FIELD METHODS MANUAL

Volume I

Diagnostic Tools for Supporting
Joint Forest Management Systems

Prepared for the
Joint Forest Management Support Program

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User’s Guide to the Manual Series

This report is the first in a two-volume Field Methods Manual set which is being developed to support the implementation of Joint Forest Management (JFM) programs.

Volume I of the Manual describes a range of diagnostic tools and techniques which can be employed to better understand the complexities of the community-forest relationship and thereby help derive improved participatory management strategies between user communities and Forest Departments (FDs).
Volume II summarizes learning from a field training workshop held in Gujarat in April, 1992. Experiences from the Gujarat Participatory Rural Appraisal (PRA) illustrate the utility of methods described in Volume I and the types of forest management issues and implementation options that can be generated.

These Field Manual volumes were written as guides for foresters, NGO development practitioners, university-based researchers, and donor agency staff who are interested in strategies to empower communities and bring them meaningfully into formal forest management systems. The methods were designed to provide an initial understanding of forest use practices and conditions, while opening a dialogue with community members regarding management problems and opportunities.

Volume I is divided into four parts. Part I reviews the macro-forest management context in India, and highlights common management problems that can be addressed through diagnostic research. Part II outlines the steps in preparing for community forestry research and Part III describes the four major components of an integrated rapid appraisal strategy for helping develop community forest management programs. These include: 1) community profiling techniques using PRA, 2) methods and analysis procedures for understanding patterns of vegetative change, 3) approaches for illuminating socio-political and institutional characteristics affecting resource management, and 4) assessments of the economics of forest production systems. Part IV reviews strategies for Forest Departments and community groups to utilize the learning from rapid appraisals in order to develop more effective, collaborative management systems.

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GLOSSARY

baadas       a bundle of fuelwood weighing approximately 15 kgs
B/C Ratio    Benefit Cost Ratio
falia        hamlet
FD           Forest Department
FDc          Forest Development Corporation
FLCS         Forest labor Cooperative Society
FPC          Forest Protection Committee
GO           Government Order
GFD          Gujarat Forest Department
HRMS         Hill Resource Management Societies
IRR          Internal Rate of Return
JFM          Joint Forest Management
Kotwalia     Scheduled caste of basket-makers
NPV          Net Present Value
NTFPs        Non-Timber Forest Products
Nigam        FDC purchasing agent
<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
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<tr>
<td>NGO</td>
<td>Nongovernmental Organization</td>
</tr>
<tr>
<td>PD</td>
<td>Process Documentation</td>
</tr>
<tr>
<td>PRA</td>
<td>Participatory Rural Appraisal</td>
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PART I: INTRODUCTION

The Changing Forest Management Context in India

The purpose of this Methods Manual is to suggest selected research tools that Forest Departments (FDs), NGOs, and university researchers might use to assist communities in developing effective forest management systems. In order for planners to design policies and programs supporting community management of natural forests, they will require better information regarding the diverse ecological, institutional, and economic features of Indian forests. Rapid diagnostic studies within each region which examine local management problems and potential will help to meet this need.

There is a growing recognition that sustainable forest management necessitates a meaningful involvement of forest communities. In some countries, the extensive logging and forest clearing conducted over the past thirty years have created vast areas of degraded natural forest and high degrees of social disruption and conflict between rural communities and FDs. While communities generally have few or no formal rights to these public lands, they are often driven to exploit them -- further leading to progressive degradation. Many Asian nations have targeted these areas for extensive replanting with the establishment of fast-growing number and pulpwood species, however these programs have high replanting costs, are staff intensive, and can affect only a small proportion of the degraded forest area.

For years some foresters, ecologists, and social scientists have maintained that degraded natural forests in south and southeast Asia could regenerate rapidly if protected. In India it is estimated that 35 to 50 million hectares of disturbed natural forest could experience significant increases in biomass and biodiversity if strategically protected (see Figure 1). Communities living in or near natural forests could protect them if clearly authorized by the government, providing the economic returns would compensate them for their opportunity costs. Recent experiences with such programs from a number of Indian states demonstrate that FDs can successfully develop management agreements with communities which benefit both parties and result in rapid increases in biomass, genetic diversity, forest productivity, and more equitable resource distribution.
Progress in establishing participatory management systems and observation of their early replication effects in West Bengal, Haryana, Gujarat, Orissa, and other Indian states encouraged the national Ministry of Environment and Forests to pass a new National Forest Policy in 1988. The Policy notes, "Forests should not be looked upon as a source of revenue," but as a "national asset to be protected and enhanced for the well-being of the people and the nation." One prime component of the policy mandates that, "The people will be actively involved in programmes of protection, conservation and management of the forests." The document further states that non-timber forest products, "should be protected and improved and their production enhanced" to generate employment and income for forest communities. In June 1990, the Government of India passed a significant national resolution providing more specific guidelines regarding the formation, functioning, rights and responsibilities of community forest management groups. It specifies sharing
arrangements in which village forest committees that, "successfully protect the forests, may be given a portion of the proceeds from the sale of trees when they mature," as well as non-timber forest products for subsistence use.

A series of recent state government policies or orders supporting joint forest management (JFM) have created new opportunities to respond to decades-old conflicts between communities and FDs. By moving from conflict to collaboration, a number of communities and state FDs have made rapid progress in establishing functional protection systems which have facilitated natural regeneration and dramatically increased forest productivity. At the present time, ten states have passed government orders (GOs) endorsing participatory management models (see Figure 2). Numerous states already possess hundreds or thousands of community management groups, some established through indigenous grassroots activism and no intervention, while other states are in the process of designing strategies to launch new programs. A great diversity of community forest management groups now exist throughout India; among others, these include: the legally sanctioned Swayam forest groups of the Kumaon; the Forest Protection Committees of West Bengal; the Hill Resource Management Societies of Haryana; the Village Forest Committees of Uttar Karnataka, Karnataka; and the informal, indigenous groups operating in Orissa, Karnataka (Sagar District), and Bihar (Hazaribagh District).

Figure 2

Locations with Community Forest Management Activities
and States with JFM Notifications
While new policies and programs represent an historic opportunity to shift from management practices of the 19th century to newly adapted systems that may better respond to the social and environmental needs of the 21st century, many challenges remain. India's social, cultural, and ecological diversity requires that emerging local management be tailored to respond to prevailing problems and opportunities. This requires an understanding of vegetative conditions, local leadership and institutions, and the importance of forests to the local and regional economy. Viable management partnerships need to be based on a solid understanding of forest use practices and dependencies, balancing economic and ecological objectives to benefit both the participating village families and the FD.
Site-specific social, economic, and ecological factors interact to provide both opportunities and limitations on the types of management options that are possible. The rate of regeneration and the ecological sustainability of the forest is influenced by a range of biological conditions including species composition, prior utilization history, soils and climate. Participating FDs and communities require greater institutional capacity to make collaborative forest protection activities succeed, and finally, the economic returns from protected, regenerating forests must yield sufficient income to sustain the management activities over time.

Traditional social and economic studies typically rely on questionnaires that interviewers and field staff must fill in, rarely if ever seeing the results or knowing why the study was conducted. Conventional vegetation studies often require years of plot measurement and monitoring. However, this type of research may fail to address relevant management problems, takes months or years to complete, and rarely utilizes community knowledge and experience. Researchers typically end up conducting studies which are only read by other researchers. At the same time, senior FD officers and field staff are usually busy with their routine assignments. Administering the department and conducting field checks, as well as supervising the planning, implementation, and assessment of field projects while attempting to meet targets, leaves little time for conventional research.

In contrast, participatory diagnostic studies involve forestry field staff and villagers in establishing research objectives, and as key informants and analysts. They also represent a primary audience for the findings. The types of management issues that become the focus of the research are problems that local people perceive to be priorities. The analysis and discussion of options should reflect the interests and possibilities available in the study area.

In order to develop forest management systems at the macro and micro level, alternative research strategies are needed to collect, analyze and channel findings in an effective way to both FD staff and community members. Participatory diagnostic appraisals can help inform both sides regarding forest dependencies, use systems, and crucial management issues. Simultaneously, the rapid diagnostic research process provides the basis for a continuing dialogue to design alternative management systems with communities. Establishing Working Groups for officers, NGO staff, and researchers can provide an institutional basis for analyzing field experiences and learning, offering a mechanism to utilize emerging knowledge for policy and program formulation.

**Contemporary Forest Management Issues**

Cases from the Asia region indicate that poor management of public forest lands is often tied to conflicts over resource rights and utilization that lead to unsustainable exploitation. Management systems are needed which can minimize social conflict, utilize natural forests on a sustainable basis to maximize the flow of important products to communities, and generate income and employment opportunities.

In India, management problems frequently arise over resources that are in high demand and under increasing use pressures. In order to reorient forest management strategies to become more locally-responsive and ecologically sustainable, certain generic problems and demands in forest areas will need to be addressed. Some of the most common forest management issues that lead to social conflict and unsustainable use are outlined below.

**Fuelwood Headloading**

In many forest communities in India, commercial fuelwood headloading represents an important source of cash for low income families, especially many of India's poorest women. In addition, it is estimated that rural populations on the Subcontinent require 133 million tons of fuelwood annually for their subsistence energy needs. Commercial headloading is a major cause of forest disturbance. Collectors tend to overexploit, not just because of their numbers, but also due to their methods of cutting and collection. Where headloaders have no usufruct security or incentives to harvest sustainably, fuelwood tends to be gathered intensively at the nearest open access site, overutilizing those resources until they are exhausted.

A complete ban on commercial fuelwood headloading would be nearly impossible to enforce, and would displace millions while causing major market shortages. Forest ecosystems can generate fuelwood sustainably, but varying production levels under different natural succession and silvicultural management conditions must be understood first. Community-based regulatory mechanisms also need to be established to control access and ensure that exploitation does not exceed sustainable levels.
**Bamboo Basket-Making**

Increasingly in India, rural artisans face difficulties in obtaining a sufficient, high quality supply of forest produce and fair prices for their products. Of the estimated 3 million tons of bamboo harvested each year in India, as much as one third are used by hundreds of thousands of villagers engaged in bamboo cottage industries. Yet production, supply, processing and marketing systems are often constrained by poor management, leading to lower quality goods, low productivity, and low wage rates for collectors and producers. Participatory management systems are particularly tailored to address the needs of such forest-dependent user groups who require a stable and continuous supply of quality raw materials based on a sustainable harvesting system.

**Livestock Management**

India possesses the world’s largest livestock population, including 15% of the earth's cattle, which play a key role in the rural ecosystem for milk, draft power, and dung. Yet since the 1950's, non-forest common property has decreased over 30%, placing additional pressures for fodder and grazing on forest lands. Overgrazing of livestock and excessive burning to promote grass growth are commonly seen as two of the major causes of disturbance to Indian forests. Both processes typically suppress regeneration of the forest. Grazing, however, does not always damage tree saplings, especially if they have reached a certain age and height. Controlled grazing may actually stimulate grass growth and increase the effective nutrient yield. Fire can also increase grass productivity, and in some cases, facilitate the germination of tree seeds.

The timing, location and intensity of grazing pressure on forest lands depends upon many factors, including the role of livestock in the agrarian economy and the availability of alternative sources of fodder and pasturage. One solution to forest and pasture land overexploitation is to completely stop open grazing and shift to stall-feeding. However, this strategy depends on human labor to cut and carry fodder, and requires a strong community will to establish controls through fencing or patrolling, fines, and rules. In some parts of India, pastoral nomads migrate vast distances to traditional grazing areas and their practices and needs should also be considered in developing improved management systems.

In terms of fodder supply, successful forest regeneration may have the negative effect of reducing grass growth due to closure of the tree canopy. Hence, which grazing regime is best suited for a particular JFM site will need to be determined by the interplay of ecological and socioeconomic factors, local traditional and scientific knowledge, and the capacity of the community protection group to enforce a particular strategy for fodder production and controlled forest access.

**Leaf Harvesting**

Forests provide mulch and green manure for agriculture. If these nutrients were replaced with chemical fertilizers, it would cost crores of Rupees and still not provide the organic materials so important for healthy soil composition. The use of green manures is especially important in the hilly regions of peninsular India as well as the Himalayas, where lopped leaves or leaf litter are often used as bedding for cattle and then converted into manure for use on the farm. Lopping branches and leaves to provide fodder to livestock during winter is also a common practice. The leaves of dozens of tree species are also collected for bidi making, leaf plates, medicinals, and human consumption. In India each year, millions of tons of forest leaves are collected annually by the nation's rural communities.

When nutrients and organic matter are continuously removed from the forest floor, at a certain threshold the forest becomes adversely affected. While heavy lopping may retard tree and shrub growth, some pruning may actually accelerate increases in stem size, foliage, and fruit and seed productivity. Ultimately, Forest Departments and communities will need to improve their understanding regarding optimal harvesting and management techniques for sustaining valuable leaf production.

**Commercial Timber**

Over the past centuries, India's forest lands have generated a steady stream of timber profits, primarily to government, contractors, and local elites. As the nation's forest lands have diminished in area and quality through growing use and development pressures, national planners and senior foresters have attempted to slow exploitation, culminating with the national logging ban of 1986. There is some agreement that the nation's natural forests will not be able to play the same primary role of timber and pulp supplier that they have historically, and that the sources for these products must increasingly shift to private woodlots. At the same time, under effective management regimes a sustainable yield of timber, poles, and pulpwod is possible, especially to meet local needs.
While many forest areas possess management Working Plans, they tend to be based on outdated or inaccurate data and often assume the goal of maximizing timber productivity and revenue generation. In areas where the FD has earlier established Forest Labor Cooperative Societies (FLCSs), village members have lost employment opportunities as a result of the logging ban, or are finding ways to continue their activities, causing further damage to the forest. FD staff need to work with community members involved in the timber extraction industry to reach an agreement on the structure of an effective timber management system. Sustainable timber management systems, however, will not be established until foresters and communities have better information regarding the viability of current extraction levels and its impact on forest regeneration, as well as timber supply and demand for both local and commercial needs. Since current institutional management mechanisms frequently fail to ensure sustainable yields, new organizational arrangements need to be designed through participatory research with the concerned parties.

The five management problems described above need to be assessed in terms of their ecological, institutional, and economic dimensions. Figure 3 illustrates the relationships between thematic, interdisciplinary research questions dealing with a range of important forest management issues. In the following parts of the Manual, research tools will be presented which can provide information to design a more sustainable and productive management regime, responding to local human ecological needs.

**Figure 3:**

Management Issues and Ecological, Institutional and Economic Research Questions

<table>
<thead>
<tr>
<th>ISSUES</th>
<th>ECOCLOGICAL</th>
<th>INSTITUTIONAL</th>
<th>ECONOMIC</th>
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<tbody>
<tr>
<td>Fuelwood Head loading</td>
<td>- What is the standing biomass and annual growth rate?</td>
<td>- Who are the important fuelwood user groups?</td>
<td>- Now much fuelwood is currently required for commercial and subsistence use?</td>
</tr>
<tr>
<td></td>
<td>- What is the density of coppicing and non-coppicing trees?</td>
<td>- What institutional mechanisms exist to control access and regulate use?</td>
<td>- How economically dependent are user groups on fuelwood?</td>
</tr>
<tr>
<td></td>
<td>- What are the methods and ecological impact of fuelwood extraction?</td>
<td>- What rights and Incentives do user groups have to manage fuelwood sustainably?</td>
<td>- What employment alternatives exist for fuelwood hand loading, especially for poor women?</td>
</tr>
<tr>
<td>Bamboo Basket-Making</td>
<td>- What is the maximum sustainable yield for fuelwood?</td>
<td>- What user groups are involved and what role might they play in bamboo stand protection and management?</td>
<td>- How could bamboo processing techniques be improved to increase quality, volume and value?</td>
</tr>
<tr>
<td></td>
<td>- Now could bamboo stand productivity be increased through silvicultural techniques?</td>
<td>- What is local capacity to manage bamboo under a lease agreement with the F.D.?</td>
<td>- How could bamboo baskets be marketed to best increase profits to producers?</td>
</tr>
<tr>
<td>Livestock Management</td>
<td>- What are the ecological inputs of different grazing intensities on forest regeneration?</td>
<td>- What is the community’s capacity to regulate optimal levels of forest grazing?</td>
<td>- What are the current fodder supply levels and demand requirements?</td>
</tr>
<tr>
<td></td>
<td>- Now does forest protection and canopy closure affect grass and leaf fodder productivity over time?</td>
<td>- What are the Incentives and conditions that would encourage a shift to stall feeding?</td>
<td>- Given local opportunity costs, would a shift to stall feeding be economically viable for the community?</td>
</tr>
<tr>
<td></td>
<td>- What tree and gross fodder species mixes maximize productivity and nutritional value?</td>
<td>- What are the gender implications of a shift to stall feeding?</td>
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<tr>
<td><strong>Leaf Harvesting</strong></td>
<td>- What is annual leaf litter fall?</td>
<td>- What type of local institutions could manage and support forest based leaf industries?</td>
<td>- How could woman leaf collectors and processors increase their incomes?</td>
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<td>- What are the comparative economic advantages of green manure vs. chemical fertilizers?</td>
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<td></td>
<td></td>
<td>- What is the marketing system for leaf products and how could it be improved?</td>
</tr>
<tr>
<td><strong>Commercial Timber</strong></td>
<td>- How sustainable is the current rate of timber extraction?</td>
<td>- Who are the timber user groups and where and when do they operate?</td>
<td>- What is the economic impact of the logging ban on local communities, foresters and contractors?</td>
</tr>
<tr>
<td></td>
<td>- What are the related ecological and environmental impacts of timber harvesting?</td>
<td>- What are the patterns of land use and control in logger over areas?</td>
<td>- What alternative employment opportunities exist for displaced rural loggers?</td>
</tr>
<tr>
<td></td>
<td>- What are the ecological impacts of shifting forest management from a commercial timber focus to an NTFP system?</td>
<td>- What local institutions exist or could be developed to better regulate timber extraction and manage NTFPs?</td>
<td>- What are the costs and benefits of a transition from a commercial timber rotation to a NTFP based production system?</td>
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PART II: PREPARING FOR COMMUNITY FOREST RESEARCH

Rapid appraisal methods are useful for gaining a preliminary understanding of the research area in a relatively short period. The diagnostic tools presented here combine participatory research methods with simple sociological and ecological measurement techniques, using both modern science and indigenous knowledge to present an interdisciplinary picture of human-forest interaction patterns. Information from multiple sources is used to crosscheck and inform the research team. The research process is designed to build on the increased understanding emerging from each field visit by sequentially pursuing issues raised in previous interviews and field observations to verify and elaborate. The approach requires extensive data analysis and debriefings immediately following each data collection activity.

Time spent preparing for diagnostic research can be an excellent investment. Without adequate preparation, research teams may lack an informed orientation to the study site and could waste time collecting information that already exists. Preparation also includes explaining objectives and soliciting the involvement and support of the community and relevant members of the FD, other key governmental groups, and NGOs working in the area.

Identifying and Developing a Research Team and User Network

Past PRA experiences indicate that small, interdisciplinary teams of two to four members usually the most effective units for conducting studies. It is important that each team have at least one member fluent in the local language and at least one woman. Prior to entering the community, the research team should discuss and determine their roles and means of coordinating their activities. It is highly preferable for the PRA team to stay in the village overnight, or at least nearby, to informally socialize, build rapport and facilitate evening discussions.

The research team should be expanded to include a cross section of community members to act as the “resource faculty”. Ideally, this group would include men, women, and children from different socioeconomic groups within the community. It may also include individuals with specialized knowledge (i.e., medicinal plants, forest product marketing systems, etc.). In some cases, it may be useful for the outsiders and the village resource faculty to break into sub-groups to further explore special topics.

Studies which are conducted without a clear user group in mind may be poorly focussed and of little relevance. During the research design phase, an effort should be made to involve those individuals and groups that have an interest in forest management in a communication mechanism which ensures the free flow of information, especially learning generated from the field. Normally, these would include senior officers and local field staff from the state FD, community members and leaders, researchers, and possibly local non-government organizations. Early meetings of this Working Group allow opportunities to discuss research design questions and schedules, clarify priority issues, and identify key individuals who might be involved in the research. It is also helpful to reach an agreement among Working Group members regarding how and where the information will be used once collected.

Background Research

As a first step, the collection of secondary data is important for an understanding of the local and regional context in which the research will be conducted. Academic researchers may have already documented the social and historical conditions in the area. Aside from books and articles, a wide variety of government reports are often available describing social, economic, environmental, and development features. Maps of most areas are available on a scale of 1:50,000 from the Survey of India, while local forest maps can be obtained from the Forest Department. Research teams need to allocate time for collection and analysis of such background documents.

Selecting a Research Site

In selecting appropriate research areas for community-forest management studies and programs, it is useful to work with the local District Forest Officer and Range Officer to identify a range or beat with important
management problems and possibilities. Researchers should try to choose study areas that reflect a cross-section of institutional, ecological, and economic characteristics and conditions.

To study the social and institutional constraints and potential for community management, it may be useful to choose a site where communities are already active or interested in establishing forest management systems. Areas with strong community leadership and active, supportive FD field staff may present new strategies for village mobilization and collaborative action. Communities with current or past traditional forest (or other resource) management institutions may illuminate ways to integrate indigenous systems into emerging JFM programs. It is particularly important to identify and include communities which are heavily dependent on forest resources.

To understand the economics of forest product volume levels and flows on a per hectare basis, it is helpful if there are well-defined collection areas. If possible within the proposed study area, blocks of forests ranging in size from 25 to 200 hectares can be delineated with clear boundaries on the beat maps. It is also important that the study area has a well-defined community of users, so that the human use pressure is more easily quantified.

If the researchers wish to gain insights into how production levels may change as the forest regenerates or degrades, an attempt should be made to choose a number of sites in varying stages of protection and succession, or degeneration. Candidate research sites in different "protection age classes" should ideally be visited together with local forest guards and selected members of the community to assess specific vegetative and social characteristics. The Check List provided in Appendix 1 can serve as a guide to the socio-ecological site assessment.

Physical and vegetative characteristics across sites should be similar, including the percentage of coppicing species and percentage of good grass stock (especially in semi-arid areas), disturbance patterns in terms of fires, grazing, fodder and fuelwood cutting, topography, soil, and microclimatic conditions. Evaluation of social characteristics might include the presence of a community forest management group, degree of community homogeneity, and presence of any access rules and regulations (although these may not be applicable in an unprotected site). In selecting the final sites, the team should also consider logistical convenience and apparent community willingness to assist the research team with the study.

Establishing the use history of prospective sites is also valuable in comparing regenerating growth patterns across sites. Sites should be selected with similar histories and experiences to facilitate comparisons. The data could be drawn from Forest Department Working Plans for the area, maps, aerial photographs taken at different points in time, interviews with past FD staff familiar with the area, and with older villagers.

The PRA field trials in southwest Bengal were quite successful in identifying regenerating forests of various age classes which were protected by village committees. The researchers selected sites that had no protection, 3 years, 5 years and 15 years of protection. The sites were all within 5 kilometers of each other and possessed similar soils, topographic conditions, and plant species. Each research team can determine the periods of protection they want to use in selecting sites for their studies. In West Bengal, because the JFM program is based on a 10 to 15-year rotation, it made sense to select sites using a five-year interval. It may also be helpful to include additional sites during the first five years of protection, since changes are most rapid during this period. Researchers should work with FD staff to select a number of candidate sites for different age classes of forest (see Figure 4).
Time series plots provide a useful basis for understanding likely trends in the availability of timber, fodder, fuelwood, and other NTFPs as regeneration occurs. PRA trials in Gujarat found that in many areas where there are numerous user communities and many small forest tracts at varying levels of disturbance or stages of regeneration, it was difficult to assess specific levels of productivity for any given tract based on community recall alone. In villages with a range of smaller patches of protected and unprotected forests, some product flow trends were possible to estimate; however, in large forest tracts with multiple user communities, per hectare productivity estimates based on recall were more difficult to calculate. In such cases, population data on individual species productivity or harvest flows will need to be determined using vegetative research.

Ultimately, the Working Group will heed to select study sites that reflect important social, ecological, and economic characteristics affecting forest management in the district or state. Research areas should possess common management conditions so that findings are useful in solving problems and improving programs in neighboring areas.

**Working Together: Community-Research Team Interactions**

It is important that the team begin to build rapport with the community prior to data collection. One of the first steps is to clearly explain the study goals and methods to the villagers, including the distinctly different approach of the community members as experts and the researchers as students. The research team should stress that it has come to learn from the community and to help communicate their knowledge, needs and ideas to the Forest Department, providing a basis for negotiations to design improved management systems that respond to community and environmental priorities. The community should understand that the study is meant to help the research support group, community, and Forest Department better understand the ecological and economic status, changes, and potential of the forest. At the same time, the researchers should be careful not to raise community expectations that the research will result in development projects or programs in the area.
Past experiences indicate that each PRA field visit may take three to four days or more. Since this represents a considerable time contribution on the part of community members, at least some of their opportunity costs should be met. While cash compensation may deter a sense of effective participation, the NGO MYRADA suggests arranging meals near the village to be shared by all participants.

In recent PRAs conducted in Gujarat, a number of approaches were used in introducing the research team to the community. On the first day, both formal and informal meetings were held to explain the objectives of the research and enlist community assistance in carrying out the studies. On days two and three, it became apparent that many community members had limited time to meet with the researchers, and that the teams needed to adjust their schedules to minimize the disturbance to the work routine of the village. Strategies to achieve this objective included scheduling meetings in the early morning and later in the afternoon and evening, conducting discussions during rest breaks in the forest or fields where the villagers were working, or holding discussions with special groups, including children, older men and women who were less busy.

Even after the team has been introduced to the village and becomes well-established, when visiting new households or neighboring communities the researchers should remember to introduce themselves and explain their purpose, since the new participants may be unaware of the study's objectives. Each time researchers meet with a new group, time should be allocated for building rapport and creating a conducive social environment for learning about forest use from the people.
PART III: RAPID APPRAISAL RESEARCH METHODS

A: PRA TOOLS FOR COMMUNITY-FOREST PROFILING

The purpose of the Community-Forest Profile is to familiarize researchers with the social and economic characteristic of the village and the patterns of human forest interactions in space and time. These methods also provide background which can inform more specialized assessments of vegetation, human organizational, and forest production systems described in later sections. The Community Profiling methods discussed below entail the descriptions of seven different information types (see Figure 5).

**Figure 5**

PRA Steps for Profiling Community-Forest Relationships

<table>
<thead>
<tr>
<th>Step</th>
<th>Information Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Background Information</td>
</tr>
<tr>
<td></td>
<td>➞ Population census</td>
</tr>
<tr>
<td></td>
<td>➞ Livestock ownership</td>
</tr>
<tr>
<td></td>
<td>➞ Land ownership</td>
</tr>
<tr>
<td></td>
<td>➞ Religious and caste composition</td>
</tr>
<tr>
<td>2.</td>
<td>Community and Forest History</td>
</tr>
<tr>
<td></td>
<td>➞ Historical Transect</td>
</tr>
<tr>
<td></td>
<td>➞ Time Line</td>
</tr>
<tr>
<td></td>
<td>➞ Trend Line</td>
</tr>
<tr>
<td>3.</td>
<td>Community Forest Values and Perceptions</td>
</tr>
<tr>
<td></td>
<td>➞ Perceived Ecological Benefits</td>
</tr>
<tr>
<td></td>
<td>➞ Social and Religious Significance</td>
</tr>
<tr>
<td></td>
<td>➞ Perceived Economic Value of Products in cash and kind</td>
</tr>
<tr>
<td>4.</td>
<td>Spatial Information</td>
</tr>
<tr>
<td></td>
<td>➞ Sketch Map</td>
</tr>
<tr>
<td></td>
<td>➞ Product Flow Chart</td>
</tr>
<tr>
<td></td>
<td>➞ Land Use Transect</td>
</tr>
<tr>
<td>5.</td>
<td>Temporal Information</td>
</tr>
<tr>
<td></td>
<td>➞ Seasonal Calendar</td>
</tr>
<tr>
<td></td>
<td>➞ Daily Activity Schedule</td>
</tr>
<tr>
<td>6.</td>
<td>Inventory and Classifying</td>
</tr>
<tr>
<td></td>
<td>➞ Species Inventory</td>
</tr>
<tr>
<td></td>
<td>➞ Gender Specific Inventory</td>
</tr>
<tr>
<td></td>
<td>➞ Species Use Typology</td>
</tr>
<tr>
<td>7.</td>
<td>Forest Product Ranking and Scoring</td>
</tr>
<tr>
<td></td>
<td>➞ Product Importance Scoring Table</td>
</tr>
<tr>
<td></td>
<td>➞ Comparative Product Ranking</td>
</tr>
</tbody>
</table>
1: Background Information

Upon entering the community it is important to collect information regarding the socioeconomic and demographic characteristics of the area. A Community Profile Background Sheet proved useful in earlier PRA exercises in gaining a quick overview of some important features of the village, while also involving community members in a discussion of household-oriented topics (see Community Profile sheet in Vol. U, Appendix 1). All members of a PRA team need to share and discuss community background data early during the course of the study. Basic socioeconomic statistics help identify important sub-groups within the community so that different local perspectives are represented in the PRA process.

Survey questionnaires structure the flow of information. To encourage informal, free flowing discussions, the research team can use the questionnaire as guidelines. It is likely there will be gaps in the information collected during the first day; consequently, the research team should continue to update the baseline information and discuss its implications for the PRA as it progresses.

2: Community and Forest History

Forests and communities are both dynamic, interacting elements within larger ecosystems which must be understood in terms of their relationship to one another and how they have changed over time. There may be little written record of these changes, so it may be necessary to interview village elders who have observed how the forest ecosystem and community use patterns have altered over the past 30 to 50 years. In degraded forest areas, it is important to document the processes of ecological change, reconstructing the actors and activities that have affected the forest ecosystem (See Community and Forest History Interview Guidelines, Volume II, Appendix 2).

Local forest officers can usually provide considerable information on the forest history of the research site. Some issues worth pursuing include the history of logging, fires, cleaning and pruning operations, and enrichment plantings (when, what species, how many, survival levels, etc.). Villagers can assist the research team in understanding informal use patterns and pressures, as well as the types of environmental effects they perceive from changes in forest vegetative cover. Other issues to probe with Forest Department staff and communities include: grazing practices (type and number of livestock, periods of grazing allowed, other restrictions, etc.), fuelwood and fodder collection patterns (number of users, volume collected, etc.), surface water and wind-generated soil erosion, changes in microclimate, and changes in water tables, well levels and flooding.

In beginning a discussion regarding the community, ecological, and forest history of the area, it is often helpful to ask a group of older people to reconstruct what the forest was like when they were children. Developing maps, land use and historical transacts of the research area can also illustrate the changes in forest cover and structure over time and their impact on the flow of forest products and local hydrology. To better identify how the structure and composition of the forest have changed, it may help to ask community members to prepare a historical transect of the area. Since this exercise is meant to illustrate community perceptions regarding relative changes in the forest environment and requires remembering the forest structure and composition as long as 50 years ago, recollections should only attempt to approximate conditions in the past (see Figure 6). Experience from other PRAs suggests that it is helpful for participants to begin by drawing the forest at present as a baseline, and then follow with earlier periods. The villagers decide the appropriate time periods to draw; usually three to four periods are sufficient. They can attempt to draw the size and composition of the forest trees in each period, indicating relevant management information at each time segment. For example, they might list the number of different productive species available, the type of management system, periods of logging, rules, rights, and regulations, and advantages and disadvantages of particular systems.

Figure 6: Gamtalao Historical Transect
Time lines can also be helpful in identifying important past events (i.e., droughts, land reforms, forest felling, fires, etc). Historical studies of the area and the Forest Department Working Plan can help identify significant socio-political and environmental events providing a framework for the time line. Oral histories can provide more details on local events, how they were perceived by the community, and their eventual impact on forest management. An example of a time line from Gamtalao village in southeastern Gujarat follows (see Figure 7).

Figure 7: Time Line of Gamtalao
Trend line graphs are also useful in showing changes in the population, rainfall, and volume flow of important forest products over time (see Figure 8). They can also be used to chart patterns of forest disturbance and regeneration. Information generated during the preparation of a historical transect might show how the diversity of forest products and species has declined over time. Involving community members in discussions of declining or increasing availability of products can also raise a range of important issues. Information on how distances travelled to collect fuelwood, fodder, NTFPs, and water have changed can be depicted in graph form by community members.

Figure 8: Trend Lines for Wood Extraction in Karnataka, 1973-1989

<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>1922</td>
<td>Original Gamtalao village established</td>
</tr>
<tr>
<td>1925</td>
<td>Phulwadi falia founded</td>
</tr>
<tr>
<td>1947</td>
<td>Independence</td>
</tr>
<tr>
<td>1950s</td>
<td>Private land allocation and titling</td>
</tr>
<tr>
<td>1968 - 1970</td>
<td>Commercial clear-felling of forests in the area</td>
</tr>
<tr>
<td>1970</td>
<td>Kotwalia basket-makers begin to settle in Phulwadi</td>
</tr>
<tr>
<td>1980 - 1987</td>
<td>Repeated attempts and failures to reforest Gamtalao area with Acacia auriculiformis and Eucalyptus</td>
</tr>
<tr>
<td>1988</td>
<td>Circle Conservator and GFD staff hold meeting with Gamtalao villagers to discuss reforestation, community needs and collaborative management possibilities</td>
</tr>
<tr>
<td>1988</td>
<td>Formation of Gamtalao Forest Protection Committee (unregistered); 25 hectares protected with enrichment planting of local species</td>
</tr>
<tr>
<td>1989</td>
<td>Gamtalao begins protecting 60 additional hectares; Phulwadi villagers request the people of Gamtalao to allocate 35 hectares of forest land under their protection</td>
</tr>
<tr>
<td>1990</td>
<td>Gamtalao FPC places 20 more hectares under protection</td>
</tr>
<tr>
<td>1991</td>
<td>First gobar gas plant set up (12 total)</td>
</tr>
<tr>
<td>1992</td>
<td>Phulwadi women propose to establish Mahila Mandal</td>
</tr>
</tbody>
</table>
3: Community Forest Values and Perceptions

Historically, many communities have been heavily dependent on forests to supply a broad range of raw materials for housing, fuelwood, medicines, tool making, and food. Gums, resins, fibers, and fruits have also been collected for sale and trade in local markets. Beyond their economic importance, forests have provided refuge for rural people when attacked by outside groups. Forests play a role in stabilizing the local hydrology and microclimate, often improving agricultural productivity and ground water availability. They provide a home for birds, animals, and insects which can control agricultural pests. Forests also provide an escape from the pressures of village life. They serve as a meeting ground for women, and frequently have great religious significance for tribal communities. Traditional tribal songs and poetry are replete with images of the forests, reflecting its centrality in the culture, economy, and World view. Many forest tree species such as mahua,
ficus, and sal, as well as animals and birds such as monkeys and peacocks, take on totemic importance and receive special protection by the community.

PRAs indicate that rural communities are well aware of their heavy dependence on the forest and are concerned when forests are threatened by overuse and degradation. Establishing more effective management systems depends on the motivations of the community and their perceptions of the value of the forest. Understanding the economic, social, and religious significance of the forest to local groups reveals the degree of commitment they may have in sustaining these threatened ecosystems. Community values of the forest may vary among men, women and children in the village. Consequently, interviews should be conducted with different types of community members to assess their management priorities, perceived needs, and incentives to contribute labor and resources toward forest protection. In some cases it may be preferable to hold these discussions in the forest where members can observe and identify important aspects. It may be useful to begin with a question about the most important benefits of the forest and then to gradually pursue more specific functions such as religious, socioeconomic significance, environmental functions, and the forest's relationship to agricultural and livestock management systems.

4: Spatial Information - Sketch Maps, Product Flow Maps, and Land Use Transects

Through interactive exercises with the community and observation, the research team can help create a picture of spatial resource use patterns by developing sketch maps, product flow maps, and transects of resource use patterns. The main purpose of diagnostic sketch-mapping is to create a visual representation of the resource system which can be easily understood by both villagers and foresters. An alternative to traditional mapping, participatory sketch-mapping has been developed successfully with communities in many parts of Asia. Prior to beginning the exercise, the research team needs to explain to community members the purpose of the mapping activity as a way to learn more about the forest's condition and community use patterns. A suitable site for map construction should have a large, flat area where community participants can relax and work without disturbance, possibly off the road under a tree or in a communal courtyard.

The team should first request participants to draw a map of their village and adjacent forest areas on the ground, utilizing stones, twigs, leaves, seeds and other local materials to identify characteristics. The process should proceed with as little intervention as possible by the researchers. Villagers often debate what characteristics are important, and as a result, a wide variety of relevant and unexpected information may emerge. Ground maps can be recorded both by photographing and copying onto a large sheet of white paper or previously prepared base map. The maps can serve as a focal point for discussions on forest-related resource issues.

In one forestry PRA, the sketch-mapping exercise was held in the school courtyard. The mapping began with a demarcation of roads, settlements and rivers which were drawn in the gravel with a stick by the teacher. The researchers suggested some local materials might be used to highlight these features, so the school teacher began involving his students in procuring ash, dirt of various colors, leaves, flowers and other materials. The use of a wide range of local materials was an effective method to involve the students in collection and decisions on how to depict landmarks. The colorful ground map which resulted attracted the interest of many community members, drawing their comments and suggestions (see Figure 9). The earth sketch map was later drawn on a large sheet of paper and taken to the forest for ground truth checking (see Figure 10). This involved walking and driving through the forest, and stopping periodically to check features on the map. A final map integrating more information was prepared by an artist after the originals were returned to the communities (see Figure 11).

Figure 9: Limbi Ground Sketch Map
Figure 10: Drawing of Limbi Sketch Map
More specialized maps can be drawn based on PRA discussions and field observations. Maps of use routes, collection areas, and informal usufruct areas are especially useful for holding follow-up discussions regarding new management systems (see Figure 12). A map of forest condition and standing stock levels can also be helpful in determining sites for vegetation measurement and the impact of existing use practices (see Figure 13).

Figure 12: Flow Routes in Nawanagar, Pinjore, Haryana
Working with villagers to draw land use transects can also provide a valuable perspective on the types of ecosystems and use patterns in the area. These can be drawn while sitting on a ridge, roof top, or other elevated place with a group from the community. While sketching the transect, it is useful to distinguish major zones of land use and topography (hill top, forested plain, agricultural land, village, river, etc.). Under each
zone, the community can list important information such as species composition, economic activities, and management problems and opportunities. Figure 14 illustrates a 3 km transect of Chandana forest area in southeast West Bengal.

![Figure 14: Land Use Transect in Chandara, West Bengal](image)

<table>
<thead>
<tr>
<th>Land Use Types</th>
<th>River</th>
<th>Fields</th>
<th>Village Bamboo &amp; Fruit Trees</th>
<th>Degraded Sal Forests</th>
<th>Protected Sal Forests (7-8 years)</th>
<th>Village</th>
</tr>
</thead>
<tbody>
<tr>
<td>Management Problems</td>
<td>- River bank erosion</td>
<td>Rainfed, marginal farming, small holdings</td>
<td>Heavy dependence on fuelwood heading for income. Lack of unity on effective FPC functioning</td>
<td>Overcutting and overgrazing of sal coppice growth Soil erosion</td>
<td>Rapid sal regeneration under effective FPC protection - continued threats from neighboring villages. Inadequate intermediate product flows</td>
<td>Lack of access to low cost rice (padi) High interest rates on loans</td>
</tr>
<tr>
<td>Management opportunities</td>
<td>- Bamboo planting on banks</td>
<td>Fodder and fast growing fuelwood species (trees and shrubs) on bunds</td>
<td>Develop small NTFP industries: leaf plates, mushroom cultivation, bamboo products</td>
<td>Form FPC and establish access controls. NTFP species, enrichment planting, target headloading families specifically</td>
<td>Encourage FPC’s of neighboring villages to act cooperatively Allowing more rotational felling and thinning with NTFP enrichment planting</td>
<td>Storage facility for grain for rice pounding Establishment of FPC bank account and credit system</td>
</tr>
</tbody>
</table>

### 5: Temporal Information - Seasonal Calendars and Activity Schedules

In order to document the flow of forest products over time and better estimate yields, it is important to determine how product collection changes over the seasons. This can be done by working with community members to develop a seasonal calendar of forest product collection activities. If villagers list a great number of forest products during the inventory exercise, it may be best to limit the seasonal analysis to products given high priority scores in each type class (e.g. three to five fodder products, fuel products, edible products, etc.) All products with commercial value, either sold in raw form or processed, should be included in the calendar.

Other PRA studies in India have shown that it is helpful to study seasonality by placing twelve stones in a row on the ground, with each one labeled with the local name for the appropriate month. Participating villagers are asked to indicate which months each product is available. Only one product or type of product should be discussed at a time. The villagers can use seeds to show the relative availability, indicating low and high yield periods. After each product or type of product has been indicated, the information should be recorded by photographing the calendar and transcribing it onto paper. After recording, the next product or type can be discussed and laid out on the ground calendar. Calendars can also be effectively portrayed in a circle as shown in Figure 15. If the research team and participating villagers have time, they may also want to draw a seasonal calendar showing the high and low periods of labor input into agriculture, forestry, and other production systems. The villagers can indicate peak demand periods for different types of forest products like fodder, fuel, food, and raw materials.

![Figure 15: Seasonal Calendar of Forest Product Flows, Gamtalao](image)
The preparation of daily activity schedules can help identify labor allocation patterns. One PRA found that beginning a semi-structured interview with women by preparing an activity schedule served as an effective icebreaker because it dealt with familiar routines, was a comfortable topic, and promoted group consultation in which 4-5 of the women reached consensus regarding their typical day-to-day schedule (See Figure 16). Daily activity schedules can be cross-checked by spending a 24-hour period in the village and timing activities. Labor allocation data can then be used to calculate labor costs for the collection, processing and marketing of different forest products.

Figure 16: Daily Activity Schedule of Women in Moti Pipal, Limbi Panchayat

4 am  Wake-up: Sweep
5 am  Fetch water (Milking)
6 am  Breakfast cooking
7 am  To forest for fuelwood
8 am  "
9 am  Walk roundtrip with headload to Ukai dam and sell
10 am  11 am
6: Inventory and Classifying

It is well established that many forest communities throughout the Asian region have considerable understanding of the forest ecosystem and its species composition. Ethnobotanical studies demonstrate that tribal and some non-tribal people who have strong ties to the forest can identify hundreds of productive species and their uses as sources of foods, medicines, fiber and construction materials, gums, dyes, tannins, etc. Using secondary data and local resource specialists, this information can be collected for the case study sites. As a prelude to fieldwork, books or reports should be obtained listing all the forest species found in the area, ideally giving local names and uses.

A number of ethnobotanical methods have been developed to inventory non-woody forest products which can be adapted by the research team to the particular needs of the study area. While many of the fruiting, flowering and seed-bearing species only yield products during the dry season, other products such as mushrooms may only be available during the monsoon. While it may be possible to inventory many species at one point in time, to collect information on production levels research teams will need to ask villagers to recall what they collect throughout the year.

The community can begin by listing all forest species used for subsistence or commercial use, classified according to important uses which they identify. The resulting "folk typology" may reflect categories such as: edible flora (mushrooms, fruits, oil seeds, nuts, flowers, tubers, leaves, stems); edible fauna (including insects, honey, fish, animals, birds); construction materials (timber for roofs, house walls, agricultural tools, grasses and barks for rope); medicinals (leaves, bark, roots, stem, seeds, fruits); fuels (trees, shrubs, leaves, grasses); fodder (trees, shrubs, leaves, grasses); and others (gum, resins, lac, toothbrush sticks, etc.) Once the important use types have been identified, the name of each category should be written in the local language on large pieces of poster paper, and the community encouraged to list all the local names of each species under each use category. A separate column should list the parts of the plant utilized.

Since it typically requires one to two hours with a small group to complete the initial listing of species, this exercise should be done when the villagers have time to think carefully and are not under pressure to perform other tasks. Separating groups of men and women to list forest species can create a competitive atmosphere which facilitates a more thorough listing and indicates gender-specific knowledge. Species lists can also be cross-checked and further elaborated by walking through the forests with knowledgeable local informants. Walk-throughs can focus on specific use categories, identifying all species used for medicines, fodder, or edible foods. The advantage of conducting a walk-through is that it also allows the researcher a chance to see where different species are located. During harvest periods, the researcher can observe product collection techniques, photograph harvesting processes, interview collectors, and record volume or weight measurements if a scale or tape measure is brought along.

7: Forest Product Ranking and Scoring

In addition to classifying, researchers can also assess the relative importance of different forest products to the community. To facilitate the comparison, it may be best to allow the villagers to compare products within each type of use (i.e., fodder, fuel, food, etc.). Each type of product can be represented by its local name, a picture, or the actual object, listing these products on the ground or on a piece of poster paper. PRA exercises in India have found that the relative importance of each product can be determined by providing village participants with a fixed number of seeds or stones to award scores. If 5-15 products occur in a use type, the
villagers can be asked to place the number of stones or seeds next to the name, picture or object to reflect its importance in relation to other products on the list. The participants may need some time to agree on a score, and men and women may wish to score the products differently, in which case two columns should be used.

During earlier PRAs, both ranking and scoring techniques were used by community participants. Ranking indicates the degree of importance given to each item, while scoring is a comparative measure which provides an indication of their magnitude of importance in relation to each other. Community participants had little difficulty in understanding the scoring method, and once familiar with the procedures, they conducted the exercise with considerable interest. Most of the scoring exercises were carried out in small group discussions, at times stratified by socioeconomic group or gender. In scoring exercises, it is important that the researchers attempt to assess the criteria that the participants are using, whether it is commercial value, strength, ease of collection, nutrition, etc. Criteria will generally vary by use type. For example, villagers may give higher scores to fuelwood species which 1) produce less smoke 2) are easy to cut or collect and 3) burn longer or hotter. By investigating criteria for evaluation, the research will uncover considerably more information about why certain species are more valuable than others. Once the rankings have been completed and tables drawn up, the researcher may want to return to the village to further explore the rationale or criteria used in scoring different species by use. Since there may not be sufficient time to acquire this knowledge during the first scoring exercise, a follow-up session could be very useful.

Data from scoring exercises can be displayed in tables as shown in the Phulwadi village forest species example (see Figure 17). It is important that the researcher explain the significance of the different scores given. For example, why is teak ranked so much more highly for agricultural implements than other timber-bearing trees? Ranking and scoring techniques can also be used to determine priority management problems and options perceived by the community or forestry field staff.

Figure 17: Scoring of Forest Species by Use, Phulwadi Village
The community profile generates a broad picture of local forest use practices. This information can be used to design and inform follow-on studies of vegetative change, institutional conditions, and the economics of forest production systems. For example, sketch maps and forest use history should guide the selection of study plots for assessing vegetative conditions. Information on the community's social composition can help identify important groups and organizations for institutional analysis. Finally, profile data on daily and seasonal work patterns, product flows, product inventories, and priority scores can identify issues and provide a basis for designing the economic analysis of forest production systems.
PART III: RAPID APPRAISAL RESEARCH METHODS

B: STUDY OF VEGETATION STATUS AND CHANGE

Introduction

Studies of vegetation conditions and patterns of ecological change in natural forests are essential for management decision-making at the state, district, and village levels. Due to the immense ecological and microclimatic diversity found in India, it is necessary to conduct localized studies to understand and respond to the highly varied environmental contexts. Knowledge of the vegetative characteristics of forest ecosystems can be effectively combined with economic and institutional information to develop participatory and locally-adapted management systems based on appropriate resource development strategies. Forest vegetational status and dynamics can be investigated through a combination of conventional ecological mensuration methods and participatory research techniques. The methodologies advocated here differ in certain ways from conventional forest ecosystem studies in terms of approach, time line, and audience. Traditional ecosystem research has been typically directed toward an academic audience and often requires lengthy data collection. In contrast, these methods are designed to generate a rapid understanding of the vegetative conditions in natural forests utilized and/or managed by community groups. The main purpose of study is to help communities generate practical management options that will lead to optimal productivity, while also responding to environmental needs. Resulting management options will be site specific and tailored to local vegetation, economic and institutional factors. Data on vegetation status by itself may not be sufficient to generate viable management options.

The target groups utilizing the vegetation data for generating management options include Forest Departments, NGOs, local institutions and communities. For planning purposes, these groups require timely information that allows them to identify trends reflecting degeneration or regeneration and corresponding productivity levels for important species under current and potential use practices. These groups are not likely to be trained to carry out complex conventional ecological research, and they often do not have the time to wait for lengthy studies. To respond to the requirements of forest managers, whether they be government officers or villagers, vegetative assessment methods should be rapid, simple, user-friendly and applied. The goal is to guide the generation of management options rather than simply describing the forest or grassland ecosystem. These methods also can facilitate community involvement, both capturing the experiences and collective wisdom existing among village members, and bringing families into a dialogue concerning the vegetative state of the forest and how it could best be managed to meet their economic and ecological needs. An exemplary range of participatory vegetative assessment techniques are described in the proceeding section.

1: Management Issues and Parameters

A cross section of examples illustrating common management issues and research parameters, sites, and field methods are presented in Figure 18. Typical issues may include the annual amount of fuelwood or tree leaves that can be extracted sustainably, or the impact of forest protection and increasing canopy closure on fodder grass yields.

<table>
<thead>
<tr>
<th>Management issue</th>
<th>Vegetation parameters to be investigated</th>
<th>Site Selection</th>
<th>Methods for Study</th>
<th>Calculations</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Quantity of sustainable harvest of firewood</td>
<td>- Species of all trees</td>
<td>- Plots at different distance from settlement up to 2km, 2-5 km, 5-10 km.</td>
<td>- Quadrat method</td>
<td>- Standing biomass</td>
</tr>
<tr>
<td></td>
<td>- Size distribution of trees (DBH and height)</td>
<td></td>
<td></td>
<td>- Productivity</td>
</tr>
<tr>
<td></td>
<td>- Density of tree species</td>
<td></td>
<td></td>
<td>- Quantity of wood removal for sustainability</td>
</tr>
<tr>
<td></td>
<td>- Basal areas</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
In the context of addressing key forest management issues faced by foresters, NGOs and local communities, the aim of the vegetation study is to generate information which will assist in identifying strategies which respond to local resource problems. For example, the research and analysis framework might address such management questions as the current impact of fuelwood extraction practices on wood and biomass productivity described in Box 1.

### Box 1: Sustainable Harvest of Firewood
- A Case Study of Moti Pipal Hamlet, Surat District

<table>
<thead>
<tr>
<th>2. Sustainable lopping levels of leaf biomass for manure/fodder</th>
<th>3. Impact of protection on grass productivity</th>
<th>4. Sustainable leaf collection level for plate-making</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Species name DBH and height distribution</td>
<td>- Monthly grass yield</td>
<td>- Name of all trees used for leaf-making</td>
</tr>
<tr>
<td>- Vegetation profile</td>
<td>- Vegetation profile</td>
<td>- DBH and height distribution of trees</td>
</tr>
<tr>
<td>- Legume/non-legume trees distribution</td>
<td>- DBH and height of trees</td>
<td>- Basal area of trees subjected to leaf removal</td>
</tr>
<tr>
<td>- Shrub and tree app. density</td>
<td>- Canopy cover</td>
<td></td>
</tr>
<tr>
<td>- Coppicing nature</td>
<td>- Basal area</td>
<td>-</td>
</tr>
<tr>
<td>- Protected and regenerating plots</td>
<td>- Plots of different lopping intensity: high, moderate, low</td>
<td>- Plots under different periods of protection: 3, 5, 10 years, 10 years</td>
</tr>
<tr>
<td>- Control plots: open access, undisturbed</td>
<td>- Plots at different distance from settlement (2 km, 2-5 km., etc.)</td>
<td>- Control plots: free grazing, no grazing</td>
</tr>
<tr>
<td>- Category of land: reserve forest, protected forest, private forest</td>
<td>- Control plot where no anthropogenic lopping</td>
<td>- Regulated removal plots</td>
</tr>
<tr>
<td>- Quadrat method</td>
<td>- Harvest method</td>
<td>- Quadrat method</td>
</tr>
<tr>
<td>- Sample tree harvest method</td>
<td></td>
<td>- Leaf biomass</td>
</tr>
<tr>
<td>- Shrub and tree leaf biomass</td>
<td>- Grass productivity</td>
<td>- Productivity of leaves from different size and app. of trees</td>
</tr>
<tr>
<td></td>
<td>(annual)</td>
<td>Quantity of sustainable leaf removal</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

In the context of addressing key forest management issues faced by foresters, NGOs and local communities, the aim of the vegetation study is to generate information which will assist in identifying strategies which respond to local resource problems. For example, the research and analysis framework might address such management questions as the current impact of fuelwood extraction practices on wood and biomass productivity described in Box 1.

The Demand for firewood will continue at current levels or increase both in rural and urban areas of Surat district of Gujarat, in Moti Pipal hamlet of Surat, almost all the households are engaged in headloading firewood for personal use and sale (see Volume II, App.4). The community derives significant income from sale of firewood (Rs. 300 per month per household during 8 month collection season). Thus the community would have a strong interest and stake in sustainable levels of firewood harvesting for continuous income generation as well as meeting their own requirement of cooking fuel.

While there is a need for more thorough studies of vegetation, institutional and economic aspects
of the community-forest management situation specific to Moti Pipal, it is possible to draw some inferences on the issues of sustainable harvest from the quick PRA study of the production system to forests near Moti Pipal, tree diversity and frequency varies due to different levels of degradation. Calculations of actual standing biomass would need to be made to estimated standing tree biomass of 120 mt. of air dry wood per ha. (400 tress of 40 years of age at 0.3 mt per tree). Using this theoretical stocking level, at about 1 kg. of firewood use per capita per day, the firewood required to meet domestic requirements is estimated to be 260 mt. per year for the hamlet of 110 families, or 2.4 metric tons per year per family. In addition, the commercial removal by 106 out 110 headloading households is estimated to be 508.8 mt., or eighteen 40 year old trees per family annually. Combining subsistence and commercial fuelwood extraction, the Moti Pipal community is annually harvesting 768 mt. from the forests. Further vegetative studies could determine whether this level of extraction is sustainable, however, initial assessments indicate overexploitation is occurring. A number of options are available for the community to stabilize fuelwood exploitation. These may include:

- Option 1: Fuel efficient stoves and biogas for cooking could be fully explored. If every family in Motipipal hamlet shifts to efficient stoves, energy saving would approximate about 40%, reducing the annual requirement of firewood from 260 mt. per year to 156 mt per year, however limitations on such raw materials as dung, water and capital investment requirements may pose obstacles.

- Option 2: Considering a theoretical standing biomass of 120 mt per ha, and a net primary productivity of woody biomass of 7 mt per ha. per year (assuming that 6% of standing biomass is the net primary productivity), the local community could harvest about 50-70% of the productivity for sustainability, or 3.5 mt per ha. per year.

- Option 3: If option 2 requires travelling longer distance and extra human effort and if the community prefers clear-felling over selective harvesting, then replanting must be immediately undertaken with local species which profusely coppie. Valuable NTFP-yielding trees like mahua, karanj, and mango should be excluded from clear-felling.

- Option 4: The community could divide the forest into 10 blocks and could rotationally harvest in cycles each year, allowing 10 years recovery to regenerate. The harvest in each block could also be done at various levels: 25% of standing biomass, 50% of standing biomass, or 75% of standing biomass.

A full scale vegetation and economic study may generate more options. Collaborative discussions between community and FD staff can further elaborate and a final selection can be mutually agreed upon.

2: Vegetative Diagnostic Studies at the State Level and Community Level

Indian states are at various stages in designing and implementing JFM systems. At the macro-level, Forest Departments need to assess the biological potential for natural regeneration, targeting areas where coppicing trees and root stock already provide opportunities for rapid regrowth under community protection. If tree root stock and grass seed/slip is dense and healthy, but prone to rapid degradation by overgrazing and cutting, the area should receive priority attention. Vegetation status would be one of the important criteria for consideration in conjunction with indicators of community interest, cohesion, and management capacity in selecting locations to initiate program activities.

The ecological identification of potential and priority areas for JFM should consider soil and water conditions, as well as the type of vegetation present. The potential of any area would be measured with respect to the opportunity for quick natural regeneration. The rate of natural regeneration or net primary productivity of a patch would depend on numerous factors: 1) coppice potential (the higher the percentage of coppicing trees, the higher the rates of regrowth); 2) Stump potential (if stumps or root stock is present, the capacity for coppice growth would be higher); 3) soil status (if the soil is highly eroded, prone to desiccation, low in organic matter etc., the potential for regeneration would be low); and 4) indicator plants (certain plants are keystone indicators of ecological balance or stages of degradation like colonizing weeds).

Several of these factors are shown in the site selection checklist provided in Appendix 1. These assessment tools need to be adapted to the local ecological contexts within respective states. Assessment could be conducted at the Circle and Divisional levels of the FD, relying on secondary data as well as field observations and interviews with field staff who have worked in the area. Preliminary assessments can be recorded on the FD’s Division maps, with more detailed descriptions prepared on range or beat level maps.
Once approximations have been mapped using existing data, sample ground truth checks should be made to improve the macro-level assessment of natural regenerative capacity of disturbed forests.

3: Local Knowledge of Vegetation Status and Change: A Participatory Approach

The vegetation assessment methods suggested in this manual rely heavily on point-in-time measurements and consequently have limitations in addressing questions related to vegetative change and sustainability. However, given the urgent need for improved management responses to rapidly degrading forests, the proposed methods attempt to partially compensate for the lack of longitudinal information by sampling areas at different stages of degradation and regeneration to reflect the types of changes that occur over time. Since community members have observed these changes and can often recall sophisticated levels of detail, they provide an excellent primary source of information concerning changes in the forest ecosystem. Local informants can identify pressures that have stimulated changes, levels of vegetation removal, responses of species and ecosystems to different methods and rates of extraction, the emergence of new species, seasonality patterns and multiple uses. Because of their specialized knowledge of local forest species, community members can often identify more plants and animals, more quickly and accurately, than botanists.

Participation of the local community in vegetation analysis can be achieved in numerous ways. A proven strategy is to involve one or two members of the community as resource informants in the team from the outset to assist in making observations, and in recording data from transects and quadrats. Key informant interviews with special user groups such as basket-weavers, mat-weavers or women leaf plate harvesters will also provide insights into collection and utilization practices. Finally, group discussions with women, artisans, farmers, and migrant graziers would also benefit the team by giving them access to specialized knowledge.

As a first step, there is a need to define the issues on which community-generated information should be obtained. A topic for which local knowledge would be useful might include the condition of the vegetation before the current management system was introduced or before a certain intensified period of degradation began. Community members could describe the types and density of species which dominated the forest in the past, and how the size of different tree species, types of ground vegetation, and associated wildlife have changed. Villagers could also describe changes in vegetation due to pressures such as extensive grazing, commercial harvesting of timber or leaves, or fuelwood headloading. This would indicate which species have vanished or declined, which tree species are regenerating, which shrubs, herbs, or pioneering trees have invaded, and which tree species coppice after repeated harvesting. Community perceptions of changes in NTFP availability over time due to modifications in vegetative composition are important indicators. Furthermore, villagers can often describe other related ecological impacts. Communities are usually highly aware of changing ground water levels, flooding and erosion problems, increases in agricultural pests, and microclimatic variations which they sometimes perceive to be related to changes in forest vegetation. Community perceptions and experiences with such environmental impacts need to be carefully documented and assessed.

The research team may also choose to explore labor required for collecting forest products due to changes in vegetation status. This may be reflected in women's hours allocated for collecting a given quantity of fuelwood or leaves (seeds or grass), the part of the tree lopped or collected now, compared to the past, and the number of trees that are lopped or collected to produce a given quantity of forest product. Changes in geographic catchment area for wood or NTFP collection, or distances walked for collection, may indicate changes in availability.

4: Vegetative Parameters: Species Richness and Density, Size Distribution, and Basal Area

A range of vegetation parameters are generally investigated to understand forest management issues. Parameters may include species diversity, plant density in multiple tiers (including trees, shrubs, herbs and climbers), vegetation profiles of forest structure and canopy cover, size distribution of trees (including DBH and height), and basal area of trees, standing biomass, and annual productivity of trees, shrubs, and grasses. Some parameters are simple to estimate (e.g. tree species density or DBH), while others are more difficult to assess (e.g. productivity, standing biomass). All parameters need not be investigated for any given management issue. The investigator must use discretion to carefully select the appropriate parameters for the study given the limited time, resources, infrastructure, and trained manpower available.

Species richness or diversity is assessed by separately listing all plant species (trees, shrubs, climbers, etc.)
in the study area. Data on species richness can be estimated in plots under different management/protection regimes and expanded to indicate species uses. Species density explains the dominance of different tree species under various management systems or periods of protection. The tree species density can be obtained by adding together the number of similar species in each quadrat replication and converting the density of each species from the sample area to a per hectare basis. Such information confers important management implications. For example, data from Alahalli in Shimoga district, Karnataka reveals a high density or dominance of Terminalia species, an important indicator of the availability of leaf biomass for manure. Similarly, the dominant presence of the multi-purpose *Garcinia* species in Hunsur village is an indicator of the availability of NTFP food, oil, and raw dye materials.

DBH class distribution of each tree species indicates the proportion of larger and smaller trees in the forest. DBH, information can be used to indicate tree age, which may reflect potential yields of fruits, seeds, leaves, fuelwood and timber. Basal area is one of the most important indicators of size of the standing stock or volume of trees. By recording the GBH (girth at breast height or circumference) or DBH (diameter at breast height) of all trees in each quadrat, employing a formula, and summing basal areas, the conversion from total basal area for the sample to a per hectare basis in m/ha can be obtained. The following formulae are useful:

\[
\pi = 3.143 \\
\text{radius} = \frac{\text{GBH}}{2\pi} \\
\text{diameter} = \frac{\text{GBH}}{\pi} \\
\text{Basal Area} = \pi (\text{Radius})^2
\]

Basal area/ha could be used as an indicator of the level of degradation or status of standing stock. If the basal area is declining, it can be safely concluded that the forest is degrading. The dominance and sizes of different tree species in the forest can also be obtained by calculating the basal area of each species in descending order. Since the number of trees of a particular species is not an adequate indicator of tree size or dominance with respect to canopy spread in a given area, basal area of a species can be used as a more accurate indicator.

### 5: Steps for Vegetation Studies

Vegetation dynamics studies using rapid appraisal methods generally require 4 to 5 days. The first day should be allocated for discussions with local forestry staff and community members concerning vegetative management conditions and problems. Resource persons from the village should be selected to participate on the team and to help identify appropriate study locations and sample plots. These steps were described in the earlier sections of the Manual. As a guide, a suggested activity schedule listing the various steps in conducting a vegetation study is given below.

#### Steps For Conducting Vegetation Studies

<table>
<thead>
<tr>
<th>Day 1:</th>
</tr>
</thead>
</table>
| - Procure measurement materials like ropes, tape, calipers  
- Gather information from the community and FD field staff through group interviews regarding vegetative changes; identify management problems and needs  
- Assemble team by identifying local community participants  
- Reconnaissance survey of the vegetation plots and settlements  
- Select specific site for vegetation study  
- Select parameters to be investigated for each management issue - Select vegetation study methods |

| Day 2: |
6: Site Selection

Site selection should be determined by the objectives of the vegetation study. These may include establishing benchmark research sites in degraded areas for long-term monitoring of the effects of natural regeneration in degraded forests, or a series of plots under different periods of protection to reflect succession patterns through a short study. This manual emphasizes rapid assessment methods to diagnose management problems. Consequently, site selection would attempt to represent the impact of existing forest use systems, including: free grazing, controlled grazing and no grazing; removal of only fodder, dry parts, and controlled harvest under JFM programs; and uncontrolled harvest of NTFP. In site locations representing different periods of protection, the vegetation status would differ as tree growth would typically increase and grass production may decrease over time. It may also be useful to select sites at different distances from the settlement. Plots closer to settlements are likely to be more degraded than plots further away. Generally, vegetation exploitation advances in concentric rings around the settlement. Plots in areas up to 2.5 km, 2.5 to 5 km, and 5 to 10 km from the settlement could be selected to cover a range of extraction levels.

It is also important to include a control plot. This will allow a benchmark comparison of the impact of any management practice (or different periods of protection) with plots which are both 1) unprotected open access, and 2) undisturbed natural forests. The second category of control plot is not easy to locate. In this case, only control plots that are not subjected to any management inputs or protection can be studied. For example, the difference in vegetative regeneration can be clearly observed and measured between a plot where grazing is prevented and a control plot where free grazing is practiced. Control plots should be near the study area, and possess similar soil and topography. The size of the plot depends on the purpose of the study and the condition, heterogeneity, and size of the forest areas (see Figure, 19). The most common method employed for vegetative analysis is the, quadrat technique. Point-centered quarter method is also described for use in highly diverse areas with randomly distributed species. It is far easier to estimate crucial parameters such as basal area per ha., species diversity per ha., and standing biomass per ha. using equations through the quadrat method than the point-centered quarter or other methods. The mensuration methods described below are designed to allow the researcher to gain an understanding of species diversity and density, basal area, biomass, and productivity.

Figure 19: Decision Chart for Selection of Method for Study
7: Quadrat Method

A quadrat is typically a square plot, however the investigator can select square, rectangular or circular quadrats. In the quadrat method, a specific size quadrat and its replications are marked in the field and vegetation data is recorded for flora falling inside the quadrats. The size and number of quadrats depends on the nature of the study and the vegetative conditions as discussed in the review of site selection criteria. It would vary for different vegetation types because in a given plot, there may be few trees but hundreds of herbs. The investigator may be interested in exploring 0 layers of tree, shrub, regenerating seedlings, and herbs. While the researcher is interested in saving time, the goal is to get as accurate an estimate as possible. Generally, it is Preferable to use more quadrats or quadrats of larger size to provide a better sample. However, statistically even small-sized quadrats or a smaller number of quadrats Property sampled will provide as good an estimate as a fuller census. Keeping in view the limitations on investigators’ time and resources, certain quadrat sizes and numbers are generally acceptable as standards as indicated below. Replications of quadrats are necessary to account for variations in soil, moisture availability or topography. In selecting the location of the quadrats, the research team should not choose ‘representative’ sites, but instead should select randomly in the field to avoid bias. This can be achieved by a random selection on the map in the office, before departing for the field. Also, selection of locations along borders (i.e. of forest and field) should be avoided as be would be subjected to the edge effects and may be larger, more diverse or overused.

After selecting the site and locating the quadrats, the next step is to record relevant observations. In the pre-selected locations, mark the four comers of the quadrat using pegs for the defined dimensions, attaching strings or rope to mark the perimeter of the quadrat. Data to be recorded will vary for trees, shrubs and herbs. Observations should be recorded for all plants lying within the quadrats.

### Quadrat Size for Vegetation Studies

<table>
<thead>
<tr>
<th>Vegetation</th>
<th>Size of quadrat</th>
<th>No. of quadrats or replication</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trees</td>
<td>50m x 20m</td>
<td>5 to 8</td>
<td>If the soil type, topography, vegetation is highly variable, increase number of quadrats</td>
</tr>
<tr>
<td>Shrubs</td>
<td>5m x 5m</td>
<td>10 to 16</td>
<td>For each tree quadrat include 2 plots for shrub and seedlings</td>
</tr>
<tr>
<td>Regenerating trees</td>
<td>5m x 5m</td>
<td>10 to 16</td>
<td></td>
</tr>
</tbody>
</table>
Trees:

Data on number of trees, trunk size (DBH), density of coppicing trees, and species distribution are critical for estimating the standing biomass and productivity. Such information is essential to understanding the sustainability of biomass removal, spatial and temporal decisions on extraction, and possible modes for product sharing. Data on the standing biomass, productivity and stump density of coppicing trees would be valuable for decisions regarding economic and institutional aspects of JFM management. Data may be recorded in the format given below:

Tree Quadrat (50m x 20m)

Location: Limbi Quadrat No.: 6 Date: April 4, 1992

<table>
<thead>
<tr>
<th>Name of tree (local or scientific name)</th>
<th>Girth (GBH) in cms.</th>
<th>Height Class</th>
<th>Coppice or Seedling</th>
<th>Name of Associated Climbers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Terminalia bellerica</td>
<td>93</td>
<td>A</td>
<td>Coppice</td>
<td></td>
</tr>
</tbody>
</table>

(see Appendix 2 for a glossary of terms used in this table.)

Shrubs and Regenerating Seedlings:

The plant types of interest are shrubs and smaller tree seedlings or smaller coppice shoots. Tree seedlings include woody plants with less than 30cm GBH and height above 1.4 m. The presence of a large number of tender coppice shoots is an indicator of future growth potential. The assessment of regenerating seedlings will help in decisions on feasible projected quantities of biomass removal for different uses. The smaller quadrats for shrubs and seedlings should be randomly located inside the larger tree quadrats, and marked using pegs and rope.

Shrub & Seedling Quadrat Size 5m x 5m, 2 plots

<table>
<thead>
<tr>
<th>Species</th>
<th>Number</th>
<th>% around layer*</th>
<th>Species</th>
<th>GBH(cm)**</th>
<th>Height Class***</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gnidia glauca</td>
<td>56</td>
<td>51-75%</td>
<td>Grawia glabra</td>
<td>12</td>
<td>A</td>
</tr>
</tbody>
</table>

* % categories: 91-100%, 76-90%, 51-75%, <50%  
** ≤ 30 cm  
*** ≥ 1.4m.; Height classes = A, B, C (see Glossary App.2)

Herbs:

Herb layer vegetation data may not be of interest to all researchers, foresters or local communities. However, in some situations herbs may have medicinal or food value. The small herb plots should be located randomly inside shrub layer quadrats.

Herb Quadrat (1m x 1m, 2 Plots)
Finally, since all species present in a forest patch may not be covered in the quadrats, the investigators should list other plant species (i.e. trees, shrubs, herbs) noticed outside the quadrats when they are working in the field.

8: Grass Biomass Production Assessments Using the Quadrat Method

Estimation of grass production is of great interest to local communities for its value as livestock fodder or as raw material for rope-making. In terms of management, grass productivity data from patches protected for various periods is necessary to understand the optimal period of protection before yields decline due to shading by trees and shrubs. Grass production can be estimated monthly, seasonally, or yearly. One difficulty in estimating grass production in plots under grazing is quantifying the grass consumed by livestock. To overcome this, the quadrats selected for measurement should be fenced at the beginning of the study and protected from grazing while data is being collected. The size and number of quadrats required for measurement include 5 replications of 5m. x 4m. (20 m$^2$), to provide a total sample area of 100 m$^2$. These 5 replication blocks should be randomly marked in the grassland patch and protected by a thorn or barbed wire fence. To estimate fodder grass productivity, divide each of 5 replications into 12 quadrats of 1m x 1m size. Grass growth occurs during the rainy season and generally continues for 1 to 2 months after the rains end. Depending on the region and when the first rains arrive, one month into the rains should be the starting point for the first harvest measurements. Every 30 days, one plot of 1m x 1m should be harvested in each of the 5 replicates. The harvest technique requires clipping and weighing (in grams) all the grass in each 1m x 1m plot and recording the data. Grass productivity can be expressed as fresh weight since green grass is generally fed to livestock. Gow grass typically contains about 5-10% moisture, so dry weight can be estimated; alternatively, a sample of 50 or 100 gm of fresh grass can be dried in the oven or sun and weighed.

One of the most common methods of calculating grass productivity is to use the peak month's grass yield as the annual productivity of the plot. The procedure involves adding the dry or fresh weight of each plot to obtain monthly totals from all sample plots, calculating yields/ha for each month, and identifying the highest yield month. By taking the maximum month's yield per hectare and multiplying by the total grassland area, the total grass production available to village livestock if land were protected can be derived.

Aside from fodder, in some areas grasses such as bhabbar (Eulaliopsis binata) are used as raw material in the production of fibre, mats and brooms. Depending on its end use, grass is harvested at specific periods in order to get a desired stalk strength or maturity. Discussions with local collectors and processors can determine the week or month for harvest. Five replicates of 2m. x 2m. quadrats should be randomly laid out and fenced to protect from grazing. Once the appropriate time has been established by local users, the one-time harvest and weighing of above-ground parts can be done. The biomass obtained for this collection week defines the productivity of that plot. An example of how grass data can be analyzed to understand forest management issues is presented in Box 2.

Box 2: Management Options for Bhabbar Grass Lands in Haryana

The fast-degrading Shivalik foot hills are spread over area of 3 million hectares in Haryana, Punjab and Himachal Pradesh. Historically, local communities have had rights to (i) grazing (ii) small timber for housing and (iii) fallen and dry wood for firewood. Under the FD Working Plan (1971-91) in the Morni hills, grazing was prohibited due to server problems of erosion. However, grass cutting with a sickle was still allowed in this area.

In recent years JFM programs have been initiated in the Shivalik hills by the Haryana FD. Various patches under protection for different periods have responded by naturally regenerating. Local communities are noticing significant changes in vegetation; but impression by some were that bhabbar yields were declining, while others felt that yields were increasing with protection. The key management issue facing communities and the HFD was to identify the protection period (and interventions necessary) to maximize grass yield. Grass productivity (bhabbar and other) was monitored using the quadrat method in plots under protection for 0 (control), 1,3,6 and data was recorded in the following format:
The findings showed that bhabbar yields continued to increase up to 6 years, after which bhabbar and other grass yields declined. The decline could be due to several reasons, including increased shading by regenerating *Acacia catechu* trees and impacts of *Lantana* infestation. Given these findings, it might be decided that strict protection of grassland is desirable for 5 to 6 years, but after that various vegetative manipulations may be necessary if bhabbar grass continues to be a priority biomass type for the community. For example, *Lantana* may need to be pollarded or pruned, and lopped twigs used as firewood. Alternatively, the community might decide to protect a part of the land continuously to get firewood and grass, while the remaining part could be treated by removal of *Lantana* and tree pruning.

9: Estimating Sustainable Leaf Biomass Harvesting Levels Using the Quadrat Method

Leaf biomass from forests is normally removed in two ways, either by sweeping the forest floor to collect the fallen leaf litter, mainly for manure, or by lopping leaves from standing trees for fodder and plate-making. Leaves often serve as an important raw material for such small industries as leaf plate manufacturing. Leaf litter productivity studies are complex and involve establishing litter traps in the field, collecting litter every fortnight, and separating and drying leaves, and twigs for a full one year. A more feasible and easier option is to use an equation to approximate the leaf litter productivity. The leaf productivity of a tree depends on its age and size, namely its girth (GBH) or diameter (DBH). Based on this relationship between DBH and leaf production, the methodological steps detailed below can be adopted for estimating leaf biomass. In summary, by means of the quadrat method, the technique involves measuring the DBH of the selected species whose leaves are used for plate-making (e.g. *Shorea robusta* or *Butea monosperma*). Frequency distribution for DBH classes can estimate the mean DBH per class and guide the selection of "representative" trees. The leaves of these can then be lopped at maturity and weighed to derive an average for each DBH class. Summations for all classes can obtain a per hectare leaf biomass estimate.

Steps to Estimate Leaf Biomass

1. Classify and derive frequency distribution per DBH classes depending on range of DBH values.
2. Estimate mean DBH for each frequency class.
3. Select one "representative" tree in forest with DBH closest to DBH mean of each class (i.e. if 5 DBH classes, select 5 trees).
4. Lop all leaves from representative trees during peak weeks of leaf growth.
5. Convert from representative tree to total for each DBH class and obtain the sum for all classes:
   \[
   \text{Total leaf biomass for DBH Class } i = \text{Wt. of lopped biomass for representative tree Class } i \times \text{# trees in Class } i
   \]
6. Convert the sample quadrat estimate to per hectare projection.

(To increase accuracy lop all regrowth 1-2 times during year to confirm annual productivity.)
It is difficult to predict what percentage of the leaf biomass could be extracted from the plot without affecting nutrient cycling or long-term biomass productivity in any significant way. This would require a series of long-term monitoring studies in different locations. However, some studies have indicated that approximately 50% of tree leaves may be lopped without any appreciable negative effect on the growth or leaf biomass productivity.

10: The Plotless Method: An Alternative Assessment Technique

The plotless method, also known as the point-centered quarter (PCQ) method (or distance method), is one of the quicker and more reliable methods to employ when examining large forest areas and/or areas with heterogeneous and randomly distributed vegetation. While this method does not fully reveal the plant diversity of a stand, it reveals the dominant species and some of the rarer ones. Density is calculated for a given area by first estimating the mean distance between trees, and then squaring this mean distance to yield the average area occupied by a plant.

Trees:

The first step is to point for the transect. In hilly arm it is best to start from ground level and proceed up the hill, while in flat areas it is preferable to begin at the edge of the forest. If there is a large variation in vegetation, such as in the valley and upper reaches of a hill, or if there are clear cut variations in the tree density in different patches, the patches should be considered separately with different transect lines. Normally, two transect lines of approximately 1 km. in length should be used. Ten points along each transect at distances of 100 m. can be selected for measurement. Accuracy increases as the number of points increase. If the forest is small, points should be chosen at shorter 50 m. intervals. Selecting points at 100 m. or 50 m. intervals can help avoid bias. If the forest is small and a 1 km. straight line is not possible, a perpendicular line can be taken as shown in Figure 20. At each interval, the following data format and methods can be adopted:

```
Data Format for PCQ Method

<table>
<thead>
<tr>
<th>Point number &amp; quarter (a-d)</th>
<th>Name of tree</th>
<th>Distance from central point (m)</th>
<th>GBH* (cms)</th>
<th>Height class</th>
<th>Occurrence of climber</th>
<th>Coppice or seedling</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 a</td>
<td>Terminalia paniculata</td>
<td>4.09</td>
<td>19</td>
<td>A</td>
<td>None</td>
<td>Seedling</td>
</tr>
<tr>
<td>1 b</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
```

*Select only trees with > 30 cm GBH; If more than one shoot or coppice, take each GBH measurements.

1. Using a compass, walk along a straight line with a stick or rope to indicate the transect.

2. At each 100 m. point, establish a perpendicular line with the stick, resulting in the formation of 4 quarters.

3. At each 100 m. intersection point, record the distance of the tree nearest to the intersection in each of the four quarters (see Figure 20).

Figure 20: Transect Line Location
Shrubs and Herbs:

The PCQ methodology for studying shrubs, regenerating seedlings and herb vegetation is similar to that of the quadrat method but a few points need to be considered. From the four quarters formed by the transect intersection, randomly select two of the quarters and then two shrub quadrats within each of the two quarters. A number of points should be located along the transect where shrub and herb layers are to be measured.
Specifically, if two transacts are used, select 3 points (3rd, 6th and 9th) on the first and 3 points on the second transect. In the plotless method, every species present in a given area may not be covered along the transect points. Thus, all plant species outside the transect points should also be listed during the fieldwork.

### 11: Measuring Canopy Cover

Canopy cover is defined by the extent of ground area covered by the spread of tree branches and leaves. It indicates the openness of the ground to sunlight, and suggests the gaps available for natural regeneration or grass growth. Good canopy cover suppresses grass and herb plant growth. Thus, canopy cover data is important for decisions on vegetation manipulation (pollarding, pruning, removal) to encourage grass productivity or shrub growth as well as to identify shade-loving plants. Canopy cover can be estimated by recording the percentage overlap between adjacent tree crowns directly above a large number of points in the forest. One can either study the development of the canopy over time in the same plot, or conduct a cross-section comparison of patches under varying modes or periods of protection and management. A rapid technique to estimate canopy closure involves selecting a representative point in the forest to start, stopping every 5 m. along a compass line to directly look above and observe the tree canopy, and recording 30 observation points for the sample to obtain a mean score and percentage for canopy closure (see data sheet and Figure 21).

#### Data Sheet for Crown Canopy Scores

<table>
<thead>
<tr>
<th>Observation Points</th>
<th>'0' No Canopy cover</th>
<th>1 (Adjacent crowns meet)</th>
<th>2 (Crowns overlap still allowing light)</th>
<th>3 (Sky not visible)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Figure 21: Estimating Canopy Cover**
Figure 22: Grid Projection and Canopy Structure Measurements
Figure 23: Vegetation Profile in a Mixed Forest in Huliyurdurga, Karnataka
12: Vegetation Profiles

The vegetation in a regenerating plot may consist of tall trees (spreading or non-spreading), dwarf trees, trees growing under the shade of tall ones, shrubs, herbs, etc. Vegetation profiles indicate the arrangement or structure of the above-ground forest ecosystem, depicting both the vertical and horizontal spread of different plant types. Data on height and spread of trees or shrubs is necessary to make management decisions which maximize the type of biomass the community requires. From a given patch, the community may desire grass as fibre, shrubs as manure, tree twigs as fuel, tree leaves for plate-making, or a combination of these. The vegetation profile, in combination with community demand and preference information, can help determine optimal vegetative manipulations to achieve management goals. A vegetation profile can be prepared for each type of forest and for two types of vegetational differences: (1) those reflecting structural changes over the years in a given forest patch, and (2) cross-sectional comparisons of similar patches under various ages or periods of protection. To rapidly assess forest structure, the following methods are suggested:

Vegetation Profile Assessment

1. Select a representative strip 30m. X 5m.

2. Fix the central line of the strip and mark the axis on the graph paper.

3. Walk the central line, marking position of each tree within the strip on graph paper with respect to the central line (see Figure 22).

4. Record for each tree GBH or DBH, height, bole length and major first branch

5. Mark the canopy area by measuring at least 4 points of the crown, mark the shape of the canopy, and measure the distance between trees (see Figure 22).

6. Based on this information, draw a forest structure profile.

The vegetation profile indicates the presence of tall trees in the height range of 10-20m. and a
As described earlier, the standing biomass or biomass productivity of trees is the most important parameter for making management decisions on the quantity of sustainable tree biomass extraction. Biomass is the wood weight or volume of trees (including stems and branches) at a given time (standing) or over a period of time (productivity) in a prescribed area. One of the two methods of estimating biomass is the harvest method, in which all trees are felled in the selected number of simple quadrats and their weight estimated. This technique is not often practical or desirable as it involves the felling of a large number of trees. Biomass can also be estimated using DBH and height as indicators of tree volume or weight. Several studies have established a quantitative relationship between the weight of certain trees and their DBH and height, however such biomass estimation equations are currently only available for a limited number of important tree species.

The equation used is as follows:

\[ \text{Biomass} = b + a (D)^2 H \]

where \( D = \text{DBH}, H = \text{Height}, a \) and \( b \) = constants (species specific)

Alternatively, based on data from a number of forests in India, a rough estimation of standing biomass is also possible by using basal area per hectare data:

\[ \text{Total biomass} = b + a (\text{Basal area in m}^2/\text{ha})^2 \]

where \( b \) and \( a \) are given constants as follows,

\[ a = 35.23, b = .156 \ [\text{SE} = .0351] \ [R^2 = .68] \]

It must be noted that although standing biomass is a critical parameter, it is also one of the most difficult measurements to estimate accurately. Most importantly, no management decision should ever be based on one such parameter alone, but instead must consider the range of vegetational institutional and economic factors influencing the system. In West Bengal, researchers have attempted to estimate sustainable firewood and leaf yields using the methods described in Box 3.

**Box 3: Sustainable Harvest of Firewood and Leaves From Sal Forest**

In the regenerating sal forests of West Bengal, the JFM committees are interested in assessing the quantity of wood for fuel or leaves for plate-making that can be harvested sustainably. Basal area of Sal (Shorea robusta) forests of different ages in a village is given below:

<table>
<thead>
<tr>
<th>AGE</th>
<th>Basal Area m²/ha</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 years</td>
<td>7.6</td>
</tr>
<tr>
<td>18 years</td>
<td>18.7</td>
</tr>
<tr>
<td>41 years</td>
<td>20.4</td>
</tr>
</tbody>
</table>

Standing Biomass: Basal area in m²/ha can be calculated for sal forest of given ages. To approximate the standing biomass in tons/ha, the basal area can be substituted in the following equation:

\[ \text{Standing biomass} = 39.156 + 0.1011 (BA)^2 \]

\( \text{SE} : 0.01 \)

\( R^2 = 0.91 \)

For example, if an 18-year old sal has a 18.7m²/ha basal area, its standing biomass would be 74.5 t. Based on preliminary findings which estimate sustainable extraction levels may lie around 3-6% of standing biomass, the community...
could decide to harvest about 4-5% (3.5 tons) of this standing biomass as firewood.

Leaf biomass estimation: Leaf productivity can be estimated for a sal forest of a given age using the following equation based on basal area:

\[
\text{Leaf productivity} = 1.456 + 0.1219 \times (BA)
\]

(SE: 0.019)

\[R^2 = 0.79\]

If the basal area of the 18 year old sal plantation is 18.7m²/ha, the leaf productivity would be 3.7 dry t/ha/year. The dry weight of leaves can be converted to fresh weight by adding 75% water weight or dividing the dry weight by 0.25. Thus the fresh weight of leaves for the 18-year old plantation would be 14.8 t/ha/year. Based on field studies it may be possible to estimate that about 30-50% of the leaf biomass could be removed sustainably for plate-making. In other words 4 to 7 tons leaves could be lopped annually.

Summary

Understanding the structure and function of the natural forest ecosystem is essential to establishing sustainable use systems. Growing rural population pressures throughout India will require that many natural forests are utilized intensively to meet local needs. It is important that while meeting resource demands, the forest's environmental functions, including soil conservation, biodiversity, local hydrology and microclimate, will also be sustained. While FDs and silvicultural researchers have gained considerable knowledge regarding the growth patterns of important timber species, much less is known concerning NTFPS, regenerating forest ecosystems, and how they change over time. Specialized research that indicates how natural forests can be sustainably harvested to generate a steady flow of products is critically needed. Forest user communities may possess insights regarding forest ecosystem regeneration and how forests might best be managed. Combining conventional vegetative research techniques with local knowledge, based on community experience, may be the most effective way to design management systems that meet both environmental and economic goals.

At the same time, while PRA and diagnostic vegetation studies conducted at one point in time can help initial management options, the local community as well as the FD will greatly benefit by monitoring vegetation dynamics, including wood and NTFP removals, over longer periods of time. Long-term monitoring plots could be set up by the local community, and with guidance from teachers, local students and other interested community members could monitor forest ecosystems using the proposed baseline methods. Future volumes of the Field Methods Manual series will attempt to document new, more effective methods to assess vegetative conditions and change through rapid appraisal and long-term monitoring.
Fundamentally important to the sustenance of India's natural forests is the evolution of effective local resource management institutions. Over the past two decades, the failure to actively involve communities in social forestry and national park management has generally left forest resources unprotected and poorly maintained. The inability to effectively galvanize and sustain community participation in resource management has also placed a greater burden on Forest Departments. Not only are foresters deprived of community support, but they must spend considerable energy in defending the forest against the communities. Frequently, management success or failure is more influenced by FD-community relationships than by technologies, capital inputs, economics or ecological conditions.

Understanding the social and institutional needs and problems affecting human forest use behavior in order to reduce conflict situations may be the most critical element in any forest management research and extension program. Through diagnostic research methods, important institutional issues and questions can be pursued by teams working with FDs and community user groups (See Figure 24). Findings can help generate options which can contribute to the development of joint forest management programs.

With the promulgation of state and central government policies for JFM, a growing number of FDs are beginning to develop management partnerships with community groups. Since JFM presents a new form of forest management, more field experience is required to identify processes for the establishment of collaborative agreements. This involves developing methodologies to document and analyze emerging experiences with JFM and to identify policy and operational strategies for program improvement by implementing FDs. Process documentation techniques have proven to be useful in capturing emerging experiences with participatory forest management. Researchers who use this method can serve as the "eyes and the ears" of institutional change. They attend village and FD meetings, and hold in-depth interviews with staff and villagers to record the evolution of joint management systems. Detailed memos written after each meeting or interview describing problems, issues, and opportunities can include suggestions to improve programs. The memos are then used to formulate Working Group agendas, itemizing management options and decisions that need to be made by FD officers and support staff. Process documentation memos and Working Group agendas, also provide a historical record concerning the institutional development of new management systems.

Figure 24:

<table>
<thead>
<tr>
<th>Issues</th>
<th>Questions</th>
<th>Methods</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Macro Assessment</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Identifying High Potential</td>
<td>In what parts of the state have forest protection groups acted in the past or are emerging? Where have FD staff or NGOs taken the initiative to encourage community management groups?</td>
<td>Interviews with FD field staff and NGOS; Map locations with community forest management traditions and current activities</td>
</tr>
<tr>
<td>Areas for JFM</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Community Assessment</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Identifying forest user groups and conflicts</td>
<td>Who are the forest user groups and what is the nature of their resource conflicts?</td>
<td>Venn diagram of user groups; Group interviews with FD and community regarding resource conflicts</td>
</tr>
<tr>
<td>Clarifying forest territory access and product rights</td>
<td>How have forest rights changed over the past50 years? What are the territorial access and usufruct rights of forest user groups?</td>
<td>Time chart with rights by period; Map forest use area by group and products</td>
</tr>
<tr>
<td>Identifying potential</td>
<td>What are the characteristics of</td>
<td>Organizational chart of village</td>
</tr>
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</tbody>
</table>
Identifying Conducive Social Environments at the State and District Level

In designing a state or district level JFM program, it is important to identify Conducive social and institutional contexts where collaboration between FDs and communities is likely to be successful. In some areas, communities are already protecting natural forests through local formal or informal management institutions of their own. These groups require official acknowledgement and legitimacy from the FD. In other areas, Communities may be highly motivated to begin participating in forest management and will require information and encouragement from the FD or an NGO. By contrast, some communities or individuals may have little interest in forest management or may be too factionalized to take effective action as a cohesive group. By identifying and giving priority to sites that offer conductive social environments for participatory management, FD programs will be able to greatly enhance their success. Building on past traditions and existing indigenous efforts will allow programs to respond more naturally to community needs, as well as reduce costs and accelerate expansion. Frequently, the success of one community is the strongest force in encouraging others to emulate successful program initiatives.

While some Indian villages are encumbered by inter-caste conflicts and corrupt leaders, many communities possess capable leaders and families that are genuinely concerned about the forest environment. Current reports indicate that thousands of villages in many parts of the country have formed forest protection groups, both with and without the support of FDs. As pressures on the environment increase and strategic forest products become increasingly scarce, it is likely that other villages will be compelled to take action. It is this
grassroots environmental movement, based on committed families, village leadership, and local management capacity, that provides the best hope for regenerating and sustaining India's natural forests. Community resource management initiatives often seem stimulated by such social and political changes as land reform, NGO activism, the replacement of leaders from elite groups by representative members of the community, and general trends towards greater decentralization and democratic processes.

From a sociological perspective, some communities will be more interested and capable in developing forest management institutions than others. Initial studies indicate that villagers take action for a variety of reasons, including a growing perception of scarcity of forest resources, particularly items important for their subsistence and cash income (roofing poles, wood for tools, fodder, fuel, medicines, and food). In many cases, communities are also concerned about undesirable environmental changes occurring as forests are disturbed and increasingly denuded. These may include such hydrological changes as declining water tables and accelerated run-off, modified micro-climate and soil moisture levels, or declining bird populations which control agricultural pests. Finally, some communities feel their sociocultural and religious belief systems are undermined as the forest becomes degraded. These concerns are often strong motivating forces in spurring communities to establish controls and regulations to protect the forest and reduce its use to more sustainable levels.

In operationalizing these management systems, some communities achieve greater success than others. Studies indicate that both strong leadership and social homogeneity are associated with success in establishing management activities. In areas where concerns about forest deterioration are limited or absent, and where factionalism or a lack of leadership at the community level exists, the emergence of effective JFM systems may be much less likely.

Interviews with FD staff and NGOs who have worked in different parts of the state can help a research team identify areas where communities are already involved or have managed forest resources in the past. Using a state map, regions can be delineated where there are forest protection committees or where more conducive environments for collaborative forest management exist. A review of secondary information (e.g. census data, historical records and gazetteers, socio-political studies) can also help identify favorable contexts. For example, districts with large tribal populations characterized by historical traditions of forest management may be good targets. Once broader geographical regions are identified, compiling data on more specific ecological and social conditions in different ranges can help Fds identify priority areas. The Checklist of Indicators can guide forest officers in rapidly evaluating information on relevant conditions for JFM (see Appendix 1). With experience, better methods of assessing site feasibility can be developed.

2: Community Level Diagnosis

JFM is based on the creation of a management partnership between the FD and community groups. Ideally, decisions are made jointly between the department and affected communities after an open dialogue generates consensus. However, despite efforts to encourage a participatory process, it is inevitable that some communities are excluded. The process of empowering community groups and equitably allocating forest lands is critical to the success of the program. If inappropriate communities are involved, or territorial management responsibilities are not divided fairly, or strategic communities are excluded, conflicts can arise which will weaken and potentially destabilize the program. It is important to understand the types of resource allocation patterns that are appropriate in different contexts within India and develop procedures to ensure that this designation process is carried out in an open, participatory manner.

As a first step, all forest user communities should be identified during diagnostic activities. The research team can assist local FD staff and villagers clarify those groups that should logically be brought into a dialogue regarding future management systems. This may include those communities in or near the forest, migratory graziers, and other outsiders that come from greater distances to utilize the resources. It is also important to identify commercial users of forest resources, including contractors, middlemen, and mill operators.

Information on user groups can be collected through key informant and group interviews. Community members can usually name with accuracy the surrounding villages, especially those who rely on certain forest products. Use patterns indicating the identity, sex and number of collectors, products collected, and time of collection can be indicated on a map. For example, twenty women may come to the forest every morning from a village to collect headloads of fodder or fuelwood for 8 months of the year.

A useful way to illustrate user groups and their rights or authority over forest resources is to draw a social Systems Diagram indicating forest users and managers (see Figure 25 and Box 4). The figure shows the
significant dependence of the Banjara community on fiber grass and the Jat community on fodder grass, while also identifying the roles and interactions of contractors, FD field staff, and the paper mill near Pinjore. During the process of diagramming, the research team can also clarify through informant interviews the special rights and responsibilities different groups may hold over forest resources. Drawing this type of diagram and collecting user group specifics can help outside facilitators involve different groups and factions in a discussion to reach consensus regarding new management systems.

Figure 25: Systems Diagram of Forest Users and Managers in Pinjore, Haryana

It is helpful to diagram the relationships between FD officers, user communities, middlemen, and outside project staff vis-à-vis forest resources. Figure 25 illustrates interactions between principal forest use actors in Pinjore Range, Haryana. It is clear that communities primarily interact with the beat guards, and to a lesser extent with the beat officer, rarely coming into contact with the ranger. The Banjara communities primarily rely on bhabbar grasses for rope-making, while the Jats are more dependent on forest fodder grass. In the past, local contractors purchased grass leases from the FD while levying face on village users. This undermined community incentives to protect forest resources, leading to illegal grazing and fuelwood cutting. New agreements allow communities to buy grass leases, providing them with lower cost raw materials. In return, the communities cease open grazing and protect forest resources. While the program has made considerable progress in formally involving forest villagers in management, many institutional issues remain unanswered. Relations and management agreements between Jat, Banjara and other community groups need to be improved so that conflict is minimized and their different forest resource needs can be met. The operation of the World Bank-supported Kandi watershed project has caused some tension due to the absence of any effort or mechanism to coordinate project activities with community groups and respond to their perceived priorities. Finally, while some of the Beat Officers and guards have good relations with forest user communities, the FDO and the forester need more time to provide support and encouragement to both groups as they attempt to establish cooperative agreements.
The FD normally formalizes a collaborative agreement with specific communities by designating clearly defined territories for management. The decisions regarding which communities and management areas are often shaped by considerations of proximity to the forest, degree of forest dependency, prior rights, and interest level. It is important to clarify the boundaries of the management territory in question. In some cases, the community or the FD may wish to gradually place increasing quantities of forest land under community management as village capacity is demonstrated.

Microplanning and participatory sketch-mapping can bring foresters, NGO staff, FD and villagers together to develop more appropriate management plans for forest areas. Sketch-mapping techniques to determine user groups and access routes were discussed in the PRA Community Profiling section. Mapping activities may include sketching a use map on the ground or on paper, indicating access routes, areas which are specially controlled by certain members in the village, and areas that are open access. The mapping should also indicate areas used by outside groups, whether they be migrant graziers or artisans from other villages. Walking through the forest with village members can also aid the research team in cross-checking information about the proposed management area. Key informant interviews with FD field staff, village leaders, and representatives of different user groups can highlight diverse perspectives, including misunderstandings that may exist regarding territorial rights and responsibilities.

If communities are to assume a formal role in forest management, some form of community-based institution is required to coordinate the activities of village members. Specialized forest management organizations, such as the Forest Protection Committees of West Bengal, seem to function more effectively as forest protectors than other multi-purpose organizations such as village panchayats. Smaller, homogeneous groups representing a single forest-dependent settlement are also proving among the most effective operational units for organized protection and management. While thousands of informal village protection groups have been formed by communities in Bihar and Orissa, those with the sanctioned support of the FD or local NGOs may prove to have more long-term stability. Diagnostic studies are needed to determine how informal local groups can be strengthened. More experience is also necessary to determine how single product-oriented groups effectively function as forest managers. These include tree growers’ cooperatives, dairy groups, or associations of fuelwood headloaders.

While some village institutions may not be appropriate for overseeing the forest management program, they may be able to provide support to certain components of the system. For example, a Mahila Mandal may support the activities of women leaf plate-makers, while a milk marketing cooperative may facilitate a shift to stall feeding which reduces open grazing in the forest. To determine which village institutions might play a lead or support role in establishing a participatory management system, the research team should work with a representative group of villagers to draw an organizational chart of community institutions, listing their membership, primary activities, and leaders. A Venn Diagram for Limbi panchayat indicates the presence of three major local user groups, including older settlers with greater forest usufruct rights, new and displaced migrants with heavy fuelwood headloading dependencies, and bamboo artisans. In such a situation, a management institution is needed that can facilitate an agreement regarding the different needs and prior rights of all user communities (see Figure 26 and Box 5).

Figure 26
A social analysis of the forest management context in Limbi forest, southeastern Gujarat, identifies the communities that use forest resources and differentiates them according to period of settlement and primary forest product dependency (see Figure 26). History of settlement is important since recent migrants have no rights to mahua flowers and certain other forest products. The stronger usufruct authority of the old settlers will need to be reflected in new agreements, while at the same time responding to the economic needs of fuelwood headloading families in the newer settlements of displaced families. The needs of Kotwalla basket-makers in relation to the new management system also require consideration. At the present time, the basket-maker have certain rights to bamboo resources, but these are managed through an inefficient quotas system.

The FD has helped members of the Limbi panchayat establish a FPC. The committee has a limited membership and is not yet very active. The ex-panchayat headman who facilitated organization of the FPC claims that it has been effective in reducing large-scale fuelwood extraction by outside cartloaders, and has also helped to control forest fires. The FPC has not, however, developed any method for regulating the hundreds of women fuelwood headloaders utilizing the forest reserve. Thus, the FPC will need to considerably broaden its membership, recruiting most or all of the families of user communities, and especially encouraging representation of women headloaders and other dependent users. The FPC also needs to clarify its relationship with the Forest Labor Cooperative Society (FLCS) which continues to carry out some logging activities. The FLCSs are the largest timber-oriented organizations in the region, wielding political power and a strong interest in continued exploitation. The GFD could facilitate negotiations in an effort to integrate FPC and FLCS objectives and operations.
Disputes over access to scarce and valuable resources can often stimulate social conflict. Transparent planning processes can reduce conflict by helping affected groups reach a consensus about important decisions regarding the sharing of resources. Yet, even with consensus-based decision-making, conflicts can emerge. When disagreements and injustices arise, they need to be resolved as quickly and equitably as possible. Given the burdens on the legal system, formal judicial systems rarely facilitate a rapid resolution. Community councils and informal dispute arbitration systems currently operate in some areas in India, effectively settling disputes arising in JFM programs. In other cases, FD staff has worked with village committees to negotiate disagreements. A summary and evaluation of current approaches to dispute arbitration in the area would help FDs and NGOs to facilitate their development. During a group interview, a matrix can be drawn indicating protection mechanisms, benefit-sharing arrangements, and dispute arbitration systems. Under each column, the participants can list the system of operation, specifying problem areas and appropriate conflict resolution mechanisms.

3: Forest Department and Support Group Level Diagnosis

If senior officers and field staff are to play an effective role in supporting a transition from custodial to participatory management, they must have confidence that their organization will support their efforts. Since JFM is a new approach, and not yet fully understood, some officers may be uninformed or unsupportive regarding its function within the larger management system. JFM also implies some fundamental changes in staff attitudes, gender orientation, and norms and procedures if it is to be effectively integrated into the department. To that end, FDs may need to systematically feed more information on the program to their officers, actively encouraging field staff to experiment with new management systems through professional incentives, promotions and other acknowledgements of achievement. The department will also need to modify procedures and norms to respond to community priorities, and participate in reciprocal trainings and reorientation sessions with community groups and NGOs.

One of the primary institutional issues in developing a JFM system is to define who among the FD staff are the critical players operating at the interface of the program's implementation. Identification will involve key individuals at three levels in the organization's hierarchy: 1) policy decision-making, 2) mid-level management, and 3) daily field operations. While support for the transitions required by JFM is ultimately necessary on all levels, those most crucial to initiating such changes are presumably situated at both the top and bottom of the institutional chain of command. Case studies reveal that field staff who approach their job with flexibility and sensitivity in responding to community needs have been most effective in establishing stable working relationships and laying the foundation for collaborative management. A supportive DFO who effectively encourages his field staff to reorient its approach toward listening to, and working collectively with communities, including women, can be a decisive factor in a program's progress. However, it is equally essential that a clear understanding and support of the program's objectives, as well as endorsement of reforms as field learning is documented and analyzed, emanate from the highest levels of the FD and Ministry, and is supported and communicated by mid-level managers.

Through group and individual interviews with a range of FD staff, an organizational chart of key actors can be developed to illustrate the relationships of staff involved in JFM and the relative strengths of their interactions with each other. The primary objective of this methodology is the identification of individuals within the FD at various levels who will assume strategic roles in the implementation of the JFM program. Once the major actors have been identified, it is important to understand their attitudes and knowledge regarding the program's philosophy, objectives and implementation. The psychological culture within the FD strongly influences the values and worldview of its staff. A thorough investigation should be made into the staff's perceptions of the roles and capabilities of both 1) communities to organize, protect and manage forest resources sustainably and 2) the FD to shift from custodial authority to cooperative management partner and facilitator. Small group discussions supplemented by individual staff interviews can reveal attitudes, uncover confusions, biases and contradictions, and assess the staff's need and institutional potential for psychological and behavioral modification toward the process of empowering communities. The qualitative information and impressions stemming from these staff interviews can then be compared with outside informants, such as village leaders and other local NGO and GO agency staff, who may offer their own differing opinions concerning the values, receptivity, and behavior toward the community of forestry field staff and senior decision-makers.
In addition to the importance of values and attitudes, the organizational opportunities and constraints involved in reorienting field staff to work intensively with communities must be understood in the context of the staff's daily work regime. Given the time constraints imposed by its standard workload and responsibilities, including numerous procedural requirements such as program reporting and monitoring, the actual staff time available to assist communities in JFM field activities needs to be carefully evaluated. A logical first approach to this assessment might involve working together with operational staff to develop a Daily Activity Schedule by season (Figure 27). The schedule of time allocations for various activities could be followed by a scoring exercise in which staff rank their tasks by perceived usefulness in improving forest management. The combination of these methods would help identify the less relevant and more time-consuming tasks, which might be modified or substituted in exchange for community management activities which were considered higher priority by the implementing staff.

Figure 27
Related to formalized work schedules of field staff are the broader agency norms and procedures which influence staff motivation and priorities, drive decision-making, and dictate the channelling of feedback from the field. The creation of incentives and professional growth opportunities such as promotions, public recognition, opportunities for specialized study and tours, and training courses, are prerequisites for successful long-term integration of JFM into agency operations. The historical institutional bias which marginalizes gender issues and works against greater recruitment and involvement of women, both at higher and lower field levels, needs to be seriously addressed.

Through group discussions with both male and female field staff, a matrix of incentives and disincentives for working more directly with communities can be developed (See Figure 28 and Box 6). Brainstorming sessions with field staff can pinpoint institutional constraints to community participation in forest management perceived by field staff, mid-level and senior officers. Identify the advantages and disadvantages of JFM for field staff.
can lead to a discussion of ways to improve the incentives, norms and procedures to make them more supportive of staff efforts to work intensively with villagers. At the same time, FDs will need to open communication channels to allow a greater flow of information and suggestions from experienced field staff to senior officers. Feedback from the field will be instrumental in allowing the agency to adapt program strategies as learning emerges through trial and error experience. Currently, many FDs hold regular meetings of senior officers to coordinate administrative activities and project planning and implementation. Few FDs, however, have routine meetings with forest communities or field-staff to feedback field-level management problems and experiences to senior department officers. As a result, there is little upward flow of information from those directly involved in field-level forest management. By diagramming existing channels for communication and decision-making, it is possible to identify weaknesses and suggest measures to facilitate the exchange of information. Figure 29 indicates how existing information flow mechanisms in the Haryana Forest Department might be enhanced through proposed monthly meetings at the community and forest block level.

Figure 28:

Incentives and Disincentives of JFM: Perceptions of Guards, Haryana Forest Department

<table>
<thead>
<tr>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. If people protect, less time needed for patrolling, theft and fire control</td>
<td>1. Erosion of direct authority of FD</td>
</tr>
<tr>
<td>2. Reduction in conflict with community; personal reward of improved rapport</td>
<td>2. Community may take advantage of new authority</td>
</tr>
<tr>
<td>3. Improved locally-adaptive planning allowing more time, information and cooperation from community</td>
<td>3. Lack of clarity regarding new tasks and expectations</td>
</tr>
<tr>
<td>4. Smoother implementation of project activities</td>
<td>4. Additional workload on top of regular duties; no formal incentives</td>
</tr>
<tr>
<td>5. Enhanced natural regeneration, biodiversity, ecological balance</td>
<td>5. Inadequate reorientation and training to operate effectively as facilitators/partners with community groups and women</td>
</tr>
<tr>
<td>6. Improved livelihoods of forest-dependent</td>
<td>6. Loss of informal income and/or pressure from outside interests to collude communities</td>
</tr>
<tr>
<td>7. Professional prestige, and personal satisfaction for successful management</td>
<td></td>
</tr>
<tr>
<td>8. Mechanism of information chanelling from field to inform program</td>
<td></td>
</tr>
</tbody>
</table>

Box 6:

Analyzing Organizational Constraints to JFM with Haryana Forest Department Field Staff

A three-hour semi-structured interview with two beat guards from the Haryana Forest Department revealed their perceptions regarding the problems and opportunities presented by the JFM program. The interview began with an informal discussion to profile the informants’ family, educational backgrounds, and early professional experiences, including prior training programs. As the discussion gradually moved on to the experiences of HFD staff with JFM, the two guards stated how important it was for them to receive strong institutional support from their senior officers, including clear instructions through line authority for endorsing new participatory activities. They noted that without such support, no matter how well-intentioned the field staff may be, they run the risk of punishment if they take initiatives on their own accord.
The guards also noted that they had received little or no formal training after ten years with the FD. They recommended new training programs be initiated to build staff skills for improving interactions with community groups, and assisting villagers to form management organizations, and resolve disputes. They also expressed the need to learn methods for accounting, production monitoring, sketch-mapping, and micro-planning. The guards suggested the current policy of frequent transfers and rotations be modified to allow them longer periods to build relationships with community members.

A separate, stratified group discussion with women officers of the HFD indicated that, to date, women have rarely moved into management positions of authority which would allow them to assist village women in playing an influential role in forest management. The interview demonstrated that women tend to be tracked into secretarial or other administrative support positions, and rarely are assigned field responsibilities. It became clear that new positions and incentives need to be created which provide opportunities for women staff to more meaningfully contribute to JFM policy formulation and implementation.

Figure 29
One of the most important institution-building strategies to operationalize the JFM program will require improvement of the current staff training program, in terms of its stature, structure, social reorientation and curriculum. While national and state-level forest training is typically imparted by a rotating staff without specialized expertise as trainers, curricula also tend to be highly technical and uni-disciplinary in nature. In contrast, JFM programs will require revised approaches and curriculum which focus on human values, organizational and motivational behavior, interpersonal skill-building, gender sensitivity, dispute resolution techniques, and a range of interdisciplinary fields of study which encompass the socioeconomic and ecological dimensions of forest management systems. As a first step to understanding appropriate local training needs, an analysis of the current training curricula received by FD staff at different levels could be undertaken to identify its gaps and weaknesses. A logical secondary step would be to interview both trainers and field trainees concerning the perceived relevance of their training vis-a-vis its efficacy in enabling staff to facilitate community-driven JFM. A scoring and ranking exercise could develop a list of priority training needs.
and strategies for reorientation.

Another important issue involves the facilitative role of support institutions, such as NGOs, university researchers, outside specialists and other government agencies, in strengthening both FD and community capacity to implement JFM. Through diagnostic research, experienced NGOs and other researchers can assist the FD and communities in generating the knowledge to understand the ecological, institutional and economic parameters that need consideration in the design of sustainable forest management systems. Interviews with local NGOs, researchers, and allied GO agency staff would help identify their particular institutional strengths which could directly contribute to JFM program activities. Developing an inventory of current activities by FD, NGOs, other GOs and donors would highlight overlapping efforts and areas for potential collaboration. Convening a workshop could provide a forum for these groups to discuss programming and coordinate respective activities in support of JFM.

Experiences from Haryana, West Bengal, and Gujarat indicate that outside resource teams can offer valuable assistance to the FD and communities as facilitators in training, process documentation, ecological research, and communication flows, all of which are designed to capture field learning and rapidly inform program management. Assisting the senior FD officers in conducting periodic Working Group meetings to review program progress and make strategic policy decisions based on diagnostic studies and field feedback has been a major contribution of these resource teams. In the final analysis, it is the commitment of dynamic and dedicated individuals inside FD institutions who are the valuable contributors to program innovation. After identifying a small core group of leaders, an advisory committee could be established to plan strategies, secure time commitments, and define responsibilities for program development.

Given the context of increasing pressures and competing demands on state forest lands throughout India, it has become essential to reorient the goals of forest management toward building cooperative, stable relationships between community forest users and departmental managers. Diagnostic research, through methods such as process documentation, can contribute to understanding the range of socio-institutional factors which motivate behavior and influence forest use patterns. Issues need to be addressed at the state level (e.g., identifying priority geographic areas for JFM), community level (e.g., delineating appropriate management groups, clarifying access controls, rights and benefit-sharing) and FD level (e.g. normative procedures, attitudes, training). Support groups comprised of NGOs, university researchers and other specialists can facilitate the strengthening of both FD and community management capabilities, while helping to catalyze a more stable and synergistic relationship between parties. Ultimately, the success of forest management will depend upon the development of local management institutions which are empowered and supported by the FD to manage forest resources equitably and sustainably.
PART III: RAPID APPRAISAL RESEARCH METHODS

D: ECONOMIC ASSESSMENTS OF FOREST PRODUCTION SYSTEMS

The economic assessment methods presented here are designed to build on information collected during the preliminary PRA Community-Forest Profile discussed in Part III A. The profile should have generated an understanding of the patterns of forest use in space and time, important forest products, their collection and users, marketing and processing flows, and some of the key local forest management issues. This initial background information is also complemented by the more detailed studies on the multiple aspects of forest vegetation (including species structure, composition and productivity) described in Part III B, and with the community-forest department socio-institutional analysis discussed in Part III C. These earlier studies will generate many management questions as the field data are sequentially organized and analyzed. One area where additional in-depth information will be needed is in assessing the economics of forest production systems.

In the following pages, techniques are presented to estimate the volumes and values of forest products collected, harvested, and processed by forest communities. Discussion of these methods includes: calculating volumes flows, labor and capital costs, product prices, processing and marketing, and financial analysis for assessing forest production systems. In Figure 30, a chart is presented to demonstrate the relationship between these management issues, suggested research questions and proposed diagnostic methods. In many cases, supportive and complementary information generated from the community profile, vegetative assessment, and institutional analysis can be used to help answer the management questions. Figure 31 reviews the sequence of economic research activities that may be used.

Figure 30:

Economic Issues, Research Questions, and Methods

<table>
<thead>
<tr>
<th>Issues</th>
<th>Question</th>
<th>Methods</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Product volume flows and values</td>
<td>- What are the annual yields of timber and NTFP?</td>
<td>- Interviews with collectors</td>
</tr>
<tr>
<td></td>
<td>- What proportion is commercially sold and how much income does it generate for collectors?</td>
<td>- Participant observation during collection activities</td>
</tr>
<tr>
<td></td>
<td>- What is the substitute value of forest products used for home consumption?</td>
<td>- Interviews with stratified social groups</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Market visits to determine prices, volume and substitution values</td>
</tr>
<tr>
<td>2. Labor and capital costs</td>
<td>- How much labor is allocated by individuals and households for collecting, processing, and marketing of different forest products?</td>
<td>- Daily and seasonal activity schedule</td>
</tr>
<tr>
<td></td>
<td>- What recurring and fixed costs are associated with forest production activities?</td>
<td>- Seasonal calendar</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Interview collectors, processors and middlemen to identify equipment &amp; related capital costs</td>
</tr>
<tr>
<td>3. Product Prices</td>
<td>- What have been the trends in market prices over the past ten years?</td>
<td>- Interview middlemen, FD staff and collectors</td>
</tr>
<tr>
<td></td>
<td>- How do they vary between markets?</td>
<td>- Check FD records and policies</td>
</tr>
<tr>
<td></td>
<td>- How do prices fluctuate during the year?</td>
<td>- Conduct market visits across seasons for seasonal price calendar</td>
</tr>
<tr>
<td>4. Processing and marketing</td>
<td>- How does the quality and availability of raw materials compare with the requirements of processors?</td>
<td>- Interview artisans to documents raw material requirements and supply</td>
</tr>
<tr>
<td>5. Financial Analysis of Forest Production Systems</td>
<td>- What are the benefit and costs of different production-oriented management options?</td>
<td>- List non-monetized values for each option</td>
</tr>
<tr>
<td></td>
<td>- Analyze processing system in use flow chart</td>
<td>- Calculate Benefit Cost ratios and Internal Rates of Return for different management investments</td>
</tr>
</tbody>
</table>

Figure 31: Steps in Conducting Economic Assessment of Forest Production Systems

- What value additions are obtained through processing and how could profits be increased?
- How effectively do current market linkages meet the needs of village producers?
- Analyze processing system in use flow chart
- Conduct market linkage study and analyze profit margins
It is best if the economic evaluation is conducted during the collection season. In India, many important non-timber forest products are gathered during the months of April through June. This scheduling allows the team to directly observe and participate in collection activities, measure the volumes of products being collected, and interview participants while the experience is fresh in their minds. The research team should allow at least three days of field time for this phase of the study. The size of the study area influences the time required. For example, a single hamlet with a small 60-hectare tract of forest can be assessed much more quickly than a 5000-hectare forest with multiple user communities. The team should also consider transit time between lodging, community, forest area, forest office, and markets in planning its schedule. In addition, several days should be allocated for preparing question guidelines and establishing a research activity plan. Time should also be designated for analyzing and writing-up the findings during and after the fieldwork is completed. If the research team decides to seek more in-depth information through extended participant observation in
collection, processing, and marketing activities, or wishes to conduct a stratified sample survey, additional time should be budgeted.

**1: Estimating Product Volume Flows**

PRA studies in India indicate that through key informant and group interviews, researchers can gain reasonable estimates of volume flows for important forest products. In most cases, fuelwood, timber, and fodder will be of central importance, however a range of NTFPs may have considerable local economic significance and will also need to be assessed. Economically important forest products and seasonal collection patterns will already have been identified during the community-forest profile exercise. While initial interviews for estimating volume flows may generate conflicting estimates, additional interviews and in-depth cross-checking generally can clarify discrepancies and provide fairly consistent results.

It is useful to begin with a group interview, and then to follow-up with individual interviews of at least two or three other regular collectors. By interviewing members of neighboring communities and villagers of different socioeconomic backgrounds (i.e. stratified sampling), researchers can determine how collection activities and forest dependencies vary among households. Key informant interviews with local foresters, middlemen, processors, traditional herbalists, women collectors and village leaders can provide more in-depth information on special topics.

To introduce the discussion of product volume flows, it is helpful to initially inquire about collection practices (who, what, when, where, how), and to establish how many members of the forest user community(ies) are involved in the collection of that product. Men, women, and children should be distinguished if collection practices and volumes vary. Villagers can help correct one another in attempting to reach a consensus on the average volume collected on each forest trip. This information should be cross-checked with the seasonal calendar developed during the earlier PRA to estimate how many collection trips are made during the harvest season and how the volume harvested per trip may vary across the seasonal collection period. It may be helpful to refer to the sketch map developed earlier in order to determine the collection area. During the group and key informant interviews, the following questions may be raised, using follow-on questions to pursue issues, verify, and clarify responses:

1. During what season do you collect product X? (cross-check with seasonal calendar)
2. How many days do you go to the forest to collect that product during the season (per week/per month)?
3. Who goes to collect from your household (men, women, children)?
4. How much do you collect on each trip? What is the most, least, and average? (Does the amount vary between men, women, children collectors?)
5. How many people go from your village and other villages?
6. How much of the product do you collect from each individual plant/tree (max., min., average)?
7. Does the yield vary much between years?
8. Where is the collection area? What is its size? Is the product concentrated or widely dispersed? Is access controlled, are there rights over the harvest, or is it an open access resource?
9. What proportion of the product is sold and how much is consumed in the home?
10. What price is received for the product if sold in the village or market, and how much for raw versus processed material?

It is easiest to work with a single product or one class of products at a time, focusing on the collection process sequentially for each of the most important products. To ease recording, a data sheet has been developed (see Figure 32). The unit of collection (baskets, bundles, bags, weights, pieces) should be identified and later translated into an appropriate standard volume or weight. Since local collection units may vary depending on
the size of the container or the strength of the individual, it is best to establish a mean unit weight or volume as the average collected per trip (weigh or measure a sample of loaded baskets, bundles, etc. to determine the mean; see Figures 33 & 34).

**Figure 32: Data Sheet for NTFP Collection**

<table>
<thead>
<tr>
<th>Name of Species</th>
<th>Forest Product</th>
<th>Collection period</th>
<th># of collection trips/yr. by household members</th>
<th>Amount of Time spent/trip (hours)</th>
<th>Number of Collectors: using Forest Area</th>
<th>Amount collected per trip</th>
<th>Price received by collector</th>
</tr>
</thead>
<tbody>
<tr>
<td>e.g. Bassia latifolia flower</td>
<td>April 10-30</td>
<td>G : 2 E : 6 C: 4</td>
<td>G : 4 hrs. E : 5 C: 5</td>
<td>40</td>
<td>G : 4 kg. E : 3 C: 2.5</td>
<td>Rs.2.5/kg dry</td>
<td></td>
</tr>
</tbody>
</table>

**Figure 33: Basket Volume of Mahua Flowers**

**Figure 34: Small Fuelwood Bundle (baadas) for Market, Limbi**
Cross-checking the yield data with informed individuals in the community will help confirm accuracy. For commercial products, it may be possible to check with local buyers, forestry field staff, community leaders and teachers to confirm production volume estimates. PRA-generated estimates should also be cross-checked with data from the vegetative standing stock inventory. Through this type of "triangulation" based on multiple and differing sources, it is possible to assess the consistency of the information collected. Once a general agreement emerges in terms of production volumes for a given product, the researcher can assume that the findings reflect the general practices and perceptions of the community.

During the interview process, it may become evident that villagers from different socioeconomic backgrounds vary in their collection activities. To capture this variation more systematically, it may be useful to follow-up by collecting information from a small stratified sample of households. From each of the major social groups in the local community or hamlets (i.e. landless, tribals, migrant), three randomly selected households with husband, wife, and children as informants can be interviewed.

Participating in a forest product collection activity with men, women, or children is one of the best ways to further explore and cross-check volume estimates, collection time and procedures, amount of variation in volumes by different collectors, size and location of collection area, routes, and any informal or formal usufruct rights or rules governing collection. Thus research method often involves arranging to accompany a collector the day before, leaving early in the morning, walking up to 5 to 10 kilometers, and spending anywhere from a few hours to several days in the field. On-site group and individual interviews can be conducted during collection activity breaks in the forest, where products, materials, techniques and hands-on experiences can be directly referred to (see Figures 35 & 36).

Figure 35: Group Interview with Mahua Flower Collectors in Limbi Forest, South Gujarat

Figure 36: Group Interview with Tribal Members of Saraja Mali Forest Labor Cooperative Society in Limbi Forest
There are numerous ways to analyze and interpret information emerging from the above methods of estimating volume flows. The type of data collected is most suited to understanding flows into the household. Additional analysis may also provide estimates regarding total flows into the community on a seasonal or annual basis. In some cases, where the collection area is clearly defined, it may be possible to estimate product yield on a per hectare basis. If the collection territory is unclear, a productivity assessment is still possible by utilizing the vegetative data on the density of productive species and individual plant/tree size, distribution, and yield information. The information collected should help illuminate the relative importance of different forest product-based activities for the household economy and community as a whole. Analysis can indicate the proportion of families involved in the activity, their annual income and employment generated from each activity, and, if feasible, the yield of the forest product per hectare.

2: Estimating Labor and Capital Costs

In order to assess the economic significance and financial viability of forest product activities, it is necessary to estimate the labor, equipment and capital costs related to harvesting and processing activities. This information may be gathered through two or three in-depth interviews with collectors. The seasonal calendar and discussion of collection practices conducted during the initial PRA will have already indicated the duration of the forest product collection season. This step requires a more careful review of time allocations. Requesting knowledgeable people in the community to prepare a daily activity sequence can identify the time spent in collection and processing, as well as its relation to other agricultural and household work in order to compare estimated net returns per hour. To cross-check and average data, labor allocation information should be gathered from at least three collectors of different ages and sex.

The researchers will also need to assess fixed costs related to the equipment used in harvesting and processing. This includes the cost of knives, axes, baskets, machine presses and other implements. The team should find out from forest users how long the equipment can be utilized before replacement is required. Where relevant, capital costs should be assessed through interviews. Ideally, the researcher should observe and participate in the collection, processing, and marketing activities to confirm labor expenditure estimates. Participation will also allow the research team to identify tools and their fixed costs, as well as recurring expenses for materials and transportation. Researchers may wish to elicit community suggestions regarding ways to make the current labor allocation and equipment requirements more cost effective.

Labor allocation for forest product collection and processing can be estimated by drawing a daily or weekly activity sequence with a key informant group of collectors. If the complete activity (including collection, processing and marketing) occurs in a single day, the daily activity chart can capture the entire process. However, if the process requires a number of days, an extended calendar needs to be used. Recent PRAs in Gujarat using activity schedule diagramming indicated that logging and liquor distillation are far more profitable on a daily basis than other extraction activities. However a seasonal calendar further illustrates that both logging and liquor distillation opportunities are limited, so that fuelwood headloading becomes by far the most lucrative activity on an annual basis. Unfortunately, these activities are either currently being carried out at unsustainable levels (Ongoing and headloading), or are illegal (distilling). Increasing the productivity of the alternative forest activities through enrichment planting, and improved value-added processing and marketing, could make these systems more sustainable and attractive economically while also absorbing more labor. The analysis of such data should be discussed with community members, who can explain current use practices and problems as well as offer alternatives that they might support.
3: Establishing Product Unit Prices

In assessing market values, prices should reflect what village collectors/processors receive for selling the product (wholesale), either to buyers who come to the village or at local markets, rather than what village buyers pay (retail). Since prices may vary by markets and season, at least two to three local markets should be sampled to obtain prices at several periods during the year. The price listings for forest products should reflect the mean price received by village collectors during the year. Local market price data should be cross-checked with at least three village collectors to confirm consistency. It may also be useful to learn how market prices for important products have fluctuated over the past ten years. Earlier forest product PRAs in India indicate that gathering information on wholesale prices for commercial goods is fairly straightforward, although prices often vary considerably across markets and among buying agents. Researchers need to check a number of markets and local buyers to establish average price levels. They also need to clarify how prices are set and why they vary between buyers and markets. A data sheet for product market price assessments is provided in Figure 37. Questions to guide the interview might include:

Do you sell forest product X?
How much do you sell and how much do you consume at home?
To whom do you sell? How much do they pay? What is the final retail price in the market?
Are there any other places to sell product X?
How do prices rise or fall during the year?
How have prices changed over the past five to ten years?

Figure 37:

NTFP Market Price Data Sheet

<table>
<thead>
<tr>
<th>Species</th>
<th>Product</th>
<th>Market 1</th>
<th>Market 2</th>
<th>Market 3</th>
<th>Mean Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chun Alu</td>
<td>Tuber</td>
<td>Rs. 3/kg</td>
<td>Rs. 2.50/kg</td>
<td>Rs. 4/kg</td>
<td>Rs. 3.16/kg</td>
</tr>
<tr>
<td>Sal</td>
<td>8 cm. DBH pole</td>
<td>Rs. 22</td>
<td>Rs. 14</td>
<td>Rs. 19</td>
<td>Rs. 18.33/pole</td>
</tr>
</tbody>
</table>

In fact, most forest products are not sold, but rather consumed at home. While there are limitations in trying to price goods outside the market place, a number of methods can be used to approximate monetary value. One technique is to determine a substitute value. For example, villagers may consume tubers as a high calorie, low cost food source during periods of scarcity. If they are asked what they would use as a substitute if no tubers were available, a price can be imputed (e.g. if they would buy cassava, the per kilo price of cassava would be the substitute value for the tubers). Similar methods can be employed for fuelwood, fodder and other forest products, although items harvested periodically in small quantities are more difficult to assess volumetrically and economically. In such calculations, care must be taken that weight or volume units are comparable or convertible. For edible forest products, it is also possible to determine their nutritive, rather than economic, value by estimating caloric or vitamin/mineral inputs. It may be easiest, however, to interview families for estimates on what proportion of its food comes seasonally from the forest. In this case, one could sub-divide by staple food (e.g. vegetables, meat, and fruit) or other use categories suggested by community members.

This phase of the research should be able to assess average market gate values of important forest products, stability of market prices over the season, and trends through the years. Rising prices may reflect growth of markets or shortages, whereas seasonal price fluctuations may indicate opportunities for collectors to store...
products in order to later take advantage of seasonally higher prices. Finally, an assessment of the importance of the forest for subsistence needs, using substitute values during high and low price periods, would help reflect the economic value of maintaining the land under forest, and the opportunity costs of converting it to an alternative land use.

4: Processing and Marketing Studies for Selected Products

To assess potential income flows from community managed natural forests, it would be useful to explore in-depth the values of selected commodities in village, district, national, and international markets. Since numerous forest products exist, assessments can be conducted on a select number that have the greatest commercial potential or subsistence importance. One to two commodities could be chosen from a range of use categories (medicinals, food products, fibers and building materials, gums, dyes, tannins, insects and animal products) and tracked through the marketing system to establish pricing patterns at each market level. Figure 38 provides an example of a processing and marketing flow chart for sal plates in southwest Bengal.

Marketing studies need to examine profits of collectors/ producers, processors, and middlemen to determine whether changes in processing and marketing patterns might enhance the profitability of products for community forest managers. Documentation of the processing and marketing sequence and the prices at each step can be determined through discussions with involved village members, buyers, and local forestry staff. The sequence can first be sketched on the ground for discussion purposes before copying onto paper. At the same time, it is preferable to combine recall information with actual observation and participation in the commodity production process. Through direct observation, information on labor allocation, costs, production volumes, and prices can be cross-checked. While observing the step-by-step process, researchers have additional opportunities for photographic documentation and for exploration of specific issues or problems experienced by those involved.

Documentation of the collection and production system, including marketing linkages, should assist villagers, foresters, and researchers in determining how the production process might be made more efficient, equitable and profitable. Identification of high profit margins by middlemen or intermediate processors may help guide programs in transferring value additions directly to collectors and producers.

5: Assessing Community Perceptions of Forest Production Options

Many commercially valuable forest products are threatened by overexploitation as collectors attempt to gain a marginal income. Often in competition with each other, they may use harvesting methods which not only overextract desired resources, but also damage future productive yields, potentially even resulting in localized extinction. In other cases, important forest products can be sustainably harvested because collection simply involves the gathering of fallen seeds, fruits, leaves, etc. Certain forest products decrease in availability as natural succession takes place. Fodder and fiber grasses, after impressive increases in production occur once protected, often decrease in availability as the tree canopy begins to close and shade the forest floor.

Methods described in the vegetative analysis section will help to determine whether the population of productive species is stabilized, increasing or decreasing. Simultaneously, it is possible to assess directions of change through interviews and observation. Direct participation in a collection trip allows the researcher to observe how the products are harvested and any resulting disturbance to the host plant. In-depth interviews with villagers can provide descriptions on how product availability is changing and on their own perceptions of causes and consequences.

Different methods can be used to assess potential returns for forest production options. Traditionally, financial assessment calculations consider direct benefits and costs for capital investments. In the natural resource sector, experience indicates these valuations may fail to consider indirect social and environmental costs. Alternatively, it is possible to estimate the value of different investment strategies based on community members perceptions of potential returns and benefits. Such assessment methods may better reflect non-monetized impacts as well as represent community priorities.

Community members and local foresters may discuss and share ideas on appropriate species, culturing and enrichment planting techniques, or improved processing and marketing strategies which would enhance sustainability. It may be helpful to list all the strategies suggested and rank order or score them. In follow-up
discussions with the community, this type of information can provide a basis for establishing management systems which allow for maximum sustainable yields of important products, taking into consideration changes in productivity over the course of natural forest succession. In Haryana, researchers asked foresters and community management groups (HRMS) to rank order their preferences for a range of forest development investment strategies. The exercise highlighted differences in perceptions regarding the value of species for enrichment planting and soil conservation technologies. Villages ranked bhabbar fiber grass the highest, while foresters ranked it twelfth. Foresters gave the highest rating to trenches for erosion control, while community members ranked trenches towards the bottom of the list. Identifying these differing perceptions of the relative values of various investment options provides a basis for a dialogue which may lead to a consensus regarding how development funds could be best utilized (see Figure 39).

Figure 39:

Forest Development Preferences of Hill Resource Management Societies and FD Staff in Haryana

<table>
<thead>
<tr>
<th>Soil &amp; Water Conservation Technique</th>
<th>HFD Preference Ranking</th>
<th>HRMS Preference Ranking</th>
<th>Combined Preference Ranking</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agave</td>
<td>5</td>
<td>22</td>
<td>16</td>
</tr>
<tr>
<td>Bamboo</td>
<td>6</td>
<td>8</td>
<td>2</td>
</tr>
<tr>
<td>Bhabbar + Khair</td>
<td>9</td>
<td>7</td>
<td>14</td>
</tr>
<tr>
<td>Bhabbar + Subabul</td>
<td>10</td>
<td>6</td>
<td>4</td>
</tr>
<tr>
<td>Bhabbar</td>
<td>12</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Brush Checkdam</td>
<td>16</td>
<td>19</td>
<td>21</td>
</tr>
<tr>
<td>Checkdams</td>
<td>2</td>
<td>17</td>
<td>5</td>
</tr>
<tr>
<td>Chhal</td>
<td>7</td>
<td>15</td>
<td>10</td>
</tr>
<tr>
<td>Churi</td>
<td>18</td>
<td>16</td>
<td>20</td>
</tr>
<tr>
<td>Contour Bunds</td>
<td>17</td>
<td>23</td>
<td>23</td>
</tr>
<tr>
<td>Dholu/Sarala + Fruit</td>
<td>19</td>
<td>3</td>
<td>11</td>
</tr>
<tr>
<td>Dholu/Sarala</td>
<td>13</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Fruit: Ber</td>
<td>21</td>
<td>14</td>
<td>22</td>
</tr>
<tr>
<td>Gabion Checkdams</td>
<td>3</td>
<td>18</td>
<td>6</td>
</tr>
<tr>
<td>Guava</td>
<td>22</td>
<td>4</td>
<td>15</td>
</tr>
<tr>
<td>Gully Plugs</td>
<td>4</td>
<td>21</td>
<td>12</td>
</tr>
<tr>
<td>Jamun</td>
<td>23</td>
<td>5</td>
<td>18</td>
</tr>
<tr>
<td>Jhoond + Fruit</td>
<td>20</td>
<td>9</td>
<td>19</td>
</tr>
<tr>
<td>Jhoond + Shisham</td>
<td>11</td>
<td>10</td>
<td>7</td>
</tr>
<tr>
<td>Jhoond</td>
<td>14</td>
<td>11</td>
<td>13</td>
</tr>
<tr>
<td>Mendar/Karonda</td>
<td>15</td>
<td>12</td>
<td>17</td>
</tr>
<tr>
<td>Prosopis</td>
<td>8</td>
<td>13</td>
<td>8</td>
</tr>
<tr>
<td>Trenches</td>
<td>1</td>
<td>20</td>
<td>9</td>
</tr>
</tbody>
</table>

6: Economic Analysis of Forest Product Benefits and Costs

The financial analysis component of the study would utilize case study data from forest plots at various stages
of regeneration and under differing management regimes, as well as secondary data regarding the current benefits and costs of other FD-sponsored programs. The analysis would attempt to determine the macro-economic implications of shifting management from strict protection or timber production to sustained yield harvesting of a wide range of forest products. The valuation of forest products would likely be calculated by assessing predicted volume flows of selected commodities under different assumptions, including both natural productivity as well as enhanced productivity under a range of manipulation techniques.

Similarly, labor and capital requirements could be calculated. Based on the financial analysis of the benefits and costs of different management options, policy recommendations could be formulated for the consideration of government planners. To improve access of forest policy-makers and managers to the research findings, it would be important to involve them in the study from the design phase. Once per hectare production estimates and labor and capital requirements have been established, they could be multiplied by the area available to project. This information could be used to discuss the implications of various management alternatives with community members.

Forest Departments and communities entering into JFM agreements may want to consider a range of production options which respond to the socioeconomic and ecological conditions prevailing at the site. In making these decisions, they will need to examine the types of products, employment, and capital that would need to be available at various points of time in the future. For example, the JFM committee might decide to dedicate a part or all of the forest to timber production. A timber-oriented production system would require significant initial investments, while the returns would largely occur at maturity, anywhere from 20 to 60 years later, depending on the species. For communities with labor constraints, but little need for immediate cash, this might be the most appropriate management system. Alternatively, the degraded or regenerating forest could be managed to maximize NTFP production, including fruits, flowers, nuts, seeds, leaves, and raw material for artisans. In this case, expenditures and returns would occur seasonally and annually over a long period. This option might be attractive for villages heavily dependent on NTFPs for subsistence and cottage industries. A third option might involve establishing softwood industrial plantations on degraded lands. The expenditure would occur only in the first few years, and the returns would occur once every 8-15 years. In cases where industries provided good markets, this management regime might be acceptable. Another alternative might be the development of a fuelwood plantation for local use. This option would be attractive for potters and other artisan communities requiring a steady source of firewood. Annual thinning and lopping, starting after 3 or 4 years, followed by felling on a 6 or 7-year rotation with coppice regeneration, might provide the best alternative if fuelwood production needed to be maximized.

In attempting to select an appropriate management system, FD staff and communities wish to consider the ecological implications, as well as how forest management investments, expenditure, and returns will occur over a number of years. If all the expenditures and returns occur in one year for competing options, it is easy to decide on the option giving the highest net return for the year. Financial analysis attempts to project what the benefits and costs will be over longer periods.

It is more difficult to compare projects where costs and benefits accrue at different years. A rupee invested today will be worth more in the future as it earns interest, whereas a rupee received 10 years from now is worth less as it foregoes earning investment interest. This concept describes "Present value" of future returns or expenditures. Calculating the present value of a future investment is called "discounting", as the payments to be received in future are discounted to the present. The benefit (or cost) occurring in year ‘n’ (5, 10 or 20 years later) has to be adjusted using an accepted time value of money. This time value of money is called the 'discount rate.' For example, suppose Rs 100 is invested at 8% interest/year. The future value of that investment in year 1 is [Rs 100 x(1+0.08)] = Rs 108. The present value of Rs 100 received 1 year into the future is Rs 100/(1 +0.08) = Rs 92.59 because Rs. 92.59 invested today at 8% interest will grow to Rs 100 in a year's time. The Net Present Value or NPV is equal to the present value of returns minus the present value of costs. NPV is used widely as a project investment criteria.

Another commonly used measure of project worth is the Internal Rate of Return (IRR). IRR is the discount rate at which the NPV is zero i.e., the interest rate at which the Present Value of the project benefits equals PV of project costs. It is basically the break-even discount rate where PV benefits = PV of costs. Consequently, the higher the interest rate at which the NPV is zero, the more financially attractive the investment. This allows planners to compare the rate of return for the project with bank interest rates. If the project is generating a higher rate of interest than banks are likely to give, it is a positive investment. The Benefit: Cost (B/C) Ratio is the ratio of present value of total benefits over the present value of total costs during the life of the investment. The ratio indicates the amount of benefits that the project generates per unit of investment in present value terms. A B/C ratio of one reflects a break-even point after discounting the interest lost during the period of investment. Anything above one reflects a positive return. Detailed methods and formulas for calculating Present and Net Present Values, IRR and Benefit : Cost Ratios are given in Appendix 3.
In Box 7, comparative financial analyses are illustrated using case study data for forests under NTFP production and firewood plantation systems. The cases illustrate how to calculate and compare NPV, IRR and B/C ratios. The study concludes that while the firewood plantation is a financially viable investment with an IRR of 15% and a B/C of 1.17, the NTFP option is more attractive with an IRR of 27% and a B/C of 2.53.

Box 7: Investment Comparison of NTFP Option with Firewood Option

A JFM program may have two options to consider for the degraded land in village: 1) a short rotation firewood plantation or 2) an NTFP-yielding forest.

**Firewood Plantation:** A eucalyptus plantation can be harvested every 6 years. The total annual expenditure or cost per ha. is given in Appendix 4, Table A, as well as the annual return from sale of twigs and firewood (once every 6 years). The net return is estimated for each year and is converted to present value in year "0" at 12% interest or discount rate. NPV for the 20-year cycle is estimated to be Rs. 1324.07 per ha.

Benefit: Cost Ratio = PV of total benefits/PV of total costs

\[ \frac{8798.2}{7473.2} = 1.17 \]

**IRR:** NPV was estimated for 12%, 15% and 16%. NPV becomes negative at 16%. It was positive at 15%. Therefore IRR lies between 15 and 16%. Thus IRR could be taken as 15%.

**NTFP FOREST OPTION:**

A forest which includes trees like jack fruit, karanj, jamun, tamarind and mahua has a density of 400 trees/ha. The annual total cost and returns are given in Appendix 4, Table B. The net return and PV of net returns for each year are estimated at 12% discount rate.

NPV = Rs. 8597.6 (sum of all PV of returns)

Benefit: Cost Ratio = PV of benefits/PV of total costs

\[ \frac{19765}{7801} = 2.53 \]

**IRR:** NPV was estimated for 12%, 18%, 24%, 27% and 28%. NPV was negative at 28% and was positive at 27%. IRR would be between 27% and 28%. Thus IRR could be taken as 27%.

Management Decisions: NPV and IRR have been estimated for both the firewood plantation and NTFP forest. At 12% interest rate NPV for both the options is positive. Thus both the options are profitable at 12% discount rate. The NPV value for NTFP option and only 15% for the firewood plantation option. The benefit: cost ratio for the NTFP option is 2.53 compared to 1.17 for the firewood plantation option. Thus, the local JFM can clearly decide in favour of the NTFP forest option.
PART IV: ANALYZING AND COMMUNICATING LEARNING EFFECTIVELY

Many planners and administrators would agree that research findings often fail to affect planning and decision-making. If research is to lead to improved forest management, field learning must be captured and utilized by policy-makers, forest officers, and community members. This will occur only if information is conveyed in a relevant form to the right people at the right time. Researchers and users should consciously attempt to achieve these goals. The following suggestions for research analysis, communication and dissemination are based on prior experience from a number of countries in South and Southeast Asia. Meetings between researchers and information users permit studies and findings to be fine-tuned to respond to programmatic needs. When applied to forest management conflicts, this process can also facilitate communication flows between rural communities, NGOs and forestry agencies, informing all parties and providing a mechanism for developing collaborative management agreements.

Analyzing and Interpreting Research Findings for Program Development

Volume I describes four short diagnostic appraisals that can be conducted to provide an understanding of community-forest interaction patterns and utilization practices. The community profile gives an overview of the forest management context in space and time, and is designed to convey the knowledge, attitudes and perceived needs of forest communities regarding their ecosystem. The vegetative assessment provides researchers with information regarding species composition, structure, productivity of the forest ecosystem and changes over time. The institutional analysis illuminates the organizational setting within the community and Forest Department, indicating leadership patterns, conflicts, program incentives and disincentives, organizational needs and opportunities. The forest production system assessment generates economic information concerning the benefits and costs of current and proposed management systems.

The integration and interpretation of this information is the most difficult and important aspect of the research process. As an interdisciplinary study, information from the natural and social sciences must be synthesized and assessed to suggest improved options for forest management. The analysis and the programmatic recommendations that flow from the studies must be sensitive to the socio-political environments within which communities and FDs operate. To ensure that the final analysis is grounded in this reality, it is imperative that community members and FD staff participate in the process of follow-up discussions, data interpretation and the formulation of recommendations.

Preliminary Analysis

Some preliminary analysis of the research findings should be carried out by the team while still in the field. Additional time should be provided to allow the team at least 4 to 7 days together after each phase of data collection to conduct a preliminary analysis of the information. This initial analysis will serve two purposes. First, the process can identify information and resource people who can further guide subsequent phases of the diagnostic research. Second, preliminary analysis will highlight management issues as they emerge.

It is helpful if preliminary reports begin by describing the objectives of the study and provide a one or two page Executive Summary which lists the key issues and findings. The report should also indicate the research team members, dates, places of information collection, and names of respondents and discussants. Wherever possible, findings should be presented in visual forms such as tables, figures, maps, diagrams, and flow charts to facilitate interpretation. After presenting a summary and reviewing the information collected, the report should expand on each key management issue, providing background on the origin of the problem. This should be followed by a list of recommended follow-up actions. For each phase or component of research, the preliminary report should be discussed with community members and FD staff during follow-up meetings to check their accuracy and discuss their management implications. Comments and suggestions from these meetings should be recorded and used to supplement the report and improve research planning and activities. Village meetings can be conducted in the evening to enable more people to attend, and meetings with foresters can be organized at the Divisional, Circle and State levels. Ideally, structured Working Groups (WGs) will have been formed to review the findings.

By synthesizing learning from the preliminary analysis reports, the team can cross-check information and identify inconsistencies. During the sequential phases of research, information from one study can guide subsequent diagnostic activities (See Figure 40). For example, the community profile which indicates use patterns in time and space can inform data on the economics of production systems, while vegetative data on the per hectare species density can be used to better calculate productivity levels and compare them to harvest levels.
Integrated Analysis

Once all four companion studies have been completed, the research team will need to meet for an extended period of time to integrate the findings and formulate management recommendations. As was discussed in the beginning of this manual, forest management problems almost always include ecological, socio-institutional, and economic dimensions. This is true whether considering grazing, fuelwood collection, timber extraction, leaf gathering, or bamboo harvesting systems. For example, women who work as commercial fuelwood headloaders do so based on a strong economic dependency; their activities have significant ecological consequences, and viable solutions will involve strategies that require programs, leaders and organizations that can facilitate more sustainable economic activities. The methods decried in this manual aim to generate the types of information that can suggest ways to balance the economic needs of the community in an ecologically sound manner through local institutions. Integration of the respective analyses can begin to answer questions regarding the economic profitability, equity, and sustainability of existing practices. Finally, current management systems can then be compared with alternative use systems. Based on this process, discussions with community groups and FD field staff can initiate the development of microplans.

A number of diagnostic case studies of this type would allow the research team to begin discussing major management issues across different community-forest-contexts and how policies and procedures might be modified to respond to this learning. Once the integrated report has been drafted and reviewed, a meeting of the Circle and State Working Groups should be called to present the findings and discuss its implications. Based on the recommendations of the Working Group, the FD and other participating government agencies, policy-making bodies and donor groups could consider appropriate actions.
A broad range of applied research questions relevant to JFM systems await investigation. At the national and state level, research is needed to guide the evolution of more supportive legislation, policies and regulations which facilitate the development of participatory resource management. At the field level, JFM studies are needed that can shape the design of joint management agreements, micro-management plans, ecologically sound strategies to enhance natural regeneration and forest productivity, local institution-building, improved processing and marketing extension activities, and community and staff training courses.

**Communicating Learning Effectively: The Working Group**

A preliminary step in developing a research program is the identification of the ultimate users of the new learning. By involving potential users from the outset in the design of the study, the likelihood that the findings will inform decision-making and planning is enhanced. The creation of a Working Group to guide research provides an institutional mechanism for study group interaction. In India, formal Working Groups have been based in the FD and chaired by the Principle Chief Conservator of Forests (PCCF). The PCCF is generally joined by other senior FD officers, including the territorial Conservator in whose area the studies are being conducted, as well as participating researchers and local government and non-governmental organizations who are working with communities.

Initially, while the formation of a Working Group (WG) before initiating diagnostic research may be preferable, in some cases this step may be organizationally infeasible or politically premature. In these areas, the launching of rapid appraisals need not necessarily be delayed, but can be started by a more informal group of like-minded individuals such as an NGO, a small team of resource specialists, or even a motivated FD officer. Preliminary experience is now indicating that findings generated through initial PRA-type studies can pique the excitement of other professionals to participate and lead to the gradual evolution of a more formally structured WG mechanism.

Where the WG has already been established, it should try to meet at least once or twice before the study is initiated to clarify broad objectives of the research, including important management problems and issues. By holding periodic meetings of the WG, the FD and other participating organizations can contribute their input into the research design and implementation phases. Furthermore, their interest in the outcomes will be strengthened. Before each WG meeting, the research team leaders and FD counterparts should develop an agenda for discussion, listing key issues with recommended options or suggested approaches.

A decision should be made in advance to identify a facilitator to present the agenda and steer the discussion, and to select a secretary to carefully record the minutes. The agenda should be kept short enough to be completed during the normal meeting period of the WG, generally not to exceed two hours. If not already determined, a date, place, and time for the WG meeting should be set and sent along with the draft agenda at least two weeks in advance. If necessary, selected members can be briefed about key agenda items prior to the meeting. During the early stages of the research, agendas should highlight ideas regarding management issues, study design, and possible sites. In subsequent meetings, preliminary findings should be itemized, noting future research needs and adjusting the work plan accordingly. As follow-up to each meeting, minutes regarding decisions should be written and distributed. At the end of the research project, findings regarding forest management issues and options, which have already been thoroughly discussed with communities and FD field staff, can be reviewed in the WG and followed by presentation of a draft microplan (see Figure 41).

**Figure 41: Steps in Working Group Learning Process**
In terms of effective and practical operation, it is essential to follow the agenda closely during the WG meetings. Senior forest officers are usually busy, and it is important to complete the agenda before they are forced to move on to other business. It is helpful to begin the session by reviewing the minutes of the previous meeting, and then to move on to discussions of ongoing research activities and plans. Only one issue should be raised at a time, allowing members sufficient time to discuss the topic. Before proceeding to the next item, decisions requiring further action, the form that action will take, and the individual responsible need to be identified. At the close, of the meeting, all decisions can be reviewed to ensure that the chairman and group members are in agreement and that responsibilities for follow-up are clearly understood. Before adjourning, it may be useful to set a date for the next meeting, typically 4-6 weeks later.

As soon after the meeting as possible, it is important to write up the minutes. They should be short and concise, following the meeting agenda and itemizing key points. Actions to be taken should be highlighted, identifying responsible individuals and detailing the proposed schedule for implementation. The draft minutes should be reviewed for approval with the senior FD officer under whose name they will be sent. Distribution of the minutes no later than a week after the meeting is advisable. Meanwhile, the core research planning group should periodically meet to discuss progress in implementing the actions decided upon. These may include the issuance of new JFM agreements and microplans, extension activities, training programs, procedure modifications, research projects, or even drafting policy amendments.

In addition to the agenda, it is also important for the research support team to utilize maps, charts, diagrams, and other visuals (many of which have been drafted with communities in the field) in order to present their ideas and discoveries to the WG. Graphics can help those not directly involved with the research to better grasp the information, as well as provide a framework for analysis and assessment of programmatic implications. As described in the manual, visuals might include historical transects or profiles of the forest study area to depict how the landscape has changed, and trend lines indicating fluctuating product availability or biomass levels. Research teams can also develop forest use calendars (on a seasonal, annual, and multi-year basis), activity sequence diagrams for selected non-wood forest products, and labor calendars. To illustrate spatial patterns, village and forest maps are most relevant. Data on the volume and values of forest products might be presented both in line graphs and histograms. As part of the ongoing synthesis and analysis, such diagrams should be prepared in the field as an integral component of the fieldwork. This will also allow the researchers to identify gaps in the data which require follow-up.
Summary

The Joint Forest Management Field Methods Manual Series describe a number of strategies to help understand how community and Forest Department partnerships might result in better management of natural forests. A preliminary effort has been made to document existing experiences with participatory rapid appraisals that can provide insights into the processes of community empowerment and transformation of the FD bureaucracy. Such fundamental changes aspire to create new human relationships. By fundamentally redefining power structures, these new relationships can lead to a more equitable, locally-responsive, and sustainable forest management system.

While early field experiences continue to confirm the value of the rapid diagnostic research approaches reviewed in the manual, this by no means negates the need for parallel research of a more conventional and longer-term nature. Ideally, rapid appraisals should be designed as one component to a larger research strategy which encompasses longitudinal studies on ecological sustainability, community-agency institutional stability, and the economics of dynamic forest production systems within the broader socio-political context. Nonetheless, the urgent and very practical need to address forest management problems in most of the developing world has thrown the historic role of traditional research into question. While its value is still acknowledged, the call for immediate and more successful responses to community resource pressures and severe ecological degradation has led to the development and practice of new rapid diagnostic methods based on community participation. Only through further field testing in a range of different situations will researchers, rural people, foresters, and NGOs learn how to more efficiently and effectively understand the complexities of resource management problems and their potential resolution. It is the editors hope that those who employ and test these methods will record their experiences and share them widely with others. In this way, research strategies will become more effective in facilitating the development of truly participatory systems of forest resource management.

APPENDIX 1

Checklist of Indicators for Joint Forest Management

Score Sheet

<table>
<thead>
<tr>
<th>Condition</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vegetative Characteristics:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Species Composition:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>% Coppicing</td>
<td>0-25</td>
<td>25-50</td>
<td>50-75</td>
<td>75-100</td>
</tr>
<tr>
<td>% Cover with good grass stock</td>
<td>0-25</td>
<td>25-50</td>
<td>50-75</td>
<td>75-100</td>
</tr>
<tr>
<td>Stocking Level:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Number of stools/ha)</td>
<td>0-250</td>
<td>250-500</td>
<td>500-1000</td>
<td>1000-2000</td>
</tr>
<tr>
<td>Quality of Coppice Growth</td>
<td>Poor</td>
<td>Moderate</td>
<td>Healthy</td>
<td>Vigorous</td>
</tr>
<tr>
<td>Disturbance Conditions:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fire</td>
<td>Annual</td>
<td>Sometimes</td>
<td>Seldom</td>
<td>Never</td>
</tr>
<tr>
<td>Grazing</td>
<td>Heavy</td>
<td>Moderate</td>
<td>Light</td>
<td>None</td>
</tr>
<tr>
<td>Lopping-Fuelwood Cutting</td>
<td>Heavy</td>
<td>Moderate</td>
<td>Light</td>
<td>None</td>
</tr>
<tr>
<td>Social Characteristics</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Community Forest Management Group</td>
<td>None</td>
<td>Inactive</td>
<td>Active</td>
<td>Strong</td>
</tr>
<tr>
<td>Community Homogeneity</td>
<td>Low</td>
<td>Moderate</td>
<td>High (Caste)</td>
<td>High (Tribal)</td>
</tr>
<tr>
<td>Leadership</td>
<td>Poor</td>
<td>Some</td>
<td>Good</td>
<td>Excellent</td>
</tr>
<tr>
<td>Access Rules and Regulations</td>
<td>None</td>
<td>Some</td>
<td>Good</td>
<td>Excellent</td>
</tr>
</tbody>
</table>
APPENDIX 2

Glossary of Vegetative Terms

Name of tree: In the field, local names should be recorded. The local community informant and/or beat officer are important resource people to assist in species identification. After reaching the office, the scientific name should be identified by a local botanist, or by using a species book with local names if possible.

GBH: Girth or circumference at Breast Height is established as one of the best indicators of the size, volume or weight of a tree. GBH for larger trees and DBH (diameter at breast height) for smaller trees should be measured at a height of 131 cms above ground, using a tape or slide calipers for smaller trees. Only measure trees of 30 cm GBH or more. Trees with a GBH below 30 cms would be considered seedlings, along with shrub vegetation. DBH/GBH measurement methods for various tree forms are illustrated in the attached diagram.

Multiple Shoots: If more than one coppice or shoot from a stump is observed, consider each shoot separately for recording GBH if estimating biomass. However, consider each stump with several shoots as one tree if estimating density or diversity.

Height: Like DBH, height can also be used as an indicator of the size or weight of a tree. It is difficult to measure the height of trees in a forest with overlapping crown covers, even using instruments. Thus, it may be adequate to use the following height classes:

- A = 2.5 to 5m
- B = 5 to 10m
- C = 10 to 20m
- D = 20 to 30m
- E = more than 30m

After some trials, a field investigator would be able to reasonably estimate height by observing the tree from a fixed distance if the density of trees is very low. Height measurement instruments such as a range finder or altimeter can be used to improve accuracy.

Coppice or Seedling (origin of tree): In a forest regeneration study, the investigator is interested in estimating the rate or level of coppicing (eg. of Shore robusta if cut for firewood or timber. local people or a forester will be able to distinguish between a tree originating from a seedling or a coppice shoot. The extent of coppicing trees is an indicator of regenerating capacity of a forest.

Stumps or Root Stock: The presence and density of root stock or stumps of coppicing trees is an indicator of potential for natural regeneration. The number of stumps for each important species in the plot should be recorded according to their coppicing capacity.

Climber: The climber associated with the trees should be recorded. In many arm, they have immense value as food, fiber or medicine to local communities.

Shrubs and Regenerating Seedlings: The plant types of interest are shrubs and smaller tree seedlings or smaller coppice shoots. Tree seedlings include woody plants with less dm 30cm GB and a height above 1.4 m. The presence of a large number of tender coppice shoots is an indicator of future growth potential.
APPENDIX 3

Methods and Formulas for Financial Assessments
**Present Value (PV):**

The basic formula for converting the future value to the present value or discounting is as follows:

\[ P_v = FV_a \left[ \frac{1}{(1+i)^n} \right] \]

where

- \( P_v \) = present value
- \( FV_a \) = future value in year 'n'
- \( i \) = interest rate (expressed in decimal form).
- \( n \) = number of years until future value occurs.
- \( \frac{1}{(1+i)^n} \) = discounting multiplier.

To illustrate, for a discount rate (interest rate) of 8% (\( i \)), the present value of a Rs. 100 payment occurring 2 years from now:

\[ PV = Rs \ 100 \left[ \frac{1}{(1+0.08)^2} \right] = Rs \ 100 \times 1/(1.1664) = Rs \ (100) \times (0.85) = Rs \ 85.73. \]

To make the calculation simple, the value for the multiplier \( \frac{1}{(1+i)^n} \) for a range of interest rates and periods can be found in a standard ready reckoner Table.

**Net Present Value (NPV):**

NPV or Net Present Value is one of two widely used investment criteria. NPV is the present value of returns minus present value of costs.

\[ \text{NPV} = \sum_{t=0}^{n} \left[ R_t - C_t \right] \frac{1}{(1+i)^t} \]

- \( R_t \) = Revenue or returns in year 't'
- \( C_t \) = Costs or expenditure in year 't'
- \( i \) = interest rate
- \( t \) = the year under consideration

The method involves the following steps:

i) select the year (t) or years (t_0 to t_n) when the expenditure and / or return occurs.

ii) estimate or obtain the returns value \( (R_t) \) for year 't'

iii) estimate or obtain the expenditure or cost \( (C_t) \) for year 't'

iv) multiply the difference between returns \( (R_t) \) and cost \( (C_t) \) for year 't' with the present value multiplier \( \frac{1}{(1+i)^n} \). (Obtain the value of the multiplier from ready reckoner Table)

v) calculate for all years (t=0 to t_n) and sum to obtain the NPV.

The investment is acceptable only if the NPV is positive. This shows that the investment is earning more than the alternative options, namely earning the interest 'i' selected for discounting.

**Internal Rate of Return:**

Another commonly used measure of project worth is the Internal Rate of Return (IRR). IRR is the discount
rate at which the NPV is zero. The IRR is basically the break-even discount rate where PV benefits = PV costs.

\[ \sum_{t=0}^{n} R_t \frac{1.0}{(1.0+i)^t} = \sum_{t=0}^{n} C_t \frac{1.0}{(1+i)^t} \]

The interest rate (i) at which the above equation holds is the IRR. IRR can be estimated through trial and error method. NPV is calculated for an interest rate estimated to be closest to the IRR, by taking a high interest rate and then reducing it until the NPV = 0.

**Benefit: Cost ratio**

Benefit: Cost ratio is the ratio of present value of total benefits over the present value of total costs. The ratio value indicates the amount of benefits that the project generates per rupee of investment in present value terms.

Benefit: Cost ratio = PV of total benefits/PV of total costs.

**APPENDIX 4**

Table A: Financial Analysis of Firewood Plantation Option

<table>
<thead>
<tr>
<th>Year</th>
<th>Total cost</th>
<th>Total return</th>
<th>Net return</th>
<th>Present Value of Net Return 12%</th>
<th>Present Value of Total Cost 12%</th>
<th>Present Value of Total Return 12%</th>
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NPV (20 years) = 1324
PV of TC = 7473
PV of TR = 8798
Benefit: Cost ratio = 8798 / 7473 = 1.17
Indicates positive project investment

Table B: Financial Analysis of NTFP Forest Option

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NPV (21 years): = 8597
PV of TC: = 7801
PV of TR: = 19765
Benefit: Cost Ratio = 19765 / 7801 = 2.53

Indicates positive project investment