SECONDARY FORESTS IN THE PHILIPPINES: FORMATION AND TRANSFORMATION IN THE 20TH CENTURY

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LASCO, R. D., VISCO, R. G. & PULHIN, J. M. 2001. **Secondary forests in the Philippines: formation and transformation in the 20th century.** Secondary forests are the largest and most dynamic natural forest ecosystems in the Philippines. This paper examines the characteristics and dynamics of secondary forests in the country. In the last century, the country lost 50% of its natural tropical forest cover. At present, the major land cover types in terms of areal coverage are upland farms, secondary forests, protected forests, brushlands, grasslands and tree plantations. The two most dominant types of secondary forests are post-extraction secondary forests and swidden fallow secondary forests. The former stems from legal and illegal logging, which are ultimately rooted in corruption, poverty and high population pressure. At present, post-extraction secondary forests are the main source of wood products of the country. Although secondary forests initially increase as a result of heavy commercial logging, they subsequently decrease due to degradation to brushland and conversion to agriculture. Swidden fallow secondary forests are generally associated with indigenous cultural communities who derive many ecological and socio-economic benefits from them. However, there are very limited quantitative data available on these forests, including areal coverage. The paper emphasises the need for research efforts directed at the sustainable use and conservation of secondary forests in the Philippines.

Key words: Secondary forests - logging - swidden agriculture - Philippines - land use change - policies

LASCO, R. D., VISCO, R. G. & PULHIN, J. M. 2001. **Hutan sekunder di Filipina: pembentukan dan transformasi pada abad ke-20.** Hutan sekunder merupakan ekosistem hutan semula jadi yang paling besar dan paling dinamik di Filipina. Artikel ini mengkaji ciri-ciri dan dinamik hutan sekunder di negara tersebut. Pada abad yang lepas, negara tersebut kehilangan 50% daripada litupan hutan tropika semula jadinya. Sekarang jenis-jenis tanah litupan utama dari segi luas kawasan ialah: ladang tanah tinggi, hutan sekunder, hutan lindungan, belukar, padang rumput dan ladang-ladang pokok. Dua jenis hutan sekunder yang paling dominan ialah hutan sekunder selepas pengekstrakan dan hutan sekunder bekas ladang. Hutan sekunder selepas pengekstrakan berpunca daripada pembalakan yang sah dan pembalakan haram yang diselubungi rasuah, kemiskinan dan tekanan penduduk yang terlalu ramai. Pada masa ini, hutan sekunder selepas pengekstrakan merupakan sumber keluaran kayu utama di negara tersebut. Walaupun hutan sekunder pada awalnya meningkat hasil pembalakan komersial secara besar-besaran, ia akhirnya berkurangan akibat pendegradan kepada tanah belukar dan pengalihan kepada pertanian. Hutan sekunder bekas ladang secara umumnya berkait dengan penduduk asli yang mendapat pelbagai faedah dari segi ekologi dan sosio-ekonomi. Bagaimanapun, data kuantitatif, termasuk data untuk luas kawasan, begitu terhad di hutan ini. Artikel ini menekankan tentang keperluan penyelidikan terhadap penggunaan hutan secara mapan dan pemuliharaan hutan sekunder di Filipina.

Introduction

From one of the world's biggest exporters of tropical hardwoods in the 1960s, the Philippines became a net importer of wood. Over the years, the Philippines' forest resources degenerated because of massive logging activities, fuelwood gathering and charcoal making, shifting cultivation and permanent agriculture (Kummer 1992). At the end of the 19th century, 70% of the total land area (21 million ha) was covered with lush forests (Garrity *et al.* 1993, Liu *et al.* 1993). At present, only about 20% (6 million ha) of the land area is forested (FMB 1997), with less than 1 million ha of primary forests. Thus, in the last century alone, the Philippines has lost about 15 million ha of tropical forests. The average deforestation rate from 1969 to 1973 was 170 000 ha per year (Forest Development Center 1987). For the next 20 years, it was about 190 000 to 200 000 ha per year (Revilla 1997), but has decreased to around 100 000 ha per year in the last few years (Lasco & Pulhin 1998). The socio-economic and ecological consequences of forestland degradation include wide-spread poverty, accelerated soil erosion and massive flooding of low-lying areas.

Forestlands are important sources of water for irrigation, hydroelectric power, industrial use and household use. They are also home to millions of inhabitants. There are about 20 million Filipinos living in upland watershed areas, half of whom are dependent on shifting cultivation for their livelihood (Cruz & Zosa-Feranil 1988). Soil erosion and degradation are serious problems in the country, where it is estimated that 8.3 million ha out of the 30 million ha of land is severely eroded (EMB 1990, Lasco & Pulhin 1998).

Philippine forests have extremely high floral and faunal diversity. They harbour 13 000 species of plants, which comprise 5% of the world's total plant species (DENR/UNEP 1997). With continued deforestation, some species are now endangered or even extinct. In fact, the Philippines is one of the biodiversity 'hot spots' or areas of concern in 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 declared as initial components of NIPAS. However, many of these areas are protected merely on paper because of lack of resources for enforcement.

Amidst this backdrop, secondary forests play an important role in the Philippines. Most forests (5 million ha or 83%) are secondary forests and important for both their ecological and socio-economic functions. Since the 1992 logging ban on primary forests, secondary forests have become the main source of timber. In addition, these forests are most vulnerable to conversion or degradation because of their proximity to local communities. Secondary forests are defined here as 'forests regenerating largely through natural processes after significant human disturbance of the original forest vegetation at a single point in time or over an extended period and displaying a major difference in forest structure and/or canopy species composition with respect to nearby primary forests on similar sites' (Chokkalingam *et al.* 2000).

Figure 1 shows the six major categories of forestland in the Philippines. These include 2.7 million ha of primary and other protected forests (mossy, pine, mangrove, submarginal), 2.9 million ha of post-extraction secondary forests, 2.4 million ha of brushlands, 2 million ha of grasslands, 0.5 million ha of tree plantations and 5.4 million ha of upland farms (FMB 1996, 1998). Post-extraction secondary forests are defined here as 'forests regenerating largely through natural processes after significant reduction in the original forest vegetation through tree extraction at a single point in time or over an extended period and displaying a major difference in forest structure and/or canopy species composition with respect to nearby primary forests on similar sites' (Chokkalingam *et al.* 2000). Brushlands are a result of overlogging and the vegetation consists mainly of relict trees, shrubs and grasses. Grasslands in the Philippines are a result of deforestation, land tillage and repeated fires that inhibit successional processes. Upland farms are largely devoted to annual crops, but include swidden fallows, forest tree-based farms, coconut plantations (which are typically intercropped) and fruit orchards.

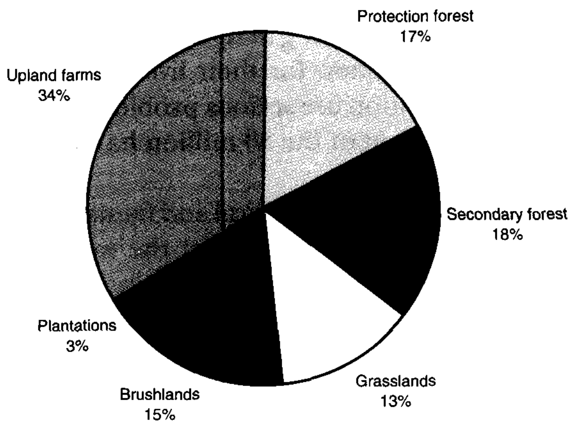

Figure 1 Forest land cover distribution in the Philippines (total area = 15.9 million ha)

This paper examines the importance and dynamics of different secondary forest types in the Philippines. The key questions it tries to answer are: How are secondary forests formed? What are the main driving forces leading to the formation of secondary forests? What are the benefits derived from secondary forests? What are the policies that influence them? What are the research needs for sustainable management and use of this resource? These questions are very important because secondary forests are the largest, most dynamic and economically valuable natural forests in the country today.

The characteristics and dynamics of the various secondary forest types are presented below and in Table 1. As can be deduced from the succeeding discussion, post-extraction secondary forests and swidden fallow secondary forests are the two most common forms of forest in the country.

Post-extraction secondary forests

Extent and driving forces

Historically, logging activities by big companies have been the most important driving forces in the formation of post-extraction secondary forests (Kummer 1992) (Figure 2). The forest area subjected to logging (known as residual forests in the Philippines) could be used as a rough estimate of the area of post-extraction secondary forest. This area remained the same between 1971 and 1997 (Figure 3). In contrast, the area of primary forest declined from over 4.5 million ha in 1971 to less than 1.0 million ha in 1997, a loss of 3.8 million ha in about 25 years. Primary forests were first converted to post-extraction secondary forests before they were totally denuded or converted. Since the latter remained almost the same during the 26-year period, it can be deduced that 3.8 million ha of secondary forests were also denuded in the same span of time or an average of about 140 000 ha per year.

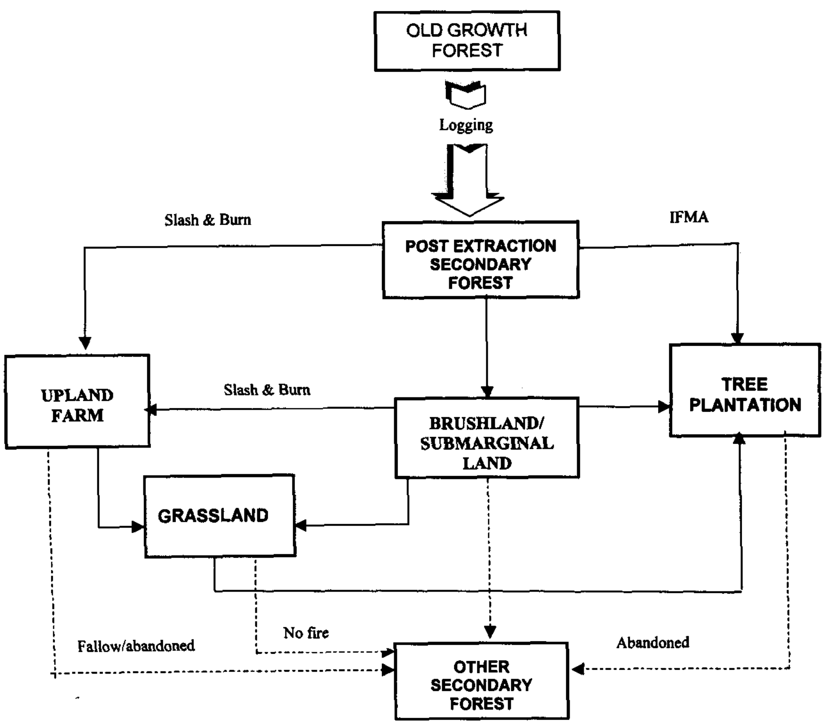

Figure 2 Formation and transformation of secondary forest

Table 1 Characteristics of types of secondary forests (SF) in the Philippines

Criteria	Swidden fallow secondry forest	Secondary forest gardens	Post-fire secondary forest	Post-extraction secondary forests	Post-abandonment secondary forest	Rehabilitated secondary forests
Prevalence	Forest fallows widespread practice of indigenous communiuties	Not prevalent	Fires in natural forests very rare. Usually in *Imperata* grassland	The most common type in the Philippines	Limited because most lands occupied. May occur in abandoned industrial tree plantations.	Most likely in brushland areas but not common.
Area	No data available	No data available, but increasing area in tree plantations	No data but very limited	2.9 million ha	No data available	No data available
Number of people involved	Not known. Total upland population ca. 10 million	Not known but number of tree planters increasing in Mindanao	Not known		Not known	Not known
Land tenure	Individual indigenous farmers do not have legal tenure. May change with the IPRA law	Varied: tax declaration, land titles, none		Timber concessions (Timber License Agreements); Community-based Forest Management agreement		In government lands
Users of the secondary forest	Indigenous communities			Private corporations; Local communities		Small farmers
User objectives	Varied: food, wood, medicine			Timber		Fuelwood
Management intensity/ capital inputs	Extensive. Some tree planting of valuable species			Relatively intensive management (timber stand improvement)	None	

Continued

Table 1 (continued)

Criteria	Swidden fallow secondry forest	Secondary forest gardens	Post-fire secondary forest	Post-extraction secondary forests	Post-abandonment secondary forest	Rehabilitated secondary forests
Importance of secondary forest to local people	Very important economically and ecologically			Employment		
SF and related land use practices under threat (conversion, degradation)	With increasing population, decreasing length of forest fallow			if TLA cancelled, becomes open access resource. Overlogging and conversion to upland farms.		
Institutional framework and policies that affect SF	IPRA law			Governed by PSLS rules and regulations		

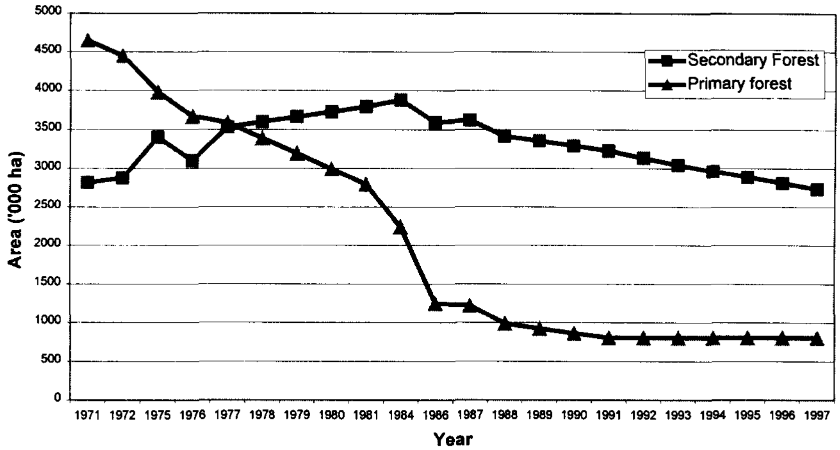

Figure 3 Area of post-extration secondary forest and primary forest in the Philippines (Source: FMB, various dates)

The main tenure instrument for commercial logging was the Timber License Agreement (TLA), valid for 25 years and renewable for another 25 years. At the height of the logging activities in the 1970s, there were a total of 471 TLA holders in the Philippines controlling an aggregated area of more than 10 million ha, a staggering one-third of the total land area of the country (Figure 4). This indicates how a few companies gained control over much of the country's natural resources. Since the mid 1980s, the number of TLAs has steadily declined and by 1997 there were only 26 TLAs covering an area of 1.31 million ha (FMB 1998).

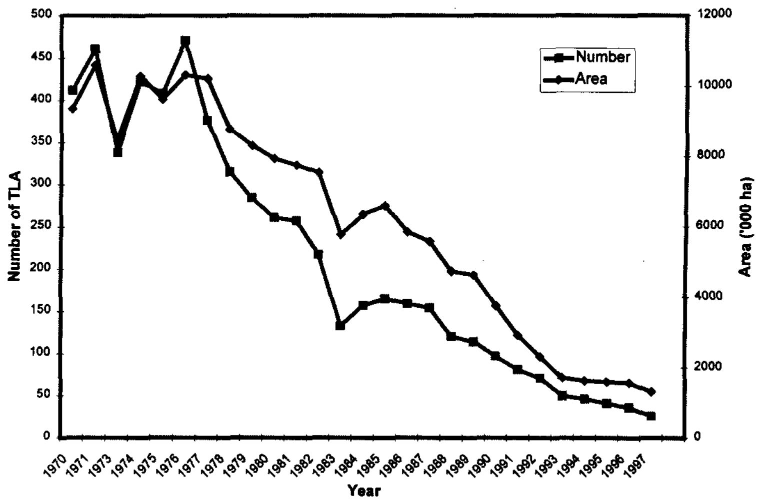

Figure 4 Number and area ('000 ha) of Timber Licence Agreements (TLA) in the Philippines

Before 1992, almost all logging activities were conducted in primary forests and resulted in their transformation to post-extraction secondary forests. While logging operations were supposed to be sustainable through the application of the Philippine Selective Logging System, in many cases, commercial logging sets into motion a process that eventually leads to deforestation and the severe degradation of forestlands (Kummer 1992). Logging roads facilitate the establishment of communities inside the forest area leading to other activities such as shifting cultivation and further cutting (often illegal) (Figure 2). Logged-over areas are also easy to clear for cultivation because the largest trees have been removed. Upland farms of migrant farmers are usually continuously cultivated until the soils are very degraded. Most grasslands in the Philippines are formed in this manner. Post-extraction secondary forests could become brushlands as a result of the continuous cutting of trees. Brushlands contain about 20% forest cover or less and, if further denuded, they can also become grassland areas. Liu *et al.* (1993) have shown, using Geographic Information System analysis, the strong correlation between the development of road networks and the formation of highly degraded secondary forests and ultimately the destruction of these forests resulting in grasslands.

In principle, the Philippine selective logging system is supposed to allow natural regeneration to replenish what was lost, but in practice this has been the exception. Based on anecdotal accounts of those that have been involved in logging operations, the prescribed cutting limit is rarely followed, as can be deduced from the large volume of illegally cut logs. Field supervision of logging activities by government personnel is very limited. Often, those assigned to supervise logging activities are in the payroll of the logging companies. On the policy level, the Philippine Constitution limits the maximum tenure of logging concessions to 25 years with the possibility (but not certainty) of renewal for another 25 years. In contrast, the Philippine selective logging prescribes a cutting cycle of 35 years. In effect, after the first cut there is no assurance that the logger can cut again after 35 years (since the concession may not be renewed after 25 years). This gives a very strong incentive to maximise harvest and minimise investments to maintain or improve the quality of the stand for future harvests. Moreover, logging concessions are also granted as part of the spoils of political victory or to pay off political debts (Broad & Cavanagh 1993, Vitug 1993). Thus, the motivation of loggers is to harvest as much volume as possible while their patrons are still in power.

Vitug (1993) investigated in great detail the politics of logging in the Philippines. Ironically, it has also been shown that TLA concessions can help prevent post-extraction secondary forest destruction (deforestation) through their protection activities. Box 1 describes what happens when a TLA is cancelled. In the past, post-extraction secondary forests were also converted to tree plantations (Figure 2) but this practice is not allowed any more.

Box 1 What happens when a TLA expires or is cancelled?

One of the major issues in the Philippines is whether to ban logging in all dipterocarp forests. In an attempt to shed light on the issue, the Forest Development Center of the University of the Philippines at Los Banos conducted a study to determine what happens when a Timber License Agreement (TLA) is cancelled or expires. Thirty-three cancelled or expired TLAs were visited 2 to16 years after cancellation/expiration in seven regions of the country to conduct interviews and ocular inspection of the areas.

The study showed that once the TLA is cancelled/expires, the forest area becomes 'open access'. The pull-out of TLA holders leaves the forest unprotected and open to exploitation. As a result, old-growth forests declined by an average of 77%, primarily due to rampant small-scale illegal logging. Such activities in the old-growth forests produced post-extraction secondary forests. However, these secondary forests also declined by 1.5% against an expected 77% increase as a result of conversion of old-growth forests to secondary forests. This discrepancy can be attributed to rapid deforestation of post-extraction secondary forests to upland farms because they are more readily accessible and require less effort to clear since the trees are smaller.

Among the study's policy recommendations are that a phase-out plan should be in place before a TLA pulls out of the area and the welfare of displaced workers must be considered. This illustrates how changes in land tenure status could drastically affect the formation and destruction of post extraction secondary forests in the Philippines.

Source: Carandang *et al.* 1996

The ultimate driving forces of secondary forest formation and their eventual destruction (deforestation) are more complex than simply blaming loggers and shifting cultivators. As Kummer (1992) rightly pointed out, secondary forest formation and eventual destruction in the Philippines are linked to the larger issues of corruption, poverty, high population density and migration to upland areas. As might be expected, no accurate data are available on the area affected and volume harvested through illegal logging activities. However, the magnitude has been estimated indirectly from various sources. For example, Japanese data from 1980 to 1982 on logs imported from the Philippines were 250% higher than indicated in the official statistics of the Philippines (Kummer 1992).

On the micro level, legal and illegal logging may in fact be interconnected. A recent study in the Sierra Madre region of the Philippines showed how the same logging equipment is utilised to cut trees legally and illegally (van den Top 1998). The same study reported that a culture of corruption among local officials, the military and forestry officials allows this situation to persist.

Benefits from post-extraction secondary forests

Before the logging ban, the great bulk of national timber supply came from primary dipterocarp forests. Since 1992, post-extraction secondary forests have been one of the main sources of logs. From 1992 to 1997, the total annual allowable cut (what the government allows to be cut) steadily declined from 1.9 to 0.9 million m^3 (FMB 1998). However, in 1997, actual log production (what the loggers reported to be actually cut) from natural forests was 158 358 m^3 or only 28% of the country's total log production (Figure 5). Total forest charges generated by the government from log producers amounted to US$4.74 million of which about 28% can be presumed to come from TLA concessions in secondary forests.

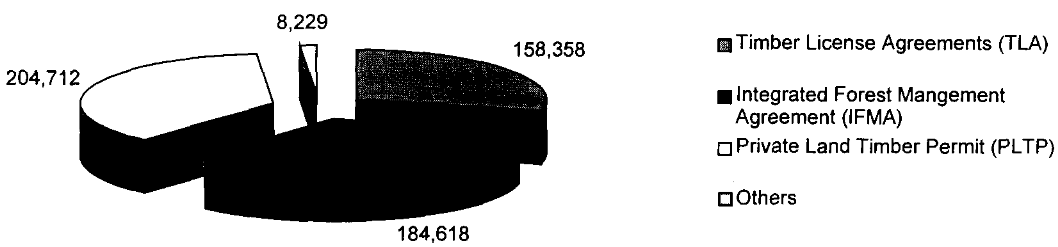

Figure 5 Total Philippine log production (in m^3) in 1997 by land tenure agreements (Source: FMB 1998)

The above data show that the total harvest from dipterocarp forests has been declining over the years. The 25-year Forestry Master Plan of 1990 recommends aggressive tree plantation development to compensate for the reduced harvest from natural forests (Department of Environment and Natural Resources 1990).

On a per-unit-area basis, the volume harvested from post-extraction secondary forests (the second cutting cycle) was much lower than that from primary forests (Weidelt & Banaag 1982). This is in fact one of the reasons why the formula for computing the number of residual trees was revised in 1992 to reflect the smaller sizes of trees present.

Aside from the legally-reported wood harvest volumes, post-extraction secondary forests are also sources of wood and other forest products to local communities living in or around them, either for domestic use or for sale. For instance, houses are generally constructed of wood slabs and sometimes even the roof is made of wood. Indigenous communities inside forest concessions also rely on the forest for food and medicines. Their activities are usually of low intensity and do not lead to massive forest degradation.

A bigger problem is the illegal cutting of logs that are eventually sold in the open market. For example, in a post-extraction secondary forest being managed by the University of the Philippines, a constant problem is how to apprehend illegal commercial loggers (Tolentino, pers. comm.). This activity, if unabated, can lead to severe forest degradation.

Next to primary forests, post-extraction secondary forests are major biodiversity refuges in the Philippines. For instance, a secondary forest in Mt. Makiling has a diversity index comparable to that in primary forests in Southeast Asia (Luna *et al.* 1999). The 4-ha study plot contain 179 species of trees and palms.

Finally, post-extraction secondary forests are also home to millions of Filipinos. It has been estimated that around 10 million people are dependent on forestlands for their livelihood and this number is growing by more than 2% per year (Cruz & Zosa-Feranil 1988). While there is no accurate estimate of how many people actually depend on post-extraction secondary forests, the number may be sizeable considering the presence of logging roads that provide access into these forests.

Silviculture and plant succession

The Philippines started implementing the Philippine Selective Logging System as early as 1954, being the first country in Southeast Asia to do so. The system involves the cutting of mature, overmature and defective trees while leaving behind adequate numbers of residual trees for sustained timber production and site protection. Harvesting is allowed every 35 years (cutting cycle). The detailed activities for the Philippine Selective Logging System are well-defined in the Handbook of Selective Logging (Bureau of Forestry 1970, Weidelt & Banaag 1982).

In general, forest disturbance is severe after logging, severely damaging most of the middle and under-storey vegetation (Weidelt & Banaag 1982). The degree of destruction is directly proportional to the power of the equipment used in logging. Based on the Philippine experience, the least destructive extraction system is truck logging followed by tractor skidder, while the most destructive is high-lead yarding. The use of the last system has already been banned because of the destruction it causes.

The first stage of succession in severely disturbed forests in eastern Mindanao is characterised by small short-lived trees such as *Trema orientalis, Macaranga* sp., *Alphitonia* sp., *Mallotus* sp., *Clerodendron* sp., *Ficus* sp. and wild banana (Weidelt & Banaag 1982). In the later stages, long-lived pioneers such as *Endospermum peltatum, Cananga odorata* and *Alphitonia philippinensis* become dominant. This stage lasts up to 20 to 30 years, after which the dipterocarps begin to dominate.

Swidden fallow secondary forests

Next to logging, swidden agriculture is another important cause of secondary forest formation in the Philippines. The length of the fallow period determines the presence and level of development of the swidden fallow secondary forest. Swidden fallow secondary forests are defined here as 'forests regenerating largely through natural processes in woody fallows of swidden agriculture for the purposes of restoring the land for cultivation again' (Chokkalingam *et al.* 2000). Swidden agriculture with long fallow periods and swidden fallow secondary forest formation is generally associated with indigenous communities who have been living close to the forest for generations. There is no information on the area covered by swidden fallow secondary forest in the Philippines. Reasons for this include the constantly changing land use and the difficulty in distinguishing swidden fallow secondary forests from post-extraction secondary forests using satellite imagery.

There are many forms of swidden fallow systems in the Philippines (see for example Olofson 1983). Some examples are presented below.

(1) The Ikalahans of Mt. Pulog, Nueva Viscaya have developed a system of intercropping, crop rotation and fallow, with sweet potato as the main crop (Rice & Dulnuan 1981). Typically, cultivation lasts for two to three years and the fallow period lasts 17 years (Rice 1981). The system is already 250 years old.

(2) The Hununuos of Oriental Mindoro also practise a form of swidden fallow agriculture. Each month, 16 to more than 35 different basic food plants are harvested (Anonymous 1986). The fallow has two stages, namely, low swidden fallow secondary forest and high swidden fallow secondary forest. In the first stage (low forest), which lasts about a year, vegetation consists of herbaceous shrubs, vines and low tree growth. The area is protected from fire through firebreaks. In the second stage (high forest fallow), which lasts seven to eight years, vegetation is composed of second-growth forest.

(3) The traditional Mangyan system avoids clearing primary forests (Nijhof 1995). Instead, secondary forests are cleared for cultivation. Such a system allows for the conservation of primary forests while perpetuating swidden fallow secondary forest areas. The landmark study of Conklin (1957) over 40 years ago on the Mangyan community revealed fallow lengths of 10 to 19 years. However, a more recent study showed that the traditional fallow system has undergone significant changes, with a decline in fallow lengths to only

one to three years depending on farmers' needs and seed availability (Gascon 1998). The reduction of the fallow period was attributed to the increase in population density coupled with the government prohibition on clearing new forest areas.

The fallow period is key to the sustainability of traditional fallow systems. The primary functions of swidden fallow secondary forests are to accumulate and conserve nutrients in the vegetation and to increase the organic matter of the top soil, thereby increasing the cation exchange capacity and the total nutrient availability in the soil (Nair 1988). In addition, swidden fallow secondary forests can also provide the following functions: help check the build up of pests, diseases and weeds; and serve as grazing and browsing lands, as shelterbelts and as sources of fuelwood, food and medicinal plants (Ohler 1985).

The Igugao woodlot in Northern Luzon functions as a source of wood, bamboos, rattans and medicinal plants. In addition, they also get food from the forest such as betel nuts, coffee, bananas, mangoes, jackfruit and a variety of oranges (Dacawi 1982). The Tagbanua of Palawan island gather forest staples when there is a scarcity of rice or root crop (Werner 1981). Likewise, the Taubuid of Mindoro gather forest products throughout the year. Mushroom, fungi, wild yams, wood grubs, snails, rats, snakes and lizards are gathered every year, while honey, fruits, nuts and fish are collected during specific seasons (Pennoyer 1981).

Finally, swidden fallow secondary forests may also serve some religious functions. For example, the Tagbanwa of Palawan believe that forests are inhabited by spirits or deities that defend their homes by causing illness to human intruders. Such sacred groves may provide seeds to open areas during the fallow. They can also be cultivated later by other tribes with different religious beliefs (Olofson 1983).

Aside from the qualitative description as presented above, there is very limited information on the extent and management of indigenous swidden fallow secondary forests in the Philippines.

Rehabilitated secondary forests

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 to 5 million ha (Garrity *et al.* 1997 as cited by Friday *et al.* 1999, Lasco & Pulhin 1998). This wide range of values is most likely due to the constantly changing use of the land from idle grasslands to cultivated farms and vice versa.

The key question is how much grassland area regenerates into secondary forests. Without fire, grassland areas can revert to natural forest through natural succession (Friday *et al.* 1999) (Figure 2). However, in the Philippines, this may not be a significant process in most grassland areas, because of the high population density that results in most grassland areas being used for farming or grazing.

The traditional approach of the government in rehabilitating the vast grassland areas is through reforestation (Figure 2) with 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 programme is subject to a lot of scepticism. A success rate of 30% may already be generous, if success is defined as the proportion of area planted that actually evolved to become rehabilitated secondary forest. Rehabilitated secondary forests are defined here as 'forests regenerating largely through natural processes on degraded lands, often aided by rehabilitation efforts, or the facilitation of natural regeneration through measures such as protection from chronic disturbance, site stabilisation, water management and planting' (Chokkalingam *et al.* 2000). The reasons for failure in reforestation efforts are legion, ranging from the technical to the social. Poor species-site matching, inadequate monitoring, corruption and social conflict are some of the major reasons (Carandang & Cardenas 1991, Carandang & Lasco 1998). Private commercial tree plantation establishment is also encouraged for the rehabilitation of degraded lands, with harvesting cycles of 10 to 15 years and this does not result in rehabilitated secondary forests.

More recently, the government has tried a novel approach through assisted natural regeneration (ANR). As of the end of 1995, about 2500 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 as well as stimulation of new natural regeneration and tree planting to fill open spaces and further shade out *Imperata* (Friday *et al.* 1999). ANR presents an attractive alternative to conventional reforestation techniques. However, at present, there is still no evaluation of the success or failure of ANR in the limited area where it has been tried. Unless more resources are committed to this effort, they will not likely be a major factor in secondary forest formation in the country.

Other types of secondary forests

The other possible types of secondary forests are discussed briefly below. These secondary forests are very rare, if present, in the country and information is not available.

Post-fire secondary forest

There are no reports of natural forests being destroyed by fire on the same scale as in Indonesia. Thus, post-fire secondary forest formation is not a significant phenomenon in the Philippines. Post-fire secondary forests are defined here as 'forests regenerating largely through natural processes after significant reduction in the original forest vegetation due to a catastrophic human-induced fire or succession of fires and displaying a major difference in forest structure and/or canopy species composition with respect to nearby primary forests on similar sites' (Chokkalingam *et al.* 2000). In the Philippines, fires commonly occur in grassland areas and young forest plantations. For example, in 1991, 13 800 ha of forest plantations were destroyed nationwide (Arroyo 1991). Forests very close to grassland areas may be damaged by fire and regenerate naturally.

Secondary forest gardens

Secondary forest gardens defined as 'considerably enriched swidden fallows, or less-intensively managed smallholder plantations or home gardens where substantial spontaneous regeneration is tolerated, maintained, or even encouraged' (Chokkalingam *et al.* 2000) are not common in the Philippines. Smallholder tree plantations however have existed since the 1970s with the Paper Industries Corporation of the Philippines (PICOP), now PICOP Resources Inc., encouraging farmers in Mindanao to plant *Paraserianthes falcataria* for pulpwood (Veracion 1979, Tagudar 1984). In the 1990s, a wider interest in smallholder tree farming (primarily with *Gmelina arborea)* began in Mindanao, with the decrease in timber supply from natural forests and the emergence of a strong marketing system. However, there is little chance for spontaneous vegetation to grow in these smallholder plantations, because of the high value of wood and the land scarcity in the Philippines.

Post-abandonment secondary forest

Abandonment of upland farms, plantations and pasture may theoretically lead to the formation of post-abandonment secondary forests. Post-abandonment secondary forests are defined here as 'forests regenerating largely through natural processes after total abandonment of alternative land use on formerly forested lands' (Chokkalingam *et al.* 2000). However, this is not likely to happen considering the high population density in the uplands.

Policies affecting secondary forest management

The following national laws and policies have direct implications for the management of the country's secondary forests.

(1) DENR Administrative Order No. 24 Series of 1991

This order promulgated the shifting of logging from primary forests to post-extraction secondary (residual) forests effective 1992. Prior to this, logging was confined to primary forests. This shift expands the economic role of secondary forests as a source of wood. At the same time, it increases the ecological stress on these forests.

(2) Republic Act No. 8371 'Indigenous People's Rights Act of 1997'

This law recognises the vested rights of indigenous peoples over their ancestral lands within forestlands including secondary forests. One major effect of this law is that indigenous peoples could now benefit more from the use of the forest resources, including secondary forests. The implementing guidelines of this law are still being finalised.

(3) Republic Act No. 7586 'National Integrated Protected Areas Systems Act of 1992'

The law stipulates that the management, protection, sustainable development and rehabilitation of protected areas shall be undertaken primarily to ensure the conservation of biological diversity and that the use of and enjoyment of protected areas must be consistent with that principle. It also designates areas as 'protected areas' including secondary forests of high diversity.

(4) Executive Order 363 from 1995

This presidential order adopted Community-Based Forest Management as the national strategy to ensure the sustainable development of the country's forest lands and to promote social justice. The policy provides for the issuance of appropriate tenure instruments that allow for the commercial utilisation of the secondary forest resources and the extension of technical and social support services to participating upland communities as incentives for sustainable forest management.

Land tenure differs for the two major types of secondary forests. For post-extraction secondary forests that are still part of a managed timber concession, tenure is granted by issuance of a Timber License Agreement. The agreement is valid for 25 years as fixed by the Philippine Constitution (Article 12 Sec. 3) and renewable for another 25 years. As discussed earlier, the main effect of this arrangement is that it encourages over cutting and discourages investments for succeeding harvests. For swidden fallow secondary forests, there could be several land tenure instruments depending on which government programme it falls under. However, the maximum length of tenure is still 25 years with the possibility of one renewal.

Research needs

In spite of the importance and dynamism of secondary forests in the Philippines, very little research attention has been given to them relative to tree plantation development and agroforestry. Natural forest exploitation has been traditionally a monopoly of big companies who theoretically have adequate resources to conduct their own research. However, in reality, research on areas like post-extraction secondary forest ecology and management has been neglected.

In general, there is a need for in-depth studies on the driving forces (biophysical and socio-economic) behind the formation and transformation of secondary forests in the country. A study of the same breadth as what Kummer (1992) did for deforestation in the Philippines is needed.

For post-extraction secondary forests to be sustainably managed for wood production, research is needed in the following areas:

(1) Silvicultural management: the Philippine Selective Logging System was developed in the 1950s and has not changed since. There is a need to evaluate the effectiveness of the system in the light of new information on tropical forest ecology.
(2) Ecology: there is still very little information available on the ecology of Philippine forests. Basic studies are lacking on aspects such as natural regeneration, plant succession and phenology.
(3) Socio-economic: a wide range of issues need to be studied including the economic profitability of wood production relative to alternative land uses such as eco-tourism, benefits accruing to local communities and the impact of commercial logging activities on indigenous peoples.
(4) Policy studies: one of the key issues being discussed in the Philippine legislature is whether to ban all logging in natural forests. There is a need for in-depth analysis of the merits of the available options considering ecological, social and economic factors. In addition, the length of tenure for forest management agreements needs to be re-examined. This is currently 25 years with the possibility (but not certainty) of renewal for another 25 years. However, the ideal cutting cycle for selective logging is set at 35 years to prevent genetic degradation (Weidelt & Banaag 1982). Thus, since there is no certainty of a second cutting cycle, logging concessions tend to maximise cutting and minimise investments in stand improvement to sustain future yields.

For swidden fallow secondary forest, the research needs are:

(1) Documentation of indigenous management practices. Given that most information is qualitative in nature, quantitative studies are needed in order to better evaluate the applicability of these practices to other areas.
(2) Development of improved fallow systems in response to population increase and changing cultures of upland peoples. Upland communities have shown the capability to develop improved fallow systems in response to new opportunities and pressures (MacDicken 1991, Lasco & Suson 1999).
(3) Economic evaluation of indigenous management practices.

Conclusion

Secondary forests are the largest and most dynamic natural forest ecosystems in the Philippines. The two most dominant forms are post-extraction secondary forests and swidden fallow secondary forests. These forests generate numerous ecological and socio-economic benefits, both at the local and national level. Post-extraction secondary forests are one of the main sources of timber supply as well as habitat for biodiversity. Swidden fallow secondary forests restore soil productivity following cultivation and provide numerous products especially for indigenous communities.

In the future, secondary forests may continue to play a key role in nation building as logging has been banned in all primary forests. Millions of upland settlers continue to rely on these forests for their livelihoods.

The major threat to post-extraction secondary forests is deforestation since these forests are more accessible than primary forests. Farmers in search of land to cultivate continue to exert severe stress on forest areas. While the national economy is showing signs of improvement, the opportunities in the industrial sector may not be enough to reverse migration from the uplands to the lowlands.

In spite of their significance, the management and conservation of secondary forests have received little research attention. Basic data on areal coverage, dynamics of land cover change, ecological processes and socio-economic costs and benefits are still lacking.

Given the importance of secondary forests for local communities and as a national timber source, there is a strong need to intensify research efforts into secondary forest ecology and management. The government must also re-examine the silvicultural system for production forests. The selective logging system was developed almost 50 years ago and has remained largely unchanged up to the present. New knowledge about Philippine ecosystems, even though meagre, as well as knowledge on similar forest types in other countries, can be considered in improving silvicultural practices.

Acknowledgements

The authors would like to thank N. Ginting, L. Snook and J. Roshetko for useful comments on this paper.

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