Community forestry initiatives in Southeast Asia: a review of ecological impacts

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Abstract: Studies in South and Southeast Asia were reviewed to understand the impact of community forestry initiatives in recent times on the ecology, with respect to species richness, biomass enhancement and forest regeneration. The findings from diverse ecological regions of South and Southeast Asia have demonstrated that community forestry has resulted in significant increase in plant diversity and biomass production. In this region, over 25 Mha of degraded forestland and fragile ecosystems have been regenerated to meet the economic and ecological needs of local communities, along with increase in productivity of timber. Various practices of the local community in enhancing regeneration, diversity and productivity have improved the status of forests. This paper suggests adaptive forest management practices in addition to silvicultural practices as a strategy to manage forests in a people friendly way.

Keywords: community forestry; Southeast Asia; joint forest management; India; ecological impacts.

Reference to this paper should be made as follows: Ravindranath, N.H., Murali, K.S. and Sudha, P. (2006) 'Community forestry initiatives in Southeast Asia: a review of ecological impacts', *Int. J. Environment and Sustainable Development*, Vol. 5, No. 1, pp.1–11.

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1 Introduction

Indigenous forest management systems in tropical Asia were primarily concerned with sustained use of resources and biodiversity conservation. A shift in management to centralised authority by colonial rulers led to forestry prescriptions applied uniformly across various sociocultural and ecological regimes that met with difficulties for sustenance of forest resources, meeting local needs and conservation. These incompatible management practices have widened the gap between forest managers and users, particularly local users, leading to forest degradation and deforestation. In developing countries, forests are critical to rural communities, and the loss of forest productivity and biological diversity is a serious threat to their livelihoods and quality of life. Deforestation and forest degradation in tropical countries has reduced forest cover to a great extent and the situation has intensified due to pressures from shifting cultivation, livestock grazing and uncontrolled gathering of forest products and clear felling. The expansion of the global timber industry had a heavy impact on the forests of Southeast Asia, especially after World War II. Also the conversion of natural forests to large estate crops virtually decimated the lowland forests of Southeast Asia. As a consequence, community forestry emerged as a strategy to address the resultant degraded forest areas.

One of the underlying factors that contributed to change in control and management of forest in these tropical Asian countries may be the colonial rule that most countries experienced (Gadgil and Guha, 1996; Poffenberger, 1999). Over several years, scattered attempts to involve the community in forest management has met with success and therefore several countries of tropical Asia initiated programmes on devolution of control and management of forests. In Asia, the shift in authority to community forest management has been through contractual agreements between the government and households or individuals in Philippines and China; village committees facilitated by government departments in India and multistakeholder district structures (tambon councils) in Thailand (Edmunds and Wollenberg, 2003). The states integrated several agendas on rural development to decentralise natural resource management (Poffenberger, 1999).

1.1 Evolution of forest management in India

In India, forests support, directly, more than 100 million forest dwellers living in and around forestlands and indirectly, another 275 million (Saxena, 1997). The genesis and evolution of forest policies in India shows that the Forest Policy of 1894 was laid with an objective to manage the forest to promote the general well being of the country, preservation of climatic and physical conditions, fulfilling the needs of the local population and realisation of maximum revenue from the forests without any role of the

community. Subsequently, the National Forest Policy of 1952 was formulated which emphasis covering of one-third of India's land area under forest cover for the ecological well being of the country, maintenance of forests to address the needs of defence, communication and industries. The local communities were alienated in management, which led to commercial exploitation, incidents of encroachment and degradation of forests (Corbridge and Jewitt, 1997; Lynch and Talbot, 1995).

The social forestry programme in the 1980s and the recognition of Community Forest Management in several parts of India, was an important catalyst to formulate the National Forest Policy of 1988, which was radically different from previous policies. Forests were meant to conserve soil and the environment and meet the subsistence requirements of local people, and recognised community role in the management of forests. To facilitate implementation of the 1988 policy, the 1990 joint forest management (JFM) Guidelines were passed, which envisaged the management of forests jointly by the local community and the Forest Department, by formation of Joint Forest Management Committees (JFMCs). Since then, 28 states have adopted the JFM resolution and the Ministry of Environment and Forests has subsequently issued 2000 and 2002 guidelines to strengthen sustainable forest management and equitable community participation in JFM. In India, 17.33 million ha of forests are being managed through 84,642 JFMCs in 28 states (MoEF, 2004).

This paper attempts to understand the ecological impacts of community forestry experiments in South and Southeast Asian countries such as Cambodia, Indonesia, India, Philippines, Thailand and Vietnam. By ecological impacts we mean here, the impact of community protection and management on biodiversity (as measured by the number of species and diversity index), biomass (measured as basal area, standing biomass and mean annual biomass increment) and regeneration (measured as forest cover, regeneration of individuals, stem density and size-class distribution of stems). In the absence of baseline data on vegetation status to monitor ecological impacts critically, we attempted the 'control plot' approach, comparing plots from community protected forests with unprotected forests or plantations in the same or neighbouring villages.

2 Methods

The impact of community forestry in India was compared by assessing JFM forests, be it plantations or natural forests with control plots, using field ecological methods. Thus, the comparisons are only indicative of the direction of change and not in absolute terms. The work was carried out in six provinces in India, namely Andhra Pradesh, Gujarat, Karnataka, Rajasthan, Tripura and West Bengal. The study was coordinated at the national level through the Ecological and Economics Research Network adopting common methodology and therefore the comparisons across provinces are possible. The observations on Southeast Asia are based on Poffenberger (2006) and Lasco and Pulhin (2006).

3 Community forestry: case studies from South and Southeast Asia

The impact of community forestry is difficult to determine on a regional basis due to lack of information on national level monitoring and evaluation. In Southeast Asia, much of

the experience emerging in rural areas is captured only in occasional case studies. It is possible, however, to examine a variety of examples of community forestry systems in different environments to assess their impact on forest cover and biodiversity.

Indonesia

A recent study of Damar (*Shorea javanica*) forest gardens, owned and managed by Krui families, found that the damar forests had better biodiversity compared to rubber estates. There were 230 plant species in adjacent rain forests, 120 in damar forests, and only ten species in the rubber estates. Further, it is an important habitat for endangered mammals such as the Sumatran rhinoceros, the Sumatran goat, tigers, tapir, gibbons and *siamangs* (monkeys). In effect, the damar forests act as a critically important buffer zone to the Bukit Barisan Selatan National Park, greatly extending the habitat for many species. Maintenance of Damar forests have conserved more than 50% species in rain forests, and in addition provided over three months of employment with substantial income (Poffenberger, 2006).

Vietnam

In Cao Bang Province to the north, the Nung, an ethnic community in limestone forests, planting a combination of indigenous pioneering valuable timber species with natural regeneration, have reforested limestone hillocks. The restoration of the limestone forests has facilitated the reestablishment of spring flows that provide water for the lowland rice fields. It has also allowed for the return of many indigenous mammal species, including five endemic and 26 rare species. Thus, in addition to restoration of degraded hillocks, the community efforts have brought back endemic and rare species in their forests.

Cambodia

In Kompong Phluk village, community members have been protecting flood forest for nearly 60 years. At present, the village controls over 15,906 hectares of land formally recognised by the provincial government. The community follows a resource management plan, allowing controlled fuelwood harvesting, monitoring fishing gear and catch levels, and generating fees for management activities. With over 200 different species of fish in the lake, many endemic, the flood forests protected by the communities provide a critical habitat for biodiversity conservation. The community effort is helping in expansion of both mangrove and freshwater forests that are critical aquatic ecosystems.

Philippines

Community based forest management (CBFM) in the Philippines includes management of tropical forests through enrichment planting, timber stand improvement, limited harvesting, rehabilitation of degraded lands through reforestation, assisted natural regeneration, and agroforestry. About 6 Mha of forest lands are under CBFM of which 4.7 Mha have been issued with various forms of land tenure instruments including 1.57 Mha with Community Based Forest Management Agreement (Lasco and Pulhin, 2006). About 6,90,687 households are involved in the implementation of the CBFM programme with around 4.14 million people who are potential direct beneficiaries of the programme. In the CBFM site of Cebu (Central Visayas), conservation of valuable habitats of the endemic life found in the area has promoted biodiversity, which include 122 endemic species of birds, 27 species of mammals and 27 species of reptiles and amphibians. On the negative side, tree plantations have been blamed for clearing of

natural forests to give way to plantations, resulting in loss of biodiversity. The biomass productivity rate varies from 20 t/ha/yr in good sites to 1 t/ha/yr in degraded areas.

India

In India, large extents of degraded forest area brought under the JFM programme has led to improvement in forest cover (FSI, 2003), tree density, biomass and biodiversity (Ravindranath et al., 2000; Murali et al., 2002). Thus, the aim of JFM, that participation of local communities to enhance forest cover, seems to be bearing fruit, surely though slowly. Here we discuss the ecological improvements, as observed in different provinces namely: Andhra Pradesh, Gujarat, Karnataka, Rajasthan, Tripura and West Bengal and in India.

JFM in India originated from Arabari range of Midnapore division in West Bengal. The experiment during 1974 was started primarily to ward off the distress condition of local people and to join hands with the Forest Department to improve degraded areas where people were given a stake in the profits resulting from protection. The experiment began to change the overall policy of state controlled forests to joint management in India. In Rajasthan, Gujarat, Karnataka and Tripura provinces, indigenous community forestry systems existed even before national policy initiatives. Thus, the policy initiatives came in handy to rejuvenate the already existing traditions.

Biodiversity

The number of species in the JFM area ranged from 1 to 44, with Andhra Pradesh recording the highest species diversity. A study from Rao et al. (2006) in three forest divisions in Andhra Pradesh indicates that the number of tree species accounted for 71.56% of the total species recorded in the state. In Gujarat, the JFM area records a total of 174 species across three forest divisions (Patel et al., 2006). In Rajasthan and Tripura, species number and species diversity index of control plots were higher than in protected JFM plots (Table 1). In Karnataka the species richness ranged from 1 to 32 in the JFM area due to two major JFM programmes in the Western Ghats and the Eastern Plains. In the Western Ghats, species richness was high but with low diversity index, while in the Eastern Plains, species richness was relatively low, but diversity index was higher (Sudha et al., 2006). The species diversity was low in West Bengal due to dominance of *Shorea robusta* with a few associated species and exhibiting low species diversity (Table 1).

Table 1 Number of species and species diversity in joint forest management forests in India

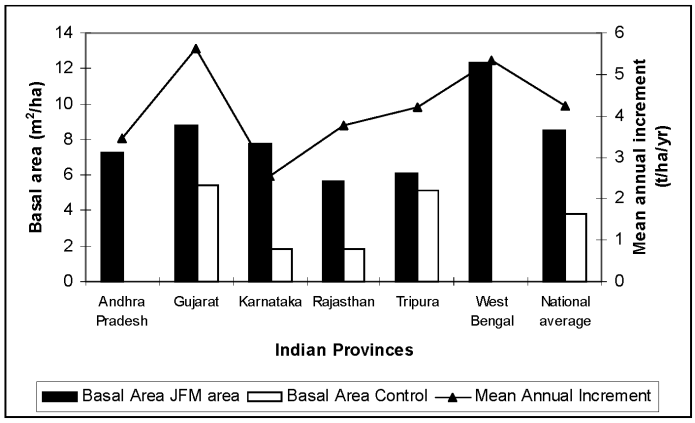
Province	*Number of species* (*range*)		*Species diversity index* (*range*)	
	JFM forest	*Control*	*JFM forest*	*Control*
Andhra Pradesh	44.4 ± 8.9	–	2.3–3.6	–
Gujarat JFM	18.1 ± 1.7	12.4 ± 0.9	1.2–1.6	0.98–1.21
Karnataka	1–32	–	0–2.58	–
Rajasthan	1–11	1–16	1.37–1.77	1.17–2.3
Tripura	2–24	3–31	0.01–3.52	0.54–5.34
West Bengal	1–8	–	0–1.614	–

In Andhra Pradesh, the study showed that effective protection from greenwood collections, cattle grazing, frequent fires and illicit clearings have promoted many species to regenerate from soil seed bank or the existing rootstock. In Karnataka, studies indicate that the plantation model adopted, chiefly governs species richness in JFM areas. Further, protection offered to plantations would enhance diversity depending on the presence of rootstocks in the soil.

Biomass

JFM in India has augmented biomass supply to local community to a large extent. The biomass growth rate ranged from 2.53 t/ha/yr to 5.61 t/ha/yr in JFM areas. In Andhra Pradesh, the basal area and regeneration has improved significantly with a biomass growth rate of 3.47 t/ha/yr was recorded (Figure 1). The JFM programme has also enhanced livelihood potential and reduced migration (Rao et al., 2006). In Gujarat, the protection accorded by communities has improved the state of forests with an annual biomass growth rate of 5.61 t/ha/yr (Figure 1). In Karnataka, the average growth rate in the state was 4 t/ha/yr for the fast growing species and 2 t/ha/yr for naturally regenerating species. The community protected forest showed significant improvements over control plots in both the Eastern Plains and the Western Ghats of Karnataka (Sudha et al., 2006).

Figure 1 Basal area and mean annual increment of JFM area



In Rajasthan, the growth rate of JFM forests in the Aravalli region was 3.78 t/ha/yr with a basal area of 5.68 m^2/ha (Aggarwal et al., 2006). In Tripura, where the assisted natural regeneration method was adopted, the basal area of protected plots was marginally higher than control plots (Tiwari and Phalghuni, 2006) and had high tree density (Table 2). The mean annual increment of JFM forests was 4.2 t/ha/yr (Figure 1). A study in Southwest Bengal (Mishra et al., 2006) of sal (*Shorea robusta*) forests, showed high tree density (1584/ha) in JFM areas, with high basal area (12.33 m^2/ha). This is due to profuse coppicing of sal species from the existing rootstock, due to protection. In plantations too, the basal area was high. Despite high usage, the community is maintaining high stand density and high mean annual increment was high (5.33 t/ha/yr).

One of the important factors, disturbance of the forest, measured as the number of cut stems was assessed in the JFM area. West Bengal recorded the highest cut stems, accounting for 13% of stems and the average cut stems is more in easily accessible areas

than in remote areas (Mishra et al, 2006). In Gujarat and Rajasthan, the number of cut stems was higher in control forests as compared to JFM forests (Table 2) indicating the effectiveness of protection.

Table 2 Stem density and cut stems in joint forest management forests in India

	Stem density/ha (*Mean* ± *SD*)		*Cut stems/ha* (*Mean* ± *SD*)	
Province	*JFM forest*	*Control*	*JFM forest*	*Control*
Andhra Pradesh	282 ± 35	–	77 ± 24	–
Gujarat JFM	1482 ± 822	855 ± 493	7 ± 4	22 ± 1
Karnataka	765 ± 358	125 ± 162	82 ± 56	–
Rajasthan	143 ± 47	145 ± 56	21 ± 11	44 ± 15
Tripura	750 ± 827	307 ± 383	–	–
West Bengal	1584 ± 606	–	207 ± 106	–

4 Ecological impacts of community forestry

It is increasingly recognised that involvement of people in forest management, apart from contributing to regeneration of degraded forest, helps in cost effective conservation of existing forests and meeting community's subsistence needs. Decentralised and participatory forest management systems have been initiated in most of the South and Southeast Asian countries to involve communities in collective decision making, social fencing, empowering them to protect and manage forests, and promote a sustained harvest of usufructs. In India alone, communities are protecting and managing over 17 million ha of forests and in the South and Southeast Asian region; as per the present available records, over 25 million ha of forests are under community control for conservation and management.

To sustain community participation, the ecological impacts that attract the local populace require sustained biomass growth rates, enhanced biodiversity and improved forest cover. In the following sections, we describe the impact of JFM on all aspects based on several studies.

4.1 Forest cover

Forest cover change due to community forestry in India has been documented through satellite imageries in Andhra Pradesh at the village and district level (D'Silva, 2001). Improvement in the forest cover of three villages ranging from 3–6%, over the two year period 1996–1998, and substantial decrease in the forest areas devoid of trees, called 'blanks', ranging from 25% to 40% was noted.

An overall improvement of 4.25% of forest cover was observed in Andhra Pradesh between 1996 and 1998, which is a remarkable change, though it is not clear if it is only through JFM activity or is a result of different afforestation programmes in the districts (Anonymous, 2000). Micro level studies in Orissa also indicate that there is improvement in forest cover over a short period of time (Ostwald, 2000). Remote sensing of the areas under community forestry in West Bengal has shown that forest cover has increased by 13 km^2 (0.15%) during 1997–1999.

4.2 Regeneration

The regeneration pattern in JFM areas revealed that vegetation is changing gradually, improving the density of stems. In the study area of six provinces, the majority of the species were present in the lower girth class, signifying good regeneration status. In Andhra Pradesh, the presence of good rootstocks has enhanced regeneration of natural species in the JFM area (Rao et al., 2006).

Unregulated grazing and extraction of forest products has lead to degradation and loss of vegetation, affecting regeneration. A national level study on community forestry in India involving eight provinces indicated that protection and management practices adopted under JFM include regulated grazing and extraction of forest products, selective retention of tree species and silvicultural operations (Ravindranath et al., 2000). The studies indicate that a longer period of protection enhances regeneration and greater biodiversity of trees species. It is important to ensure long term sustainability of economically and ecologically important tree species through adequate regeneration.

4.3 Biodiversity conservation

One of the important concerns of community forestry implementation is that not adequate consultation with local people was undertaken in order to have the species of people's choice in community forestry plantations. Studies in India have shown that the exotic species such as Eucalyptus, *Acacia auriculiformis* and *Casuarina equisetifolia* species dominated plantations (Ravindranath and Hall, 1995). In yet another study (Ravindranath et al., 2000) the species composition under social forestry project and JFM projects in Uttara Kannada district, in the Western Ghats, indicates that the species planted was not according to community expectations. In view of large demand, firewood species dominated the plantations resulting in reduced biodiversity. However, other studies also indicate that in many plantations under community forestry, biodiversity has improved, due to the protection offered to the plantations in the initial years (Bhat et al., 2001). Thus there is tremendous scope for improving biodiversity through protection and promotion of natural regeneration. Further, multispecies plantations could be raised to meet the local biomass needs.

In many traditional community forestry systems, higher species diversity was recorded due to local people adopting various management and silvicultural practices that promote biodiversity (Ravindranath et al., 2000). These villages had the advantage of longer period of protection and regulated extraction to conserve biodiversity. For instance, in Gadabanikilo (in Orissa, India) the entire forest area was demarcated in patches for extraction of *Madhuca indica* flowers, firewood, grazing etc., one patch was completely dedicated to enhance biodiversity and regeneration (Rai et al., 2000). Such examples could be adopted in JFM areas to enhance biodiversity and regeneration to enhance the future forest resource.

4.4 Biomass production and utilisation

Adequate biomass production from the regenerating forests will motivate communities to strengthen their efforts to protect and manage degraded forestlands. The standing biomass and biomass growth rates of regenerating forests under protection in India are detailed in Ravindranath et al. (2000) and Ravindranath and Sudha (2004). The extent of standing

biomass of the forest in these examples gives a fair estimate of the positive impact of protection and regulation of firewood harvesting. High growing stock is recorded in the traditional community forestry system with a longer history of protection and the productivity is comparable to the national average of plantations under social forestry.

5 Implications for community forestry

Findings from diverse ecological regions of South and Southeast Asia have demonstrated that community forestry has resulted in significant increase in plant diversity and biomass production. Over 25 Mha of degraded forestland and fragile ecosystems have been regenerated to meet the economic and ecological needs of local communities, along with increase in productivity of timber. Regulation of extraction, grazing, and soil and moisture conservation practices are some of the initial steps to create favourable conditions for regeneration. Studies have clearly shown that protection and regulation of firewood and timber extraction is very critical and communities have realised its importance.

5.1 Participatory monitoring and sustainable forestry

Currently there are no national monitoring and evaluation of community forestry programmes. There is an urgent need for such monitoring and evaluation. Further, given the large diversity of locations, with socioeconomic and ecological variations, it is necessary to involve village communities in monitoring vegetation, develop and adopt management and extraction practices, monitor their impact, and accordingly modify them. There is a need to promote such an adaptive forest management approach in many locations and judge its feasibility, by experience. A set of indicators and methods has to be developed and communicated to the local community.

5.2 Participatory silviculture

Traditional timber production oriented silvicultural practices may not be suitable for community forestry. Thus, developing a participatory silvicultural approach and a decentralised planning and management system is essential. Under participatory silviculture, there is a need for developing location specific silvicultural practices and '*rules of thumb*' for harvesting, to meet the needs of community. Conventional research involving an experimental approach is time consuming. Traditional knowledge of the local communities could effectively complement silvicultural research in developing appropriate forestry practices for JFM (Pandey, 1996).

Acknowledgements

We thank the Ford Foundation, New Delhi for supporting Ecology Economics Research Network and the Ministry of Environment and Forests for support to CES. We thank our network members and our colleagues at CES for help at various stages of this long-term research.

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