

1 Introduction

1.1 Tropical Forest Decline

Tropical ecosystems are exceptionally rich and exclusive reservoirs of much of the biodiversity on earth. However, the rapid and extensive destruction of tropical habitats has become a serious threat to their native biota. Deforestation is particularly severe in Southeast Asia, where natural habitats, such as lowland rain forests, are destroyed at relative rates that are higher than those of other tropical regions. The conversion of this natural habitat to other land uses is the major driving force behind worldwide biodiversity loss (Sodhi et al., 2004).

It can clearly be noticed that biodiversity decline is mainly the result of human activities and the loss of the world's biological diversity, mainly from habitat destruction, over-harvesting, pollution and inappropriate introduction of foreign plants and animals, is continuing. Among different land uses, shifting cultivation, logging and grazing play a key role in the process of deforestation.

Although not more than approximately 90% of the world's food for humans comes from just 15 plant species and 8 animal species, both human health and sustainably high agricultural productivity depend on the preservation of diverse biota, consisting of the estimated 10 million species of plants and animals that inhabit the planet (Pimental et al., 1992). The loss of forests also results in depleting natural resources and diminishing supports for the survival of humans.

1.2 Global activities to conserve forest biodiversity in the tropics

Thus, conservation of biological diversity and sustainable utilization of bioresources received global attention at the Earth Summit in Rio de Janeiro in June 1992, where the Convention on Biodiversity was signed by more than 150 countries. There are three important elements contained in the Convention: the conservation of biological

diversity; the sustainable use of biological resources; and the fair and equitable sharing of the benefits arising out of the utilization of genetic resources.

Three different aspects of sustainability have been identified, namely ecological, economical and socio-cultural sustainability. Ecological sustainability encompasses biotic as well as abiotic resources which are both required to be kept at the same regional quality level. This means for example that the term “sustainable use” which is stated in the Convention is defined as the use of components of biological diversity in a way and at a rate that does not lead to the long term decline of biological diversity thereby maintaining its potential to meet the needs and aspirations of present as well as future generations.

Sustainable forest management has come to the top of the agenda in the international conference. Protection, reforestation and sustainable use of forest resources are urged by international organizations, both government and non-government. Conservation and Utilization Strategies are set up with priority given to tropical forests, thereby pushing the world’s attention also towards Southeast Asian countries. (Sabhasri, 1994)

The principles formulated in the Rio-declarations which specifically concern forests are:

- Sovereignty and responsibility for utilization of resources
- Protection of environment and natural resources from suppression, governance and occupation

At the Rio Conference on Environment and Development, the governments of 172 countries agreed to adopt a comprehensive guiding principle for sustainable development. The idea of cooperation in a spirit of partnership is a challenge for development cooperation to regard its activities as a partnership process in which common interests must be pursued jointly. This provides a new basis for the negotiation of development measures (Burger, 1997).

Shortly after Rio, a forum on the “Conservation and Sustainable Use of Tropical Bioresources” was organized by Thailand and Japan with the participation of scientists from Southeast Asia and the United States (Sabhasri, 1994).

Non-governmental organizations (NGOs) as i.e. Conservation International (CI) are also exploring conservation opportunities in Indo-Burma, a region that includes Laos, Burma, Thailand, Vietnam and Cambodia (Anonymous 2005).

In August-September 2002, the second World Summit on Sustainable Development was held in Johannesburg, South Africa. Between Rio and Johannesburg, the world's nations have met in several major conferences under the auspices of the United Nations, including the International Conference on Financing for Development, as well as the Doha Ministerial Conference. These conferences defined for the world a comprehensive vision for the future of humanity. The Johannesburg Summit has also confirmed that significant progress has been made towards achieving a global consensus and partnership among all the people of our planet (UN, 2002).

1.3 The Situation of Myanmar forests

1.3.1 Biodiversity

As all Southeast Asian countries, Myanmar is rich in biological diversity. The following tables give an overview of their species richness.

*Table 1. Species richness in Southeast Asian countries: Higher Plants
(Source: WCMC, 1992)*

Country	Area (,000 km ²)	Percentage of Forests	Higher Plants		
			Flowering Plants	Gymnosperms	Ferns
Brunei	5.8	-	3000	28	-
Cambodia	177	65	-	-	-
Indonesia	1812	40	20000	-	2500
Laos	231	86	-	-	-
Malaysia	329	45	12000	-	500
Myanmar	658	52	7000	-	-
Philippines	298	31	8000	31	900
Singapore	0.6	-	2000	2	166
Thailand	512	45	12000	25	600
Vietnam	325	49	-	-	-

*Table 2. Species richness in Southeast Asian countries: Vertebrates
(Source: WCMC, 1992)*

Country	Area (,000 km ²)	Percentage of Forests	Higher Vertebrates			
			Mammals	Birds	Reptiles	Amphibians
Brunei	5.8	-	155	359	44	76
Cambodia	177	65	117	305	82	28
Indonesia	1812	40	515	1519	511	270
Laos	231	86	173	481	66	37
Malaysia	329	45	264	501	268	158
Myanmar	658	52	300	867	203	75
Philippines	298	31	166	395	193	63
Singapore	0.6	-	57	118	-	-
Thailand	512	45	151	616	298	107
Vietnam	325	49	173	638	180	80

In Myanmar, the different types of forests which differ from place to place according to the elevation and soil types host an extensive variety of flora and fauna. According to a recent study by the World Wide Fund for Nature and the Wildlife Conservation Society, 40 percent of Southeast Asia's highest priority tiger habitat areas lie in Myanmar, all of them in border regions. However, a literally recorded classification of Myanmar as a "hot spot" can not be found yet.

Myanmar still holds more than half of its region (52%) covered by forests and experienced the lowest rate of deforestation between 1973 and 1985 compared to neighbouring countries like Cambodia, Laos, Thailand and Vietnam (J. Brunner et al., 1998). Based on forest cover per capita, Myanmar and Laos are by far the most richly endowed countries in the region. However, deforestation did accelerate since 1985. According to J. Brunner et al.(1998), referring to UNEP, the average annual rate of deforestation during 1986-1993 was 1.84%. The enormous pressure of the country's rapidly growing population thus has become an obvious cause, and vast areas of forested land have been converted to different land use practices. Among them, shifting cultivation is the most serious problem threatening our indigenous forests from day to day. Logging and pasture in forest areas follow as the secondary causes of deforestation

though pasture plays a minor role in Myanmar. Illicit felling, logging and marketing of valuable tree species account for the major loss of the growing stock of the forest, especially in accessible areas.

1.3.2 Logging

Logging is the source of timber exports, which provide income for many nations in tropical regions. The timber industry has long claimed that rainforest losses are due to fuelwood harvests and land clearing by the increasing number of swidden agriculturists. However, commercial logging has had a much more devastating impact and is the primary agent for tropical deforestation. Indeed, the two types of forest destruction often go hand in hand. Along with the direct impact of cutting down trees, commercial logging has an indirect impact because it involves the building of roads. Landless farmers then use the roads to gain access to rainforest areas that they clear by slashing and burning.

In a study of selective logging in Papua New Guinea, Johns (1997) found that logging has two major impacts on the forest.

1. The physical effects of the removal of logs includes damage during felling operations, damage during skidding, clearing for log dumps and the destruction of drainage systems during track construction. In addition, microclimatic changes can occur when extensive areas of the canopy are disturbed. This will probably adversely affect epiphytes, particularly in high altitude logging operations where the greatest diversity of epiphytic plants occurs.
2. Logging operations which provide access into previously remote areas (where the richest forest resources occur) are commonly followed by land clearance for farming. Most post-logging development occurs for agriculture despite the very poor export values of, or prospects for, most tropical crops such as cocoa, coffee, rubber, oil palm and copra. Agriculture, particularly the establishment of plantation

crops, is still promoted by the Government of Papua New Guinea in spite of the economic, social or biological problems associated with deforestation.

1.3.3 Illicit Felling

WWF defines illegal logging and forest crime as the harvesting, transporting, processing, buying or selling of timber in violation of national laws. It lies within wider forest-related crime which includes both large- and small-scale theft of timber, breaking of licence agreements and tax laws, as well as issues of access to and rights over forest resources, corruption, and poor management. Corrupt department personnel and the demand for timber on the local level may also partly be responsible for this vice. Often there is unregulated use and marketing of firewood, pole, post and charcoal by villagers living close to the forests. The poorer villagers who form the majority make use of the above products for subsistence use while the more well-to-do transact the above products illegally for financial gains. Taking into account the numerous villages adjoining the forests in Myanmar, these illegal transactions and uses probably account for a substantial reduction in the growing stock which is required to replenish the forests, particularly in the case of the slower-growing hardwoods.

Wood is also the primary energy source for millions of poor and landless people in the non-industrialized nations of the tropics. Fuelwood harvesting depletes 5 million acres (2 million hectares) of tropical rainforest every year. The fuel wood crisis which has started some 50 years ago and which is now in a critical stage, has further degraded the remaining forests of Myanmar, including both reserves and public forests. It has resulted in an exorbitant price rise in fuelwood and charcoal. This has produced severe socio-economic stress on the rural population, which constitutes 76% of the total population including those residing on the mountainous regions. The result has been a migration of some of the acute poor to the remaining forested areas where they can fashion some form of livelihood by cutting firewood and burning charcoal and selling the product to the local markets. Some may resort to practise shifting cultivation resulting in even higher degradation of forests (Keh, 1996).

However, the simple rural communities do have much attachment to their villages and land, their culture and surrounding and they have no desire to move from place to place if they are not forced to do so. On the other hand, population increases and the subsequent need for more food to be produced from the same area imposes severe socio-economic stress on them. Without the help of the government and other agencies for financial and technical aid, the real poor will become even poorer, the wood fuel crisis will become more critical and the areas of degraded forest will gradually but surely increase.

1.3.4 Clear cutting and plantations

Some forest lands are also clear-felled for the establishment of plantations of various categories every year like rubber, oil palm, sugar, banana, coconut, coffee and tea.

The national forest policy, however, stresses, as its underlying principles, the maintenance of environmental stability for the preservation of permanent forest estates and the action of conserving species and ecosystem diversity. The clear felling of large areas of forest land does clearly impair these principles, since the establishment of Teak plantations, either by Taungya or in departmentals, results in soil erosion, site degradation, declining biodiversity of both flora and fauna as well as greater incidences of pests and diseases (Keh, 1997)¹.

¹ Nevertheless, a systematic management of Myanmar's natural teak forests dates back to 1856. It was originally based on the exploitation-cum-cultural system known as 'Taungya' (shifting cultivation) forestry. Under this system, Karen people planted teak alongside crops in their 'Taungya'. As the cultivators moved to a new area after a couple of years, the process was repeated, and teak plantations remained. The scientific basis of this system was formalized as the Brandis Selection System, later known as the Burma Selection System (Keh, 1997). The system involves the adoption of a 30-year felling cycle, and the prescription of exploitable sizes of trees, the girdling (killing of teak trees in preparation for felling) and thinning of congested teak stands, the systematic selection of seed trees, the removal of other trees interfering with the growth of young and old teak, the enumeration of the trees left, the carrying out of special silvicultural operations in bamboo flowering areas, and the fixing of an annual yield based on the Brandis formula. For teak, the exploitable diameter limit varies with the type of the forest. In

1.3.5 Shifting cultivation

Shifting cultivation is a very common land use practice in Myanmar, especially in the upland areas where permanent cultivable land can rarely be found. Approximately 1.5 to 2 million families practise shifting cultivation (FD, 2003) in an area of about 2.43 million hectares which constitute mostly the unclassed and degraded forests.

This kind of land use has long been considered as a poor system causing permanent deforestation and damage (FD, 2003). According to FAO (1984), the essential characteristics of shifting cultivation are that an area of forest is cleared, usually rather incompletely, the debris is burnt, and the land is cultivated for a few years, usually less than five-then allowed to revert to forest or other secondary vegetation before being cleared and used again (Upadhyay, 1995).

As the population grows and expands, and the available forest area shrinks, shifting cultivation can lead to a high level of habitat fragmentation, the complete removal of natural forests, and insufficient time for cleared fields to recover before being cut again. All these factors lead to a gradual impoverishment of the ecosystem and declining per capita yields (Dearden et al., 1996).

Selective logging and cattle ranching or grazing further affects the natural forests which follow the shifting cultivation.

productive (moist) forests, the diameter limit at breast height is 73 cm and in poor (dry) forests, it is 63 cm. At the time of selection, teak trees down to a 29-cm diameter are recorded to serve as the basis for calculating future yields. Properly implemented, the Burma Selection System (or Myanmar Selection System) has proved to be successful in maintaining a high yield of top-quality timber with a minimum of negative environmental impacts in the mixed deciduous forests of central and northern Myanmar.

The essence of this Myanmar Selection System is to enhance the natural regeneration and growth of the forest with particular emphasis on commercially important tree species, while maintaining the ecosystem's integrity. To exploit only the interest without tapping the forest capital, thus ensuring that the volume of timber that is extracted is kept within the limit of the Annual Allowable Cut prescribed, is one of the essential rules of sustainability that are integrated.

1.3.6 Grazing

In South and Central America, cattle ranching is a primary cause of deforestation. Ranchers clear rainforest land to plant pasture grass for their cattle, but the pastures do not remain productive for very long (Hecht, 1982; Serrao and Toledo, 2002). Forests, however, do survive on very poor acid soils because they have complex systems of nutrient cycling. The nutrient value of the grasses falls off, and shrubby weeds begin to invade the pasture. Soils become compacted (Hecht, 2002) and depleted and more rainforest land needs to be cleared.

Cleaning the pastures by chopping down the bush, burning, and fertilizing can give pastures a new, albeit short lease on life, although the economics of maintaining pastures versus clearing new ones works against managing existing cleared land (Serrao and Toledo, 2002). Nowadays, remnants of old pastoral landscapes are to be found on the poorest soils of the uplands or on steep slopes of rocky hills not yet re-afforested (Delescaille, 2002).

On the first view, it seems that the pasture management situation in Myanmar corresponds to the land use forms in Latin America. However, a detailed scientific work about Myanmar's pasture situation is not available at present.

1.4 Problem statement, objectives and content of the Study

The explained context shows that in developing countries like Myanmar, the need to provide adequate food for a rapidly growing population has placed enormous pressure on existing productive land. Therefore, the forest margins, the peripheral areas bordering cultivated lands, are also brought under cultivation resulting in further deforestation of the tropical lands and often in drainage of wetland areas.

Logging disturbs the forests resulting in degradation and devaluation. The forest structure is deformed by these practices deviated from the normal growth pattern and