Community Forest Management in Adilabad District, Andhra Pradesh, India: Ecological Effects

Emmanuel D'Silva

Asia Forest Network
Working Paper Series

Volume 4

The Asia Forest Network supports the role of communities in protection and sustainable use of natural forest. AFN is comprised of a select coalition of Asian planners, foresters, and scientists from government agencies, universities, and non-government organizations. Solidarity of AFN members is based on a common commitment to exploring alternative management strategies for Asia's natural forestlands. AFN's research emphasis includes the ecology of natural regeneration, the economics of non-timber forest product systems, and the community organizations and institutional arrangements that support participatory management. Lessons stemming from this research are used to inform field implementation procedures, reorient training, and guide policy reform.

For more information about the Asia Forest Network and its publications, please contact:

www.asiaforestnetwork.org

ASIA
2/F Gallares Main Bldg., Gallares Square
Graham Avenue/Maria Clara Street
Tagbilaran City, 6300, Bohol, Philippines
Tel/Fax: (63-38) 235-5800
Email: afn@mozcom.com

USA
5266 Hollister Avenue
Bldg. B, Suite #237
Santa Barbara, CA 93111 U.S.A.
Tel: (805) 696-9087
Tel/Fax: (805)696-9097
Email: mpoffen @aol.com

First published by Asia Forest Network in 2001 as
" Ecological Effects of Joint Forest Management in India:
A Case Study from Adilabad District, Andhra Pradesh"

Second Edition 2002
Santa Barbara, California

Community Forest Management in Adilabad District, Andhra Pradesh, India: Ecological Effects

by

Emmanuel D' Silva

Acknowledgements

Several individuals and institutions helped with the research for this paper. Dr. Doris Capistrano of the Ford Foundation, New Delhi, provided financial assistance that helped to defray a part of the research expenses. Dr. B. L. Maheshwari, Centre for Organization Development, Hyderabad, India offered office space, accommodation, and a base to do the analytical work. Mr. A. P. Rao and his staff of the Centre for Educational and Agricultural Development, an NGO operating in Adilabad district, provided local support in Neredigonda. Mr. Y. Narasimha Rao and MR. Ramkishan, Forest Range Officers, Tadlapet Range, helped with the filed work. Mr. Pendram Ramu and others of Behroonguda offered regular hospitality and information on the workings of forest management in their village. Mr. Pratap Bahadur rendered valuable technical advice. Mr. S. D. Mukherji, Principal Chief Conservator of Forests, Mr. P. Madhusudan Rao, Conservator for Adilabad Circle, and Mr. S. Srinivas, Divisional Forest Officer, Nirmal, provided Forest Department hospitality and co-operation. Dr. Agit Bannerjee, Dr. John McKinnon, Mr. S.D. Mukherji, and Dr. Mark Poffenberger reviewed and commented on the paper. Kate Smith-Hannsen helped with editing and layout for this publication and Asia Forest Network provided the printing as part of their working paper series. To these kind people, and many more too numerous to mention, the authors would like to acknowledge with thanks the help received.

Emmanuel D'Silva is Operations Officer, currently on leave from the World Bank, Washington, D.C., USA. At the time of writing, B. Nagnath was Divisonal Forest Officer, Jannaram, Adilabad District, Andhra Pradesh Forest Department. The views expressed in this paper are those of the authors and should not be attributed to the organizations they represent.

Emmanuel D'Silva

Abstract

Behroonguda is one of the 77,000 hamlets and villages in the state of Andhra Pradesh, India. The 97 families who belong to the Gond and Naikpod tribes formed themselves into a forest protection group in 1990, but the state government officially recognised their efforts in 1993. In 1998, five years after the recognition of the committee—referred to as vana samarakshana samithi, or VSS—Behroonguda residents began to derive usufruct benefits from the forest. The case study documents the efforts of the villagers, the costs they have borne and the benefits they have derived from protecting 500 hectares of degraded forest allotted to them as part of the joint forest management (JFM) in Andhra Pradesh. The VSS is widely regarded as being successful. The paper analyses the reasons for the success of JFM and compares the experience of Behroonguda with other similar experiments in India and other countries to draw important lessons. The paper strikes one discordant note: The people of Behroonguda had not been clearly told when the forest department's financial and technical support would end. Nonetheless, Behroonguda passed the test of sustainability when in 2001 it used its own financial resources to continue silvicultural and conservation activities in the absence of funding from the government. Many neighbouring hamlets discontinued forest protection that year when external funds ceased to flow.

A healthy forest means a wealthy village.
-Behroonguda Villager

Table of Contents

List of Tables & Box

INTRODUCTION

Adilabad is one of the poorest districts in Andhra Pradesh with a population of 2.1 million people living in an area of 1,613 square kms. About 44% of the land area is forested, though much of the forest is degraded. The district also has a large tribal population of 17% of which the Gonds is the most dominant. Most of the population lives in poverty dependent on rain-fed agriculture. Since 1994, the state government of Andhra Pradesh has initiated a programme to involve local people living in the fringes of the forest to participate in the protection and management of the forest in collaboration with the forest department; it is known as joint forest management (JFM). Forest protection committees, known locally as *vana samarakshana samitis* or VSS, have been formed in 1,008 villages in the district to galvanise the people in support of JFM.

Yapalguda, Kishtapur, and Borigam (YKB), three villages that fall in the Neredigonda forest range of Adilabad district, were selected to study the impact of JFM on the local ecology. The research indicates that the initiation of forest protection by the YKB villages has made some difference to the ecological conditions of the forests. The forests adjacent to the three villages have regenerated, the biodiversity improved, and the forest mix of old and young trees maintained. The difference in the quality and quantity has depended on the duration of protection: the longer the period of protection, the better have been the results. Where no protection regime has been in place, the condition of the forest has been worse than where such a regime existed. These conclusions from Neredigonda are compatible with the findings from the Tadlapet forest range, 100 kms away, where the forests of Behroonguda (protected by the local community for five years) were found to be better than the forest adjacent to Chintapally (where no community protection existed during the research period).

The people of Neredigonda are blessed in having a mixed-teak natural forest that rebounds easily once protection from browsing animals (particularly goats) and human interference (eg, logging) is assured. The results in some other areas of Andhra Pradesh with forests of lower economic value are said to be less spectacular. The debate on whether forest protection by communities makes a difference to the ecology of a forest is settled in the case of the forest of Neredigonda. The efforts of the people of Yapalguda, Kishtapur, and Borigam have made the difference to their forest. And so long as the villagers maintain their current consumption patterns, and protection practices, their forests will be sustainable.

Context and History

Ecological concerns or environmental considerations are mentioned in all three of India's national forest policies dating from 1884 to 1988. The Forest Act of 1894 first laid the basis for preserving the forests on hills for ecological purposes to protect against the "devastating action of hill torrents on the cultivated plains" below. A century later, the government indicated that the main purpose of the

natural forests was "environmental stability and maintenance of ecological balance" (Government of India 1988:3). However, the challenge in these policies has been to balance the various needs and demands of society and the state. During the colonial period, the government had to make provisions for meeting the needs of local people[1] for small timber, firewood, and fodder while recognising the need to raise revenue for the state. In 1952, the newly independent Indian state tried to balance the competing needs of forests for environmental and ecological purposes against national interests, such as defence and communications, and local community demands.

Alarmed by the "serious depletion" of India's forests, the policies of 1952 and 1988 set a 'national goal' that a minimum of one-third of the total land area must be retained under forest or tree cover. In the hills and mountainous regions, the ratio was increased to two-third of the area to prevent soil erosion and land degradation and to ensure stability of the fragile eco-system (Government of India 1952:34). However, even after 50 years of India's independence, achieving the national goal has proved to be elusive. Today, only 19.27% of India's geographic area is covered with forest, of which 11.7% comprise dense forest (Forest Survey of India 1997:5).[2] An even lower 3.5% of the area is in an undisturbed, pristine state (Agarwal 1997:40). The rest of the forest is in various states of degradation. The degradation is most severe in the zone of dry deciduous forest, which includes Adilabad district, Andhra Pradesh the site of the research. Between 1981 and 1990, the dry deciduous zone lost 2.14 million hectares, or about 63% of the forest area (*ibid* 37). Overall, the rate of regeneration in the forests managed by the forest department has been abysmal. Only 15% of the area logged on the basis of the department's management plans has yielded adequate regeneration (*ibid* 36).

The annual public demand from the forest is about 30 million cubic metres (cmt) for timber and 280 million tons for fuel wood (Ahmed 1997:4). Official figures indicate 12 million cmt of timber and 40 million tons of fuel wood are extracted from the forest. The unrecorded extraction is many times more. The country's foresters and planners determined during the 1970s that regeneration of the forest, in their degraded state, will not make up the shortfall in timber and fuel wood, so they turned to establishing plantations of exotic species, primarily eucalyptus (Poffenberger and McGean 1996:20). A critic says India has allowed plantations to increase at the expense of the natural forest cover (Agarwal 1997:35). About 3 million hectares a year in plantations has been proposed in the degraded forest areas (Ahmed 1997:7).[3] However, afforestation through plantations is an expensive business.

---

1 The term "local people" refers to people who live in a particularly rural or urban area (Chambers 1997). Sometimes, "local community" is used synonymously with "local people."

2 "Dense forest" refers to a forest cover of trees with canopy density of 40% and more (Forest Survey of India 1997).

3 The actual afforestation rate is only 1.3 million ha. (T.P. Singh, personal communication).

Recently, the government estimated the cost of afforestation to reach the national goal of 33% of the land area at USD 100 billion.[4]

In recent years, there appears to be a change of heart among the policy makers. While the government is encouraging plantations to meet the needs of the industry, industrial plantations are often confined to degraded private lands. On public lands, particularly in degraded forests, the government is providing incentives to local communities to participate in the regeneration of the natural forest. Thus, a government that has failed in natural regeneration with all of its resources hopes to do better with the participation of local communities. The participatory approach is called joint forest management (JFM). But will community protection of the forest, and government-assisted silvicultural treatment, make a difference to the local vegetation? This paper presents an ecological perspective using the indigenous knowledge of the local people, classical scientific research methods, and modern satellite-based technologies.

[4] This figure is regarded as "hypothetical" as several studies indicate that India's forest cover can be increased to only 90 million ha., inclusive of agro-forestry (T. P. Singh, personal communication).

IMPORTANCE OF AN ECOLOGICAL PERSPECTIVE

Origin of Ecology

The word "ecology" is derived from the Greek words *oikos* (house) and *logos* (study of). Ecology has thus come to mean a study of the house, or the habitat of an organism, a living animal, or a plant (Lal 1992:1). The word "animal" includes human beings. The father of the word "ecology" was said to be Hernst Haeckel, a German zoologist, who coined the term in 1866. Since then, several people have tried to refine the definition. Elton in 1927 defined ecology as the "study of animals and plants in relation to their habits and habitats;" Odum in 1971 defined it as the "scientific study of the structure and function of nature;" and Krebs in 1978 regarded ecology "as the scientific study of interactions that determine the distribution and abundance of organisms" (*ibid*). The key word in these definitions is "relationships" or "interactions." Ecology thus brings together the physical, biological, and social sciences, and maintains a close relation with economics with which it shares the same root.

Importance of Ecology

The importance of ecology has grown steadily since 1950s. Lal (1992:7) attributes three reasons. First, the world's population explosion resulted in overtaxing natural resources, both renewable and non-renewable. Second, the march of technology, while improving human life, often ignored biological laws. Third, the emergence of an extravagant pattern of consumption allowed little or no recycling of waste products. These factors led to a scarcity of natural resources; a decrease in productivity of biological systems, which sustained man and beast; a deterioration of climate; and the pollution of soil, water, and air.

The science of ecology has enabled us to take a holistic view of the use of living systems with interdependent components. The sustainable management of forests cannot be achieved based solely on the knowledge of tree species and tree populations. For good management, a forest needs to be studied as an ecosystem. The study of ecology also has its limitations: it is only one source of information. While ecological research provides information on the natural processes, the rest of the information on technology and human activity has to come from other sources (*ibid* 9).

FOREST ECOLOGY

The word 'forest' is derived from the Latin *foris*, or 'outdoors.' The Longman dictionary describes a 'forest' simply as a "large area of land thickly covered with trees and bushes," and 'forestry' as the "science of planting and caring for large areas of trees" (Longman 1987). 'Forest ecology' is regarded as a study of forest ecosystems. However, there is more complexity and variability in forest systems when compared with other ecosystems because the former: (a) possess a greater number of species in a unit area than do other ecosystems; (b) are more subject to human disturbances, such as fire, grazing, and felling; (c) are subject to successional changes; (d) show greater geographical variability; (e) perform multiple roles, both natural and human-imposed, with frequent conflicts between the two functions; and (f) significantly influence some other vital systems, such as rivers, lakes, pastures, and agricultural lands (*ibid,* 11).

Because of the complexity and variability of forest ecosystems, it is often difficult to establish a cause-and-effect relationship and predict with reasonable certainty the outcome of a human intervention on the system. Forest ecology provides tools to deal with this difficulty. Foresters can now take into account the effect of not only their actions on a single tree population, but also on all the components of the ecosystem of which humans are a part (*ibid* 11). However, as pointed out earlier, a technical knowledge of forestry needs to be complemented by social and other sciences to gain a better understanding of nature and human co-existence.

Classification of Forest

Depending on the objective, a variety of methods can be used to classify the type of forest vegetation prevailing in a region. Three methods of classification are highlighted here because of their relevance to the area where the research was conducted. The three methods described below are based on: (a) temperature and rainfall zones, (b) ecosystem, and (c) floristic composition.

Temperature and Rainfall Zones

Of all the environmental factors, climate influences the forest the most, determining the kind of vegetation in a region (Lal 1992). On the basis of mean annual temperature, India can be divided into four zones: tropical, sub-tropical, temperate and alpine. The tropical forest falls in the temperature zone of 24-30 degrees Celsius, the sub-tropical between 17 and 24 degrees, temperate between 7 and 17 degrees, and alpine under 7 degrees. Similarly, there is a broad correlation between average annual rainfall and forest vegetation. Thus, rain forest in India falls into the rainfall zone of 2,000 to 3,000 mm, monsoon forest in the 1,000 to 2,000 mm, dry forest in 750 to 1000 mm, and xerophytic forest in the 250 to 750 mm zone (see Table 1). Most of the forests in Adilabad district, the site of the research, fall in the rainfall zone of 750 to 1,000 mm and comprise dry deciduous species.

TABLE 1: FOREST CLASSIFICATION BY RAINFALL ZONES

RAINFALL ZONE	FOREST VEGETATION	DESCRIPTION
2,000 mm to 3,000 mm	Rain forest	Dense canopy; tall evergreen trees
1,000 mm to 2,000 mm	Monsoon forest	Deciduous trees in upper storey, evergreen trees in lower storey
750 mm to 1,000 mm	Dry forest	Only deciduous species
250 mm to 750 mm	Xerophytic forest	Low, stunted growth; thorny deciduous species; and fleshy evergreen

Source: Lal (1992)

Ecosystem

The classification based on climate has its limitations. For example, total rainfall may count less in the growth of plants than the distribution of rainfall. A classification based on the ecosystem is more comprehensive because it takes into account both vegetation and environment. In 1968, Champion and Seth developed an ecosystem-based forest classification of India, which is now widely used in forest management and planning all over the country. The authors first divided the forest vegetation into four major groups corresponding to four temperature-based climatic zones--tropical, sub-tropical, temperate and alpine. Further division produced 16 groups on the basis of rainfall and the chief morphological features of the vegetation. The groups were further divided into sub-groups. What finally emerged were 221 ecologically stable vegetation types. The authors define a forest type as a "unit of vegetation which posseses characteristics in physiognomy and structure sufficiently pronounced to permit its differentiation from other such units" (Champion and Seth 1968).

In the tropical group, seven forest types are recognised: wet evergreen, semi-evergreen, moist deciduous, dry deciduous, littoral and swamp, thorn, and dry evergreen. Of the 16 forest types in India, tropical moist deciduous forest (37%) and dry deciduous (28.6%) account for two-thirds of the total forest cover. A majority of trees in Adilabad belong to these two forest types.

Floristic Regions

Another convenient classification of forest vegetation is based on geographical regions and distinct flora associated with the region. The nine recognised floristic regions of the country are: Western Himalayas, Eastern Himalayas, Indus Plain, Gangetic Plain, Central India, West Coast (Malabar), Deccan Plateau, North East India, and Andaman and Nicobar Islands.

The Deccan Plateau. The region with a rainfall of about 1,000 mm includes the major part of peninsular India, of which Adilabad district forms a part. Teak (*Tectona grandis*) is the major species of the region. The common associates of teak are *Hardwickia, Anogeissus, Boswellia, Garuga,*

Buchanania, and *Diospyros* species. A significant feature of this region is the presence of valuable sandal forests. However, this variety is not found in the forests of Adilabad.

Ecological Uses of Forests

Forests have many ecological uses, among them preserving the earth's biological diversity, serving as a carbon 'sink,' and moderating global climate (Poffenberger and McGean 1996). India's natural forests are said to harbour over 65,000 species of fauna and over 45,000 species of flora, most of them with a high degree of endemism. Data from the Amazon Basin indicate that one hectare of natural forest stores about 220 tons of carbon, which is released in the atmosphere when it is burned (Holloway 1993:76). However, preliminary research suggests that degraded, but regenerating secondary forest may sequester more carbon than older, undisturbed forest such as that found in the Amazon Basin (Poffenberger and McGean 1996:273). This finding has important implications for Adilabad district and India because it suggests that community protection of forests can serve a higher global environmental purpose of containing greenhouse gases. Morever, the forests regulate the hydrological and moisture balance of the soil by absorbing excess water and slowly releasing groundwater to crops, controlling floods, minimising droughts, and influencing local and regional micro-climates (Poffenberger and McGean 1996:278).

Forests also have other uses to local communities. Where cash is scarce and markets distant, forests in remote areas function much like grocery shops in urban localities (*ibid* 275). They provide food for the hungry (eg, *Zizyphus jujuba* is a common snack among village children), medicine for the sick (eg, the oil from the bark of *Semecarpus anacardium*, known in Adilabad forest as kokdi, is commonly used for healing injuries), fuel wood for home cooking, and poles for house building (Arnold 1992:434). The value of non-timber forest products (NTFP) in terms of employment, subsistence, and sale in the market is very important to forest-dependent communities. A number of researchers have estimated the value of NTFPs in excess of 20% of total family incomes (Malhotra *et al* 1991; SPWD 1992c: 11).

The forests also support village industries--such as building agriculture implements, weaving bamboo baskets and rolling *bidis* or indigenous cigarettes--and provide employment to rural folk involved in the collection of fuel wood, bamboo, and tendu leaves (the latter derived from *Diospyros melanoxylon*). An estimated 15 million people in India are involved full time in the commercial fuel wood trade generating up to 4.5 billion days of employment (Van Buren and May 1982 quoted in Poffenberger and McGean 1996: 279). The bidi trade alone employs about 1.85 million people in Andhra Pradesh state. Yet, India's forests generate only a fraction of their potential, whether it be timber, pulp, grass, fruits, oilseeds or other valuable products (Poffenberger and McGean 1996:282). The potential of a natural forest serving a "higher" ecological purpose and meeting the needs of a growing population is now being realised.

Natural Regeneration of Forests

The best way forests can serve ecological and human needs is to regenerate naturally in abundance. Unfortunately, the pre-occupation of foresters and government planners in India has been on man-made mono-cultural plantatons as a "quick fix" to meet the country's varied wood and biomass needs. Plantations can be an expensive proposition, especially in semi-arid conditions where water is scarce, and can often end in failure. In contrast, natural regeneration through voluntary protection by the local community can often cost less than raising a plantation on the same land area. For example, in Behroonguda, a village some 80 kms from the research site, maintaining a teak plantation is five times more expensive than protecting a degraded mixed-teak forest that regenerates naturally (D'Silva and Nagnath 1999).

Unfortunately, natural regeneration of forests is a neglected study in India (TERI 1999:168). There is very little information available in the country on the way different degraded forests have regenerated as a result of community protection, particularly on aspects like growth patterns of various species, total volume of wood, and changes in the biomass produced each year of regeneration. However, there are a number of ways in which the productivity of natural regeneration can be assessed. The direct ways include changes in the forest cover, measurement of the growing stock of trees, and regeneration of seedlings over a period of time (*ibid* 168). Indirectly, a decrease in the level of dependence of the local people on the forest could be interpreted as a positive sign of the ecosystems' well-being. In this paper, I have relied on the direct methods to measure the changes in vegetation occurring as a result of community protection of the forest.

The Sustainability of Harvesting

It has been argued that tribals and indigenous people who live on the fringes of forest, and depend on it for survival, have lived in harmony with nature and generally followed sustainable harvesting practices (Sharma 1990; Orlove and Brush 1996 in Sinha 1999). But do today's villagers who are exposed to the market follow the traditions of their ancestors? Can the forest management practices of today's local communities living on the forest fringe be considered sustainable development? What is sustainability? Sustainability has become a central concept in the management of natural resources. The most well-known definition of 'sustainable development' was provided by the World Commission on Environment and Development (WCED 1987:8) when it said:

> *Humanity has the ability to make development sustainable--to ensure that it meets the needs of the present without compromising the ability of future generations to meet their own needs.*

Implied in the definition is a provision that current generations leave succeeding generations with at least as much capital and natural wealth as the current generation inherited (Pearce *et al* 1989:3).

Ravindranath, Gadgil, and Campbell (1996:287) have identified three steps that local communities could take to ensure sustainable forest management. The first step is to halt the degradation process through effective protection. The second step is to impose "access controls" over the resource to initiate ecological recovery. The third step involves developing site-specific methods to "manipulate natural ecosystems to ensure a sustainable supply of important forest products while enhancing biodiversity, water, and soil conservation." The authors note that these steps might "often require a reversal of past and current forest management systems."

Even if the local community follows the steps outlined will they ensure adequate stocking of the forest? And how should the community determine sustainable rates of harvesting for its members? There are at least four ways to determine sustainable practices in forest management. One way is to look for the presence of a large proportion of individuals of a particular species in the lower DBH (diameter at breast height) class (Ravindranath and Premnath 1997:12). A large proportion of individual trees, say, in the lower one-third DBH class (10-40 cm in girth) would indicate a healthy re-vegetation, and thus sustainability, of a given species.

A second indicator would be the regeneration of seedlings of various species in the forest under protection. Thus, a ratio of 5:1 to 10:1 between a regenerating seedling (girth of 10 cm or less) and the rest of the plants (girth exceeding 10 cms) would indicate a healthy process of regeneration (Rao *et al.* 1997). A third measurement would be the mean annual increment (MAI)[5] in forest growth adjusted against the wood taken from the forest by the local people to meet their domestic and income needs. If the MAI is greater than the off-take from the forest, the local harvesting practices could be deemed sustainable. Since the consumption of fuel wood is the most pressing need of local villagers, one rule of thumb recommended to local communities is to assume that one-third of MAI could potentially be extracted as fuel wood (Ravindranath and Premnath 1997:16).[6]

Finally, a change in the forest cover over a period could indicate whether the regeneration efforts are successful. Remote sensing data derived from satellites could be manipulated to determine improvements, if any, in the forest cover of a country, region, and even a local community. All of these methods were employed in the research and the results are analysed in this chapter.

5. 'Mean annual increment' (MAI) is the average annual rate of increase in the volume of stem wood in a unit area over the normal rotation of a crop. MAI is measured in cubic metres per year. (Lal 1992)

6. A critic has stated there is no scientific basis for this rule; it could be one-third, one-fourth, or one half. T.P. Singh, personal communication.

METHODOLOGY

In this chapter, four research methods were employed. The first, participatory research, was used to tap the village community's indigenous knowledge of forest and the environment. An inventory of the forest was prepared from information gathered in the course of participatory transect walks.[7] Groups of people from Yapalguda and Borigam villages walked with the author from ridge to valley identifying various species of trees and the usefulness of these species to them. The second method, village sample survey, was used to construct villagers' perceptions on a number of ecological issues. A 10% sample, representative of the village households, was used to obtain information on issues ranging from forest growth before and after VSS formation to coping with life without forest.

In the third method, sample plot survey, several plots of up to 1,000 square metres in area per village were laid on a random basis in the forest areas protected by the villagers. The plots in the two VSS village forests (Yapalguda and Kishtapur) were compared with the forest in the non-VSS village (Borigam) to determine if the protection and management by the VSS had improved the forest cover. Finally, remote sensing data were obtained from the forest department to triangulate data from the research plots. Using directional global positioning system (DGPS) equipment, forest boundaries protected by the villagers were surveyed, and the different classes of vegetation within the forest boundary were verified with the help of the forest staff. Data from the satellite images for the three villages were compared for the years 1996 (when most of the VSS were formed in Andhra Pradesh) and 1998.

Thus, community-based participatory tools, conventional research methods like sample plots in the forest and village sample surveys, as well as sophisticated satellite-based technologies were combined to measure the ecological impact of people's protection of the forest.

7. A 'transect' is defined as a line (line transect) or a narrow belt (belt transect) laid out across a given area along an environmental gradient to survey the distribution of species. The presence or absence of species is recorded in the selected area. In a transect walk, a group of people walk at an easy pace recording tree species, agricultural products, and human settlement seen. Often, the walk starts from the ridge to the valley and can take up to one hour and one kilometre (Lal 1992).

RESEARCH FINDINGS

A variety of native species are found in the forest adjoining Yapalguda, Kishtapur, and Borigam (YKB) villages. These trees have served the food, timber, medicinal, and religious needs of the villagers for several decades, and continue to do so today. I conducted a "transect walk" with a randomly selected group of people from the villages of Yapalguda and Borigam. We began the walk from the ridge of the forest adjacent to the village and ended in the valley on agricultural lands of the residents. The walk took one-and-a half to two hours during which the villagers identified the trees in their local language and the uses these trees had in their daily life.

The people of Yapalguda identified 21 tree species from the adjoining forest as being useful to them; those from Borigam identified 17 species (see Tables 2 and 3). At least 11 species appear in both sample inventories. This commonality is not surprising since the two forest patches are next to each other. In fact, more species would be found in each other's jurisdiction, if the survey had been extended beyond the limits of the transect walk. For example, chinta (*Tamarindus indica*), which yields tamarind that is used in everyday cooking, is not found in the Borigam list, but is commonly found in the forest behind Borigam village. Similarly, kareli (*Acacia sundra*), used for reddening of betel leaves, which residents chew, is in the Borigam list but not in Yapalguda's; this tree is scattered in the forest around Yapalguda. Likewise, anduk (*Boswellia serrata*) and tirman (*Anogeissus latifolia*) are found in the upper reaches of Yapalguda and Borigam, but were not identified by the two groups of villagers in the transect walk.

TABLE 2: INVENTORY FROM TRANSECT WALK AT YAPALGUDA, 1998

LOCAL NAME IN GONDI LANGUAGE	BOTANICAL NAME	END-USE CATEGORIES	MAIN END-USES
Ippu	*Madhuca indica*	Food	Nuts, produce oil for cooking
Nalamadi	*Terminalia Tomentosa*	Commercial Use	Yields gum, timber
Tirman	*Anogeissus latifolia*	Fuel, Commercial Use	Charcoal, produces handles
Tani	*Terminalia belerica*	Medicinal Value	Leaf used for stomach ailments
Modhgu	*Butea superba*	Commercial Use	Leaf plates, ropes
Teak	*Tectona grandis*	Commercial Use	Timber for houses, furniture
Tumri	*Diospyros Melanoxylon*	Food, Commercial Use	Rolling *bidis* (local cigarettes)
Niruli	*Elaeondendron glacum*	Fuel, Medicinals	Leaves used to dispel evil spirits
Sirca	*Buchanania latifolia*	Food	Fruits produce expensive sweets
Togormundi	*Morinda tinctoria*	Commercial Use	Bullock-cart centre wheel

Cocum	*Semecarpus Anacardium*	Food, Medicinals	Medicinals and cooking uses
Kirsi	*Albizzia procera*	Fuel, Commercial Use	Fuel wood, boat building
Gupti	*Odina Wodier/Linea grandis*	Fuel, Commercial Use	Packing-box material
Sale	*Boswellia serrata*	Fuel, Commercial Use	Tallest tree; used for matches
Babur	*Gymnasporia montana*	Other	Fencing material
Burgu	*Bombax ceiba*	Medicinals	Medicine for dysentery, typhoid
Raya	*Cassia fistula*	Commercial Use	Tanning material
Chinta	*Tamarindus indica*	Food, Commercial Use	Used in cooking, sale in market
Surey	*n.a.*	Food	Fruit is eaten
Makhe	*Aegle Marmelos*	Food, Religious significance	Tree of religious significance
Falesa	*Givotia rottleriformis*	Commercial use	Toy-making

The omission of a few commonly found tree species in the list prepared after a transect walk highlights one of the limitations of the participatory approach in academic research. However, the advantages of using participatory techniques, like PRA, outweigh the limitation.[8]

TABLE 3: INVENTORY FROM TRANSECT WALK AT BORIGAM, 1998

LOCAL NAME IN BANJARA	BOTANICAL NAME	END-USE CATEGORIES	MAIN END-USES
Dikamalu	*n.a.*	Commercial Use	Leaves used for making dining plates, fruit is edible
Mondi	*Madhuca indica*	Food	Nuts, produce oil for cooking, liquor extracted from flowers
Davedi	*Anogeissus latifolia*	Fuel	Fuel wood
Bamboli	*Acacia leucophloea*	Commercial Use	Cart-wheel produced from hardwood
Saguan	*Tectona grandis*	Commercial Use	Multiple uses; furniture, doorframe
Charoli	*Buchanania latifolia*	Food	Fruits produce expensive sweets, substitute for cashew
Sadhoda	*Terminalia tomentosa*	Commercial Use	Multiple uses, substitute for teak; house-building, construction

8. PRA, or participatory rural appraisal, refers to "a growing family of approaches, behaviours, attitudes, and methods to enable people to analyse and share their realities, to plan, act, monitor and evaluate." Definition provided by Robert Chambers at a workshop in New Zealand, November 1997.

Tendu	*Diospyros Melanoxylon*	Commercial Use	Leaves used to roll *bidis*, fruit edible
Aller	*Morinda tinctoria*	Commercial Use	Gum, produce buttermilk
Lotpatana	*Canthium didymum*	Food	Fruit is edible
Daduga	*Butea superba*	Commercial Use	Leaf plates, rope, roof thatching
Bonglia	*Odina Wodier/Linea grandis*	Medicinals, Fuel	Leaf used to combat chicken disease; also fuel wood use
Bore	*Zizyphus Jujuba*	Food	Fruit edible, branches for house fence
Kareli	*Acacia sundra*	Other	Used for reddening betel leaves
Ramdanda	*Cassia fistula*	Food, Commercial Use	Tanning materials elsewhere, edible fruit is consumed in village
Billa	*Aegle Marmelos*	Religious significance, Food	Leaves used in religious worship, edible fruit
Kokdi	*Semecarpus Anacardium*	Medicinal and Commercial Use	Oil used for healing injuries, fruit shell produces dye for marking

The walk with the villagers showed that they had a good knowledge of the various tree species and how they could be used in daily life. The walk also led to a discussion of problems and solutions to local resource management concerns, among them a listing of local species of importance to the villagers.

In addition, the walk led the elders of Borigam to throw a challenge to the author. "We will give you a list of 366 trees in our forest and tell you how we use these trees." The author accepted the challenge. Six weeks later, one of the educated persons in the village, came up with a list: it had 124 species. A team of four persons, comprising the young and the old, had gone into their forest backyard for several days to identify the various species. The team was disappointed it could not come up with the promised 366 species, but was elated that the forest officers attached to their village could not identify 21 of the species on their list.[9] This fact confirmed the villagers' belief that they knew more about their forest than the forest officials.

An analysis of the tree species identified in the transect walk by the two village groups highlighted four issues. First, many trees have multiple uses to villagers: for example, kokdi (*Semecarpus*

9. When asked how they came up with the figure of 366, one of the elders reasoned: "There are 365 days in a year, we can easily come up with one tree for use per day. But we thought, we should give you one more tree as a bonus."

Anacardium) is used for healing injuries, while its fruit shell produces a dye used by *dhobis* (washer folk) and dry cleaners to make indelible marks on clothes. Second, selling forest products in the market is an important consideration for the villagers. "Commercial use" is mentioned 20 times in Tables 2 and 3. Third, food use comes second to commercial use in the usefulness of a forest, followed by fuel and medicinal purposes. Grinding nuts of ippu (*Madhuca indica*) to extract cooking oil and selling the charoli fruit (*Buchanania latifolia*), which is used as a substitute for cashew nuts, are two examples of food items obtained from the forest; the former is consumed at home, the latter is sold in the market. Four, on the downside, no environmental use has been mentioned, though many trees (eg, *Bombax ceiba*) have soil-conservation properties and some leguminous trees (eg, *Dalbergia sissoo* and *Acacia nilotica*) fix nitrogen to improve soil fertility. In the minds of the villagers, environmental use is related more to the general forest than to individual trees.

Knowledge of Ecological Services

Villagers have some knowledge of the environmental services rendered by the forest and generally offer anecdotal evidence in support. Prevention of soil erosion, conservation of moisture, and replenishment of water in wells are the commonly expressed environmental benefits of protecting the neighbourhood forest. Because measuring these benefits is complex, and the villagers had no interest in their quantification, no effort was made to measure these benefits. However, residents of Yapalguda reported during May-end 1999, the height of summer, that water levels had increased in their wells between one foot and three feet in one year. There are 14 wells in the village: all of them recorded an increase in water levels over the corresponding period a year earlier.

While part of the increase could be attributed to better rainfall in 1999 in Adilabad district over the previous year, the local farmer Chitroo insisted that erecting bunds out of stones along the contours of the forest had a lot to do with the rise in the water level of his well. This increase in the water level enabled him to grow a second crop in 1998, as he was certain he would have sufficient water for his crop to tide him over to the summer. Several other villagers agreed in a group discussion that regeneration of the forest, as a result of forest protection by VSS members, and the building of bunds to slow the rush of water from the hills, had enabled them to plant a second crop after the rainy season. The people of YBK villages do not understand the concept of biological diversity.[10] However, the elders of Borigam who came up with a list of 124 tree species are aware of the disappearance of some of these species as a result of over-harvesting or indiscriminate hacking. They have named 12 tree species as having disappeared from their forest over the past three to a hundred years (see Table 4). While the elders think the disappearance of these species is a "bad thing," they are not certain how this

10. Biological diversity, or 'biodiversity' is the variety of plant and animal life in the world or in a particular habitat. A high level of biodiversity is considered to be both important and desirable (New Oxford Dictionary 1998).

loss will affect their lives. For at least three extinct species, the villagers have found substitutes. For example, *rakta khandoba* has been replaced by *pala khandoba* or *amliyar* to help with setting broken bones. For the other 11 species, the substitutes are either not known or are not available. Jadhav Baliram, Borigam's "medicine man," sometimes wanders for several days searching for plants he can use in his medicine. Often, he returns empty handed (see Box 1).

BOX 1: MEETING THE MEDICINE MAN OF BORIGAM

Jadhav Baliram, 45 years of age, is regarded as Borigam's medicine man. He has dabbled in herbal medicine for 20 years to help cure common ailments. He acknowledges that he learned of the medicinal value of plants from the Gond neighbours of his village; his guru was Vallu Maharaj who died in 1983. The guru showed him how to mix and combine various herbs.

Baliram sometimes spends several days in the distant forest, traversing 20 to 30 kms looking for a bark, or a leaf, or a fruit to cure the ailments of his people. He looks at the ailment first and then goes looking for the plant. He smiles when villagers refer to him as the medicine man, but tells me that making herbal concoctions is more of a hobby. He is saddened by the disappearance of a dozen native plants of medicinal value, but expresses happiness with the forest department's plans to encourage the growth of medicinal plants in the village commons.

Similarly, the elders of Kishtapur like Akad Singh, aged 85, remember that many tigers roamed the forest some 50 years ago. While Akad Singh regrets the loss of the tiger habitat, he would not like to go back to the days when he hid in the upper reaches of his grass hut whenever the 'king of the jungle" growled nearby. Akad Singh's observation is a pointer to the fact that while we may bemoan the loss of tiger habitats, increasing human population and their changing lifestyles have reduced the dependence of many rural people on the forest.

TABLE 4: THE EXTINCT TREES OF BORIGAM

	LOCAL NAME	LOCAL USES	WHEN EXTINCT	NAME OF SUBSTITUTE
1	Chandanero	Religious worship	100 years	None
2	Pala khandoba	Set broken leg	50 years	Amliyar
3	Dhollodaguda	Miscellaneous use	50 years	Kallodhaguda
4	Kalakumari	Deterrent against snakes	50 years	
5	Rakta khandoba	Set broken leg of animals	30 years	
6	Kodakleer	Edible fruit eaten	10 years	
7	Sisamer	Make furniture	20 years	
8	Dhollo akhero	Medicine against cough	15 years	
9	Dhallo saguna	Medicine against cough	3 years	
10	Sula	Edible fruit is eaten	50 years	
11	Badhamer	Edible fruit is eaten	50 years	
12	Sikkakayar	Serves as shampoo	50 years	

Note: It was not possible to get the botanical names of the extinct species. There is no written information on local uses. Local forest officers were not familiar with the extinct species.

In contrast, villagers had a clearer idea of the benefits they derived from picking non-timber forest products (NTFP) and could offer details on the items collected for both consumption at home and for sale in the market. The four important NTFPs to the villagers are firewood, flower and nut from the mahua tree (*Madhuca indica)*; the bidi leaf of the tendu tree (*Diospyros Melanoxylon*) used to roll country cigarettes; and the fruit of the charoli (*Buchanania latifolia*), which serves as a substitute for the expensive cashew nut used in the preparation of desserts.

Laying of Research Plots

A more systematic research into the ecological impact of joint forest management was conducted by laying research plots on a random basis in the three forest areas under protection (details in section 3 under "Methodology"). The forest department had allocated between 300 and 475 hectares to the three YKB villages for protection (see Table 5). The research plots were laid to compare data from the three villages for three purposes. First, basic ecological data were gathered for comparison, such as, the standing stock of trees, the mix of species, natural regeneration of seedlings, and other information. Second, forest areas treated silviculturally by villagers with the help of the forest department were compared with areas from the same forest, which did not receive such treatment. Third, the forests of two villages (Yapalguda and Kishtapur), which had a protected regime, were compared with those of a third village (Borigam), which did not have such a regime in place at the time of research.[11]

11. For all purposes, Borigam is a non-VSS village. The forest department hastily formed a VSS when I included the village in the research area. A VSS was formed in March 1998, a few works were undertaken, but then the VSS was dropped from the official list. The forest department "handed over" the village to another government agency for inclusion under a watershed programme financed by the Drought-Prone Area Programme (DPAP) of the Government of India. The village no longer has a VSS. The watershed programme continues in the village, but the focus is more on land development, mainly soil conservation works along agricultural fields.

TABLE 5: FOREST AREA GIVEN BY THE FOREST DEPARTMENT TO VSS FOR PROTECTION (in hectares)

NAME OF VILLAGE	YEAR OF VSS FORMATION	FOREST AREA GIVEN TO VSS		AREA SILVICULTURALLY TREATED, UP TO MARCH 1999
		OFFICIAL FIGURE	VERIFIED FIGURE	
Yapalguda	21 January 1995	475.6	269.78	158
Kishtapur	17 July 1996	421	405.1	138.76
Borigam	16 March 1998	300	423.26	56

Source: Forest Department, Neredigonda Range, Adilabad Circle

Note: The forest department had allotted degraded forest to VSS without a proper survey. Subsequent surveys revealed wide disparities in area. Thus, Yapalguda was alloted 475.6 hectares in 1995, but a survey in 1999 revealed that the forest area was actually 269.78 hectares. Borigam is treated as a non-VSS village.

Ecological Data Compared

The dominant tree species—the dominance is based on the frequency of occurrence—found in the forests of the YKB villages are listed in Table 6. Teak (*Tectona grandis)* tops the list in all the three village forests, ranging from 214 trees per hectare in Kishtapur to 337 trees in Yapalguda. Teak is a valuable timber, which in 1999 fetched a price of up to Rs 28,000 per cubic metre of wood from a mature tree with a girth of 120 cms and exceeding a height of six metres. The timber is used mainly to make furniture, but is sometimes also used in house construction. Nalamaddi (*Terminalia tomentosa*) is another hardy species with multiple uses; it is commonly referred to as a "poor man's teak" in the construction industry. Mahua (*Madhuca indica*) is a multi-purpose tree that figures prominently in every villager's list: its nut is used to extract oil by the Gonds of Yapalguda and the flower is used to brew alcohol by the Lambadas of Borigam. The residents of Kishtapur dry the flower and sell it in the market for producing sweets. A mahua tree is rarely felled; even timber thieves have respect for it, say villagers.

Because of the domination of teak the forests of YKB villages, as well those of Adilabad district, are known as mixed-teak forests. Teak trees account for 43.10 % of total trees in Yapalguda, 31.47 % in Kishtapur, and 41.54 % in Borigam. Over 30 other varieties of species were found in the research sites adjacent to the three villages (see Table 6). The residents of Borigam came up with an even longer list of 124 trees. These data indicate that the forests of Neredigonda[12] are biologically rich and diverse, despite the past history of logging, timber smuggling, and illegal hacking.

12. The administrative area in which the village of Yapalguda, Kishtapur, and Borigam fall is called Neredigonda. 42 villages form part of Neredigonda mandal. A *mandal* is a sub-unit of a district.

Standing Stock

Data collected from the research sites indicate a standing stock of trees ranging between 674 trees per hectare in Borigam and 782 in Yapalguda (see Table 7). Most trees are in the lower one-third diameter girth class--ie, 11 cms to 40 cms in diameter at
breast height. In the Yapalguda forest, 67% of the trees fall in this category; in Kishtapur it is 62% and in Borigam it is 54% (see Table 8). In the case of seedlings[13]--they fall in the
girth class of 1 cm to 10 cms--the regeneration rate exceeds six to eight times the existing stock of all trees (see Table 7). For example, Yapalguda's stock of trees is 782 trees/hectare while renegerating seedlings are 6,124/hectare, or a ratio of 1:8. The standing stock of the lower one-third diameter class and the total number of regenerating seedlings,
when taken together, indicate that natural regeneration is taking place at a healthy rate.[14]

TABLE 6: THE DOMINANT TREE SPECIES IN NEREDIGONDA FORESTS (trees per hectare)

VILLAGE	SPECIES, LOCAL NAME	SPECIES, BOTANICAL NAME	NUMBER OF TREES
Yapalguda	Teak	*Tectona grandis*	337
	Tirman	*Anogeissus latifolia*	146
	Nalamaddi	*Terminalia tomentosa*	63
	Anduk	*Boswellia serrata*	48
	Mahua	*Madhuca indica*	7
Kishtapur	Teak	*Tectona grandis*	214
	Chenangi	*Lagerstroemia lanceolata*	101
	Nalamaddi	*Terminalia tomentosa*	57
	Mahua	*Madhuca indica*	38
	Anduk	*Boswellia serrata*	35
	Chiranji	*Buchanania latifolia*	33
	Tirman	*Anogeissus latifolia*	13
Borigam	Teak	*Tectona grandis*	280
	Anduk	*Boswellia serrata*	69
	Tirman	*Anogeissus latifolia*	68
	Mahua	*Madhuca indica*	19
	Nalamaddi	*Terminalia tomentosa*	15
	Chenangi	*Lagerstroemia lanceolata*	14
	Chiranji	*Buchanania latifolia*	11

13. "Regenerating seedlings" refers to the natural regeneration of seedlings in the forest of Adilabad.

14. In a study of four forest sites in Eastern Andhra Pradesh, more than 90% of the tree species measured diameter at breast height (DBH) of less than 10 cms, defined as regenerating seedlings in this chapter (Rao *et al*, 1997). Thus, the ratio of renegerating seedlings to trees (DBH > 10 cms) was 9:1, slightly above the ratio in the YBK forests. Thus the forests were regarded as developing.

TABLE 7: ECOLOGICAL ANALYSIS OF STANDING STOCK OF FOREST, 1998 (total number per hectare)

VILLAGE	STANDING STOCK OF TREES/ha.	VARIETY OF SPECIES	TOTAL VOLUME OF WOOD (CMT)	REGENERATING SEEDLINGS
Yapalguda	***782***	***31***	***41.64***	6124
Treated area	925	29	48.15	4820
Untreated	567	11	31.89	8080
Kishtapur	***680***	***26***	***41.41***	6048
Treated area	598	19	45.87	5804
Untreated	802	19	34.72	6408
Borigam	***674***	***32***	***41.46***	4600
Treated area	675	25	45.87	3444
Untreated	670	20	34.72	6408
Behroonguda	***837***	***40***	***35.46***	6808
Treated area	715	26	28.18	7696
Untreated	1,064	35	44.81	5164
Chintapally	***458***	20	***25.28***	2253
Treated area	na	na	na	na
Untreated	458	20	25.28	2253

Note: The regenerating seedlings were counted in only one quadrant--the northwest quadrant. However, the number was multiplied by 4 to be compatible with the data for the trees. In Chintapally, the sample plots totalled 0.6 ha compared with a minimum of 1 ha. in the other villages.

TABLE 8: PROPORTION OF TREES IN EACH DIAMETER CLASS IN THE NEREDIGONDA FOREST, 1998 (diameter at breast height [cms]; percentage per hectare)

VSS	11-20	21-30	31-40	41-50	51-60	61-70	
Yapalguda	31.54	21.67	13.97	8.20	6.92	3.97	
Kishtapur	29.81	18.65	14.24	7.05	6.61	3.96	
Borigam	20.89	17.92	15.70	11.56	8.89	6.07	
VSS	71-80	81-90	91-100	101-110	111-120	121+	Total
Yapalguda	3.33	2.69	2.82	1.54	0.90	2.44	100
Kishtapur	4.11	3.96	3.52	1.76	3.67	2.64	100
Borigam	4.89	4.44	3.85	2.6	1.63	1.48	100

Silvicultural Treatment

There are considerable differences among the three villages concerning data from forest areas subjected to silvicultural treatment when compared with forest areas that were not treated.[15] In the forest of Yapalguda, the number of trees in the untreated area is almost half that of the treated area (567 versus 925); in neighbouring Kishtapur, the reverse is true (802 trees in untreated area *vs.* 598 in treated area). In Borigam, the figures for the two areas are fairly similar (670 trees in untreated area *vs.*

15. Silvicultural treatment in the YBK forests involves mainly singling and pruning of the existing stock of trees and planting new saplings in large gaps where no trees exist. In some areas, it could also include weeding. Silvicultural operations are intended to improve the quality of the forest and enhance the value of the stock. Personal communication from B. Nagnath, Divisional Forest Officer, Jannaram Division.

675 in treated area). The differences are, perhaps, on account of site-specific attributes of the local area. Local foresters can offer no other explanation.

Harvesting the Forest

As the forests nearby regenerate, the villagers harvest timber and non-timber products for use at home or for sale in the market. During 1998, 41 cubic metres (cmt) of timber were produced per hectare in each of the three forest areas adjacent to Yapalguda, Kishtapur and Borigam (YBK). During the same period, the villagers harvested between 75 and 437 cubic metres (cmt) of timber for house construction, furniture, and agriculture tools (see Table 9); the higher figure for Kishtapur can be attributed to a fire that destroyed the village in 1997.[16] The annual growth of timber in the forest is 1.98 cmt per hectare in Kishtapur, 0.87 cmt in Yapalguda, and 0.39 cmt in Borigam. The data in Table 9 indicate that the harvest of forest products in each of the three villages is less than the annual growth in the volume of the existing stock of wood. In other words, the harvest practices in 1998-99 were sustainable in all the three villages. However, in Borigam the timber taken out of the forest (148 cmt) came fairly close to the volume of timber generated in the forest in 1998 (165 cmt).

If the present rate of consumption is maintained by the villagers, and community protection of the forest continues, there is enough timber to last 150 years in Yapalguda, 38 years in Kishtapur, and 106 years in Borigam. In reality, the loss of timber is higher than that shown in Table 9 because of illegal felling and timber smuggling by organised, mafia-type gangs. No official figures are available, but one guess is that 5-10% of teak timber is smuggled out of the area each year. This would further reduce the life of the resource.

TABLE 9: TIMBER PRODUCED AND HARVESTED IN YBK VILLAGES, 1998

	UNIT	YAPALGUDA	KISHTAPUR	BORIGAM
Timber in forest	cmt/ha	41.64	41.41	41.46
Mean annual increment	cmt/ha	0.87	1.98	0.39
Total annual increment	cmt	234.7	802.1	165
TIMBER USED ANNUALLY FOR				
Housing	4-6 cmt/yr [a]	59	418 [b]	125
Furniture	.0186 x 3	3.29	5.30	5.64
Marriage pandals	0.306 cmt	1.60	5.20	1.84
Handplough	0.028 cmt x 2	3.30	5.32	5.66
Bullock cart	0.25 cmt	7.5	3.0	10.0

16. On 16 February 1997, a major fire in the village destroyed 39 houses and five cattle sheds; many more houses were damaged. The village was devastated by the huge loss. According to a note prepared by CEAD, a local NGO, there was an outpouring of support toward from neighbouring residents, the state government, NGOs, police, and school children. The latter pooled Rs. 1,250 worth of foodgrains. Construction of new houses, with some funding from the government, began in 1998 and was completed by 2000-year end. Most of the timber used by the villagers in the rebuilding came from the forest.

TOTAL TIMBER CONSUMED		74.69	436.82	148.14

Notes: ***a.*** *The average timber used in the building of a brick house is 4 cmt and in the construction of a thatched hut it is 6 cmt with 1 cmt for annual repairs.*
b*. The timber used in house construction in Kishtapur shows a high of 418 cmt; this was on account of a fire in 1997 that destroyed almost all houses. In 1998, some 80% of the houses were rebuilt. Thus, an average of 4 cmt/house was used for 76 brick houses and 6 cmt/house for 19 temporary thatched homes.*

Similarly, between 5 and 13 tons of fuel wood is being generated per hectare in the three forests. This amount comprises mainly lops and tops of the standing stock of trees. The villagers' total fuel wood use ranges from a low of 70 to 84 tons in Yapalguda to a high of 130 to 145 tons in Borigam (see Table 10). One reason for the big difference could be that Borigam residents cook more often, and brew alcohol regularly, than Yapalgudans do. Another reason, perhaps, is the better stocking of Borigam forests compared with Yapalguda and Kishtapur. At the present rate of fuel use in the villagers, there are enough lops and tops in the forest to last 15 to 17 years in Kishtapur, 32 to 38 years in Yapalguda, and 39 to 44 years in Borigam. Of the three villages, Kishtapur is more likely to face a fuel shortage, especially if it slackens its guard on protecting the forest or increases the use of firewood.

TABLE 10: FUEL WOOD STOCK AND HARVESTING, 1998

	UNIT	YAPALGUDA	KISHTAPUR	BORIGAM
Fuel wood in forest/ha	kgs/ha	10,179	5,150	13,566
Fuel wood in forest/total area [1]	total kgs	2,746,090	2,086,265	5,741,945
Fuel wood used annually [2]	total kgs	84,960	136,800	145,440
Fuel wood used annually [3]	total kgs	70,840	118,450	129,950
Fuel wood available at present consumption rate	years	32.3 to 38.7	15.2 to 17.6	39.5 to 44.1

Notes: ***1****. The total forest area being protected by the local people is as follows: Yapalguda (269.78 ha), Kishtapur (405.1 ha), and Borigam (423.26 ha)*
2. *Based on a calculation of one cartload per month per family, or 288 kgs/person/year. This estimate is based on the survey done by the author. An average load of 120 kg per cartload is assumed.*
3. *Based on a calculation of 230 kgs/person/year. This calculation is based on a 1974 pre-investment survey conducted in Adilabad district by the Government of India (Nagnath, 1991).*

With vs. Without Protection

In January 1998, when research in the area began, Yapalguda and Kishtapur villages already had a VSS. Borigam did not. The research data indicate that Borigam lags behind the other two villages in the total number of trees per hectare (674 trees in Borigam vs. 680 in Kishtapur and 782 in Yapalguda) and in regenerating seedlings (4,600 in Borigam vs. 6,048 in Kishtapur and 6,124 in Yapalguda). These data offer some evidence that formation of VSS in Yapalguda and Kishtapur--and consequently some form of protection of the forest in the two villages--had some bearing on the improvement of the forest stock and increased regeneration of the forest.

The data in Table 7 point up another interesting fact: the figures for Yapalguda are marginally higher than for Kishtapur in terms of the total number of trees (15% higher), species mix (19%), and regenerating seedlings (1%). The higher proportion could be attributed to a forest protection regime being put in place in Yapalguda two years prior to Kishtapur. Had the VSS been established for a longer period, say four years, the three figures could have shown an even higher difference.
For example, compare the data from Behroonguda and Chintapally, villages about 100 kms away from Neredigonda. The VSS of Behroonguda was established in May 1993, while that of neighbouring Chintapally was set up in November 1998--a difference of five and a half years. The total number of trees in Behroonguda is 183% higher, species mix 200% greater, and the regenerating seedlings 300% more than those of Chintapally (see Table 7). So, a degraded forest coming under village protection improves the forest stock and biological diversity; the longer the period of protection, the more the improvement.

Remote Sensing

Analysis of the information from the sample plots on the ground was triangulated with remote sensing data.[17] Both aerial photography and satellite imagery form part of remote sensing. Remote sensing is now used in vegetation surveys on a big scale, say, at regional and world levels (Lal 1992:150). The Forest Survey of India has mapped the forest vegetation of the country on several occasions--the more recent being 1981-83, 1985-87, and 1996-98--by manually interpreting satellite images. The data obtained from the 1996 and 1998 satellite passes were used to interpret changes in the forest vegetation of the three research villages.[18] 1996 is useful as a base year; it was in 1996 that joint forest management began to gain momentum in the state. In Adilabad district, 209 VSS--or 20% of the total--were formed in 1996, including Kishtapur village in November 1996. In neighbouring Yapalguda, the VSS was formed in February 1995. Comparing data between 1996 and 1998 provides another source of information on vegetation changes in the forests of Yapalguda, Kishtapur, and Borigam.

The remote sensing data indicate an improvement in the forest cover[19] of the YKB villages ranging from 3 to 6% over the two-year period 1996-98 (see Tables 11-13). The satellite-based data indicate a substantial decrease in the forest areas devoid of trees, called "blanks," ranging from 25 to 40%. The

17. 'Remote sensing' refers to the gathering and processing of information about the earth's environment and its natural and cultural resources through aerial photography and satellite scanning. The definition is derived from a poster in the GIS Cell, Andhra Pradesh Forest Department.
'Triangulation' refers to cross-checking one source of information with another. For example, information provided by men should be triangulated against that provided by women--separately. Secondary sources can be used for this purpose. Triangulation recognises that people's perceptions, knowledge, and memories differ (Gill 1997).
18. The remote sensing data were based on a LISS III imagery of Adilabad district taking by IRS-1C satellite. LISS III is the name of the camera used in imaging, while IRS-1C is the satellite identification number of the Indian Remote Sensing agency.
19. 'Forest cover' here includes 'open' and 'dense forests' and is expressed as a percentage of the total forest area. Areas with a crown density of less than 10% have been excluded from the total.

increase in the area covered by dense forest has ranged from about 4% in Borigam and Yapalguda to 8% in Kishtapur. The data also show some decrease in scrubland and a small increase in 'open forest.'

Limitations of the Data

The data from the satellite imagery suffer from several limitations. First, the period of the satellite passes over Adilabad district was not identical for comparison. In the first pass, the image of the area where YKB villages fall was captured on 2 February 1997 (it is mentioned as 1996 data to be consistent with the rest of the state). The second pass took place on 12 November 1998. In November, the vegetation in Adilabad is generally lush since the rainy season ends by mid-October. February marks the end of winter after which the vegetation begins to wilt. Thus, the four-month gap between November and February--which roughly constitutes a growing season in agriculture--could account for a considerable difference in the vegetation pattern.

Second, the reliability of interpreting remote-sensing data for a small area, such as 250 to 500 hectares of forest protected by a VSS, is 60 to 70%.[20] For example, a scrub area in the forest is difficult to distinguish from a standing crop of paddy.[21] Verification of forest classification within the area--called "ground-truthing"--can increase the reliability of the data. Unfortunately, because of the time and effort involved, the forest department has not yet verified the remote-sensing data until 1999-end.

Third, two years is too short a period in the life of a natural forest where some trees (eg, teak) take 80 years or more to mature. Comparing the data over a two-year period is, therefore, inadequate. Despite these limitations, the data make it clear that forests in the three villages are regenerating and the quality of each of the forest is improving. The rate of improvement--as determined by the percentage change in 1998 over the base data--is higher in Yapalguda than in Kishtapur and Borigam.

In three of the four vegetation categories in Tables 11-13, Borigam compares poorly with Yapalguda and Kishtapur. The exception is 'open forest' where the rate of increase is over 9% in Borigam compared with 4% in Yapalguda and 2% in Kishtapur. Morever, research from the sample plots indicate that Borigam compares less favourably with its two neighbouring villages in terms of total number of trees and regenerating seedlings per hectare, which are indicators of present and future forest stock (see section "With protection vs. Without Protection").

TABLE 11: YAPALGUDA - CHANGES IN FOREST COVER BASED ON SATELLITE IMAGERY, 1996-98

CATEGORY	1996	1998	PERCENTAGE

20. Personal communication from Madhava Rao, Range Officer, GIS Cell, A.P. Forest Department.
21. In remote-sensing language, "scrub" refers to plants with girth of less than 10 cms and a height of less than 3 metres.

			CHANGE
Blanks	12.84	9.04	-30.00
Scrub	34.96	34.52	-1.26
Open	85.26	87.00	2.05
Dense	132.71	139.22	4.91
TOTAL	265.77	259.76	
FOREST COVER (%)	82.01	87.08	6.18

Note: "Blanks" refers to an area devoid of tree and scrub; "scrub" refers to lands with crown density of less than 10%; "open" refers to forests with crown density ranging from 10 to 40%; "dense" forests have a crown density exceeding 40%.

TABLE 12: KISHTAPUR - CHANGES IN FOREST COVER BASED ON SATELLITE IMAGERY, 1996-98

CATEGORY	1996	1998	PERCENTAGE CHANGE
Blanks	18.66	11.12	-40.41
Scrub	71.54	63.94	-10.62
Open	202.81	208.63	2.87
Dense	112.09	121.42	8.32
TOTAL	405.1	405.11	
FOREST COVER (%)	77.73	81.47	3.74

TABLE 13: BORIGAM - CHANGES IN FOREST COVER BASED ON SATELLITE IMAGERY, 1996-98

CATEGORY	1996	1998	PERCENTAGE CHANGE
Blanks	92.12	68.60	-25.53
Scrub	120.73	129.49	7.26
Open	102.81	112.78	9.70
Dense	107.25	112.03	4.46
TOTAL	422.91	422.90	
FOREST COVER (%)	49.67	53.16	3.49

Villagers' Perception of Forests

Data from field research and remote sensing were complemented by surveys of villagers' perceptions of changes in their forest to determine if perceptions matched reality. A sample of the villagers was asked, "What was the state of the forest before VSS formation?" A majority of the respondents (67.5%) felt the forests in their neighbourhood were in a bad condition prior to the formation of the VSS (see Table 14). The people of Yapalguda and Kishtapur were unanimous in this opinion. However, the residents of Borigam had a different view: 73% felt the forests were in a good condition prior to the VSS formation, 13% felt they were bad, and another 13% were not sure.

TABLE 14: VILLAGERS' PERCEPTION OF FORESTS PRE-VSS, 1998

Question: What was the state of the forest before VSS formation?

VSS	Sample size (number)	Good (percent)	Bad (percent)	Don't know (percent)
Yapalguda	10	0	100	0
Kishtapur	15	0	100	0
Borigam	15	73	13.3	13.3
TOTAL	40	27.5	67.5	5

Note: Some numbers may not add up because of rounding. The village sample comprised at least 10% of the total households. Only the head of the household was asked this question, often in the presence of other family members.

The same sample was also asked, "Have the forests improved after VSS formation?" A majority of the respondents (67.5%) replied in the affirmative, 15% did not think the forest had improved, and 12.5% were not sure (see Table 15). Once again, the Yapalguda and Kishtapur residents were unanimous in replying "yes." The Borigam people had mixed views: 40% replied that the forests had not improved after VSS formation, 27% felt the forests had improved, and 33% had no opinion, or were not sure.

TABLE 15: VILLAGERS' PERCEPTION OF FORESTS POST-VSS, 1998

Question: Have the forests improved after VSS formation?

VSS	Sample size (number)	Yes (percent)	No (percent)	Don't know (percent)
Yapalguda	10	100	0	0
Kishtapur	15	100	0	0
Borigam	15	27	40	33
TOTAL	40	72.5	15	12.5

Note: Some numbers may not add up because of rounding. The village sample comprised at least 10% of the total households.

Overall, the villagers' perception of an improvement in the forest cover in their neighbourhood is borne out by the data from the research plots laid by the author in the same forests. The unanimity of views expressed by the residents of Yapalguda and Kishtapur in their responses could be attributed to the existence of the VSS in their villages for five years and three years, respectively. In contrast, the conflicting opinions among Borigam residents are due to the late beginning of their VSS. The forest protection committee was formed in Borigam in March 1998, whereas the sample survey was conducted in the three villages in August 1998. The four-month intervening period is too short for Borigam residents to understand the working of their protection committee and detect any change in the forest cover.

In the sample survey, villagers were asked about the causes of improvement in the forest. The people were also asked what role they had in making the improvement. "Protecting the forest" was the common answer. However, there were variations in the response in the three villages (see Table 16). In Yapalguda, the people had organised themselves into a VSS and formed a managing committee to oversee forest development. The villagers claimed they regularly patrol the forest area to prevent

illegal felling of trees and smuggling of timber. The villagers were a little vague on how the patrolling was done. In Kishtapur, a majority of the residents (87% of the sample) mentioned forest protection as their main contribution toward improving the forest. A few others also mentioned the building of bunds (a soil-and-moisture conservation measure) and singling of trees (a part of silvicultural treatment). Borigam residents had a list of negatives and positives. On the positive side, there was a vague mention of "done some work" in the forest (40%) and one reference to trees being planted. On the negative side, the respondents candidly admitted that "nothing had been done" (27%) or did not know of anything being done (33%).

TABLE 16: VILLAGERS' ROLE IN IMPROVING FOREST, 1998

Question: What has the village done to make the forest better?

VILLAGE	ACTIVITIES
Yapalguda	Established VSS, formed managing committee Taken up forest patrols to prevent smuggling, and to protect the forest
Kishtapur	Taken up forest protection (13) Taken up bunding and singling Done some good work
Borigam	Done some work (6) Have done nothing (4) Planted some trees (2) I don't know (5)

Note: The table summarises the responses of 40 people in the sample survey. Where there are multiple responses of a similar nature, their number is mentioned in parentheses.

Villagers were also asked about the role played by the forest department in forest development. Yapalguda and Kishtapur residents made some positive statements about the department (see Table 17). Most Yapalguda residents (70%) credited the department for initiating "forest development"--this term includes help with forming a VSS, preparing the village micro-plan,[22] and sanctioning various conservation and afforestation works. Likewise, Kishtapur residents credit the department with providing "technical advice," a term that covers advice to villagers on planting, pruning, and singling trees; on forming a VSS and managing committee; and on other village matters. Borigam residents had mixed views: a majority (40%) had no idea what the department staff had done, or felt they had done nothing (33%), while the remainder agreed vaguely that the foresters had "done some work" or mentioned specifically that they had planted trees. The VSS in Borigam was formed in March 1998, the forest work was initiated in June, and the survey was conducted in August. So, it is no surprise that most Borigam residents were not aware of work done by the forest staff.

TABLE 17: FOREST DEPARTMENT'S ROLE IN IMPROVING FOREST, 1998

22. A village micro-plan is supposed to be prepared by forest department staff in consultation with the villagers. Sometimes, local NGOs are hired to prepare the plan. A micro-plan should contain social, economic, cultural, and vegetation information of the village. It should also specify the forest area to be protected by the VSS, silvicultural plans to improve the degraded part of

Question: What has the forest department done to make the forest better?

Village	Activities
Yapalguda	Initiated forest development (7) Planted trees, organised bunding works Expand the area under forest
Kishtapur	Provided technical advice (13) Talked about VSS responsibilities Gave money for forest work
Borigam	Done some work (2) Have done nothing (5) Planted some trees (2) I don't know (6)

Note: The table summarises the responses of 40 people in the sample survey. Where there are multiple responses of a similar nature, their number is mentioned in parentheses.

In the literature, reference has been made to the symbiotic relationship that tribals, and other people who live close to the forest, have with the natural resource. Forests and tribals are regarded as inseparable; the existence and development of one depends on the other. Some of the tribals are said to regard various tree species as their kith and kin (Rao *et* al 1993). To understand this symbiotic relationship, residents of YKB villages were asked, "What would you do without the forest?" The responses ranged from a negative doing "nothing" to a positive "plant trees to rejuvenate the forest" (see Table 18).

TABLE 18: VILLAGE LIFE WITHOUT FORESTS

Question: What would you do without the forest?

VILLAGE	SOME COMMON RESPONSES
Yapalguda	Nothing (7) Leave the village, migrate elsewhere Do not know
Kishtapur	Plant more trees (14) Expand forest area
Borigam	Will have problems (4) Leave the village, migrate to cities (3) Work in agriculture Plant trees to rejuvenate forest

Note: The table summarises the responses of 40 people in the sample survey. Where there are multiple responses of a similar nature, their number is mentioned in parentheses.

Surprisingly, the Gonds of Yapalguda were quite negative: 70% of the village respondents said they would do nothing, the rest either did not know what to do or opted to leave the village in search of a better life elsewhere. Sidham Bhimrao, a VSS managing committee member of Yapalguda summed up the last view: "We would [then] have to leave the village and go somewhere else [where there is forest] for survival." In contrast, Kishtapur residents were optimistic. 93% of the Kishtapurians said they would plant trees to bring a dying or a dead forest to life. The Borigam residents' responses were mixed. While 27% recognised they "will have problems" if there were no forest in their backyard, 20% were prepared to leave the village and migrate to the cities, or work in agriculture full time. P.

---

the forest, and various works to be undertaken in the forest and in the village over a period of six years.

Nanda, who runs a village grocery store, was the most positive. “We will plant more trees to ensure the forest survives,” he promised.

The responses from the three villages indicate that most residents cannot imagine being without a forest in their backyard, as it has been a part of their livelihood for several decades. When the Gonds of Yapalguda suggest that “nothing” can be done when the forest disappears, it is more a case of disbelief that there will be no forest in their vicinity. The area where Yapalguda stands as a village today was a forest some 40-plus years ago. Even after the area was cleared to make way for houses and farms, there was abundant forest left. “Those days when a man walked into the forest from the village, he could be seen no more--so thick were the forests,” noted Mendadi Isroo, the VSS president of Yapalguda.[23] Much of the forest has now been depleted--so the man who walks into the forest today can be seen from a distance--but the residents believe the forest is rejuvenating on account of the villagers’ protection and forest department interventions through silvicultural treatment and soil-and-moisture conservation measures.

The optimistic expressions of P. Nanda, the grocer of Borigam, and a majority of people from Kishtapur are not very convincing. On their own, these villagers have done little to plant more trees. The Kishtapurians acknowledge they had neither planted trees around their homes, nor in the forest, prior to the establishment of VSS. Even after the formation of the VSS, the initiative for afforestation, in most cases, has been taken by the forest department staff rather than by the villagers. So, while the loss of the forest might be of concern to the YKB people, these concerns have not been backed by any action to reverse the forest degradation until the formation of the VSS. The first step taken after the VSS formation was to protect the forest through patrolling--either on a formal or on an *ad hoc* basis--by VSS members.

23. In December 1999, Isroo was replaced as VSS president following forest department allegations of impropriety.

SIGNIFICANCE OF THE FINDINGS

The transect walk with the people of Yapalguda and Kishtapur made clear that local communities are knowledgeable about their natural resource. The fact that the residents knew the names of the trees and the uses of each species indicates the important role the forest plays in the life of the local people of Neredigonda. The knowledge is based on the people's own practical experiences in the forest and in the use of forest products as well as oral knowledge passed on by elders. In the literature, references are made to a symbiotic relationship that tribals and other indigenous people have with forest (Sharma 1990; Orlove and Brush 1996). The findings from the research in the villages of Yapalguda, Kishtapur, and Borigam (YKB) support these assertions.

For the people of YBK villages, forests have multiple uses. The same tree often provides multiple products for use at home and for sale in the market. At times, villagers put the same product to different use depending on their personal preference or cultural practice. For example, the Lambada tribe of Borigam uses the flower of mahua (*Madhuca indica*) to brew alcohol for home consumption, while the residents of neighbouring Kishtapur dry the flower for sale in the market. The concept of forests having multiple users and multiple uses has slowly gained ground in many a developing country. The research findings from Adilabad district lend credence to the concept.

While the villagers were enthusiastic in discussing the immediate gains from forest use--eg, food, fodder, medicine, and commercial use--they were less forthcoming in discussing the ecological benefits of forests. The benefits of prevention of soil erosion, conservation of moisture, and replenishment of water tables were fairly vague to most of them. The importance of maintaining biological diversity of flora, fauna, and wildlife was lost on the villagers. Though the elders of Borigam were aware of the loss of some medicinal plants in their backyard, they had either found substitutes for the extinct plants or did not find the loss too significant. These findings are not surprising. Rural people who lead a subsistence life, as most residents in the three research villages do, are more likely to be concerned with the immediate gains or losses. The medium-term gains (eg, from the prevention of soil erosion) and long-term cost (eg, through a loss of biodiversity) are less of a concern to them at present.

It is significant that biological diversity is retained in the forests of Adilabad, despite a history of logging, timber smuggling, and illegal hacking of trees. The transect walk with the villagers pointed to 17 to 21 different tree species, the research plots showed the presence of 26 to 31 species, and the Borigam villagers' inventory listed 124 tree species. These are positive signs on the biodiversity front. However, there are danger signs as well. There has been a loss of at least 12 tree species of significance to the people of Borigam over the past century and a near disappearance of the tiger

habitat in Adilabad. The losses are probably far greater as there is no recorded inventory of loss of flora and fauna by biodiversity specialists. Besides, wildlife specialists have not conducted any census of the tiger population in the district.

Field research and remote sensing data indicate a healthy trend in natural regeneration of the forest. The regeneration of seedlings in Neredigonda matches the research results in the Eastern Ghats region of north-eastern Andhra Pradesh. In Neredigonda, the ratio of seedlings to mature trees is 6:1 to 8:1, while in the Eastern Ghats it was 9:1 (Rao *et al.* 1997). Most of the trees are in the lower one-third diameter girth class--ie, 11 cms to 40 cms in diameter at breast height--indicating that the forest is developing. In Yapalguda, 67% of the trees fall in this category; in Kishtapur it is 62 %, and in Borigam 54%.

In terms of the total volume of wood, the Neredigonda forests yield more than 41 cubic metres per hectare compared with 35 cubic metres in Behroonguda and 25 cubic metres in Chintapally, a village adjacent to Behroonguda. The lower yield in Behroonguda could be attributed, in part, to the villagers harvesting 3,198 teak poles, as part of silvicultural thinning, after five years of protection, while Chintapally village did not have a community protection regime in place at the time of the research. Data of the natural forest growth in Neredigonda, measured by the mean annual increment, and the off-take from the forest indicate that the sustainability of the Neredigonda forests is assured if the current consumption patterns and the forest management practices of the local people are continued.

Available information indicates that the formation of a village forest protection committee (VSS) has had a positive effect on the ecology of Neredigonda judged on the basis of forest cover. The remote sensing data, despite their limitations discussed earlier, highlight two useful points. First, the forest cover of Neredigonda improved by 5.13% during 1996-98 to 71%; this compares favourably with the all-India figure of 19% and the Andhra Pradesh figure of 15% (FSI :5). Second, 'dense forest'[24] increased by 5.8% during the two years, constituting 34% of the total Neredigonda forest in 1998; this compares favourably with the total of 11% in India and almost equals the average of 36% in Andhra Pradesh. These improvements, in large part, can be attributed to forest protection by the community, also known as social fencing. This finding supports the evidence found elsewhere in India and Asia that social fencing, in many cases, is a better option than raising monoculture plantations (Poffenberger and McGean 1996).

It is also significant that the longer the forest remained under a community's protection, the better the forest cover appeared, and greater was the biological diversity (see Table 19). Thus, forest cover was

24. 'Dense forest' refers to lands with a forest cover of trees with a canopy density of 40% and above (FSI 1997).

higher in Yapalguda (87%) where the VSS was formed in January 1995 than in Borigam (53%) where it was formed in March 1998. Similarly, biological diversity was lowest in Chintapally (20 tree species), where the VSS was formed in November 1998, and highest in neighbouring Behroonguda (40 species), where the VSS was formed in May 1993. The data in Table 18 make clear that local people's participation in protecting their forest makes a difference to the quantity and quality of the resource. Since this is the basis of the joint forest management, the government's approach and programme appear to be well grounded.

TABLE 19: RELATIONSHIP BETWEEN VSS FORMATION AND ECOLOGICAL INDICATORS, 1998

VILLAGE	VSS FORMATION (MONTH/YEAR)	FOREST COVER, 1999 (%)	VARIETY OF TREE SPECIES (NO.)
Yapalguda	January 1995	87	31
Kishtapur	July 1996	81	26
Borigam	March 1998	53	32
Beroonguda	May 1993	n.a.	40
Chintapally	November 1998	n.a.	20

Note: n.a. = data not available

The perception of the local people on the status of their neighbourhood forest matches the research findings and the remote sensing data. Formal household surveys and informal group discussions indicate that a majority of people believe that their forests were in a bad condition prior to the formation of the VSS in Neredigonda and that the quantity and quality of the forest began to improve once the protection regime was put in place. The villagers say that their main contribution was "protection" of the forest while that of the forest department was providing "technical advice." The villagers' response suggests a complementarity of roles--the villagers serving as protectors and managers of the resource and the government agency playing an advisor and facilitator. However, while the overbearing role of the forest department has changed over the years, it is far from an ideal facilitator.

CONCLUSION

The initiation of forest protection by the villagers of Yapalguda, Kishtapur, and Borigam has made some difference to the ecological conditions of the forests. The forests adjacent to the three villages have regenerated, the biodiversity improved, and the forest mix of old and young trees maintained. The difference in the quality and quantity has depended on the duration of protection: the longer the period of protection, the better have been the results. Where no protection regime has been in place, the condition of the forest has been worse than where such a regime existed. These conclusions from Neredigonda are compatible with the findings from the Tadlapet forest range, 100 kms away, where the forests of Behroonguda (protected by the local community for five years) were found to be better than the forest adjacent to Chintapally (where no community protection existed during the research period).[25]

Similar results have been reported elsewhere in Andhra Pradesh (Om Consultants 1998). The people of Neredigonda are blessed in having a mixed-teak natural forest that rebounds easily once protection from browsing animals (particularly goats) and human interferance (eg, logging) is assured. The results in some other areas of the state with forests of lower economic value are said to be less spectacular.[26] Nevertheless, the debate on whether forest protection by communities makes a difference to the ecology of a forest is settled in the case of the forest of Neredigonda. The efforts of the people of Yapalguda, Kishtapur, and Borigam have made the difference to their forest. And so long as the villagers maintain their current consumption patterns, and protection practices, their forests will be sustainable.

25. For details, see D'Silva and Nagnath (1999).
26. Personal communication from Mr. S.D. Mukherji, Principal Chief Conservator of Forests, AP.

ABOVE: Before Community Forest Management, Behroonguda

BELOW: After six years of Community Forest Management, Behroonguda

References

Agarwal, Anil. 1997. “Dark Truths and Lost Woods.” *Down to Earth*, June 15, 1997: 31-40. New Delhi: Centre for Science and Environment.

Ahmed, M.F. 1997. “In-Depth Country Study - India.” Asia-Pacific Forestry Sector Outlook Study. Working Paper No. AFPSOS/WP/26. Bangkok: Food and Agriculture Organization of the United Nations.

Arnold, J.E.M. 1992. “Production of Forest Products in Agricultral and Common Land Systems: Econommic and Policy Issues.” In *Managing the World’s Forests.* Narendra P.Sharma (editor). Dubuque, Iowa: Kendall/Hunt Publishing Company.

Chambers, Robert. 1997. *Whose Reality Counts? Putting the First Last.* London: Intermediate Technology Publications.

Champion, H.G. and S.K. Seth. 1968. *A Revised Suurvey of the Forest Types of India.* Delhi: Manager of Publications.

D’Silva, Emmanuel and B. Nagnath. 1999. “Local People Managing Local Forests: Behroonguda Shows The Way in Andhra Pradesh, India.” AFN Working Paper 3. Santa Barbara: Asia Forest Network.

Forest Survey of India. 1997. *State of Forest Report 1997*. Dehra Dun: Ministry of Environment and Forests.

Gill, Jerard J. 1997. “Participatory Analysis and Information Generation for Natural Resource Management.” In Kerr *et al. Natural Resource Economics: Theory and Application in India.* New Delhi: Oxford & IBH Publishing Co. Pvt. Ltd.

Government of India. 1988. *National Forest Policy, 1988.* No. 3-1/86-FP. New Delhi: Ministry of Environment and Forests.

Government of India. 1952. *The National Forest Policy of India.* New Delhi: Ministry of Food and Agriculture.

Holloway, Marguerite. 1993. “Sustaining the Amazon.” *Scientific American.* Vol 269:76-84.

Lal, J.B. 1992. *Forest Ecology.* Dehra Dun: Natraj Publishers.

Longman Dictionary of Contemporary English. 1987. London: Longman.

Malhotra, K.C. *et al.* 1991. “Role of Non-timber Forest Produce in Village Economy: A Household Survey in Jamboni Range, Midnapore District, West Bengal. Working Paper prepared for Participatory Forest Management Project in collaboration with the Government of West Bengal. New Delhi: Ford Foundation.

The New Oxford Dictionary of English. 1998. New York: Oxford University Press.

Orlove, B.S. and S.B. Brush. 1996. “Anthropology and the Conservation of Biodiversity.” *Annual Review of Anthropology* 25: 329-52.

Om Consultants (India) Pvt. Ltd. 1998. “Evaluation of JFM “& Eco-Development Programmes in Andhra Pradesh.” Final Report to the Andhra Pradesh Forest Department. Bangalore: Om Consultants.

Poffenberger, Mark and Betsy McGean (editors). 1996. *Village Voices, Forest Choices: Joint Forest Management in India.* New Delhi: Oxford University Press.

Rao, K. Kameswara *et al.* 1997. “Ecologinomics of Joint Forest Management in Eastern Ghats of Andhra Pradesh. Annual Report II, 1996-97. Unpublished. Department of Environmental Sciences and Campus Project. Vishakapatnam: Andhra University.

Ravindranath, N. H. and Sudha Premnath. 1997. “Joint Forest Management and Community Forestry: An Ecological and Institutional Assessment in India.” Working draft. Bangalore: Centre for Ecological Sciences.

Ravindranath, N.H., Madhav Gadgil and Jeff Campbell. 1996. “Ecological Stabilization and Community Needs: Managing India’s Forest by Objective.” In *Village Voices, Forest Choices: Joint Forest Management in India.* Mark Poffenberger and Betsy McGean (editors). New Delhi: Oxford University Press.

Ravindranath, Shailaja and Sudha Premnath. 1997. *Biomass Studies: Field Methods for Monitoring Biomass.* New Delhi: Oxford & IBH Publishing Co. Pvt. Ltd.

Sharma, B.D. 1990. “Report of the Commission for Scheduled Castes and Scheduled Tribes.” Twenty-ninth report, 1987-89. New Delhi: Ministry of Labour and Welfare.

Sharma, Narendra (editor). 1992. *Managing the World’s Forests: Looking for Balance Between Conservation and Development.* Dubuque, Iowa: Kendall/Hunt Publishing Company.

Society for the Promotion of Wastelands Development (SPWD). 1992c. “Joint Forest Management: Concept and Opportunity. New Delhi: SPWD.

Tata Energy Research Institute (TERI). 1999. “Study on Joint Forest Management.” Prepared for the Ministry of Environment and Forests. Project Report No. 98SF64. New Delhi: TERI.

Van Buren A. and Peter May. 1982. “Rural Energy Concepts: The Commercialization of Wood and Other Subsistence Fuels.” Brussels: ISPRA.

World Commission on Environment and Development (WCED). 1987. *Our Common Future.* London: Oxford University Press.

ASIA FOREST NETWORK