–15.9
<i>Casuarina cumingiana</i>	4	0.8–3.9
Dipterocarps	66–80	3.5–7.4
<i>Eucalyptus sp.</i>	4	8.5–13.1
<i>Gmelia arborea</i>	4–9	1.3–18.9
<i>Leucaena diversifolia</i>	4	0.2
<i>Pinus kesiya</i>	13	6.4–8.3
<i>P. falcata</i>	4–9	2.2–20.2
<i>Sweitenia macrophylla</i>	16–80	7.1–19.6
<i>Tectona grandis</i>	13	0.7–1.7
<i>Mean</i>	–	9.1

*Source:* Lasco and Pulhin (2003)

## 5 A case study: the landcare approach

One of the successful community based agroforestry initiatives in the Philippines is the Landcare movement, which was a joint effort of three major stakeholders – local farmers, local government units and technical institutions, primarily the World Agroforestry Centre (or ICRAF).

The Landcare movement has grown to over 600 groups in Mindanao and in the Visayan islands. There are now over 8000 farmers involved in this movement (Mercado et al., 2004). Operationally, Landcare is an extension approach for rapid and inexpensive diffusion of conservation farming, agroforestry practices and other natural resource management systems among upland farmers, based on their innate interest in learning and sharing knowledge about new technologies that give them more income and provide more environmental services (Garrity and Mercado, 1998). Local government units could begin with a meager investment for training and facilitating group activities.

The environmental impacts of Landcare are well documented in the Philippines. The natural vegetative strips (NVS) are very effective in reducing soil loss. Research in Claveria since 1995 has shown that narrow strips of natural vegetation reduce sediment loss from cultivated hillsides of 25–45% slope by up to 95% (Mercado et al., 2004). In addition, more than two million seedlings have been raised and planted, contributing to carbon sequestration and soil amelioration.

## 6 Conclusions

In response to watershed and forest degradation, the Philippines has adopted CBFM as a key strategy. Forest management technologies such as agroforestry and tree farming are being promoted.

This review has shown that the environmental effects of these technologies are largely positive. CBFM has led to the conservation of natural forests and the associated biodiversity. The incorporation of trees in farms and landscapes has led to soil and water conservation and carbon sequestration.

Much of the evidence presented is based on research on just one component of CBFM. Still lacking is comprehensive research that assesses the total environmental impact of CBFM projects as well as the national impact of the whole CBFM program.

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