Joint Forest Management

FIELD METHODS MANUAL

Volume II

Community Forest Economy and Use Patterns:

Participatory Rural Appraisal (PRA) Methods

in South Gujarat, India

Front Cover Photograph:
Mahua (Bassia latifolia) tree, Limbi forest, South Gujarat

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Community Forest Economy and Use Patterns: Participatory Rural Appraisal (PRA) Methods in South Gujarat, India

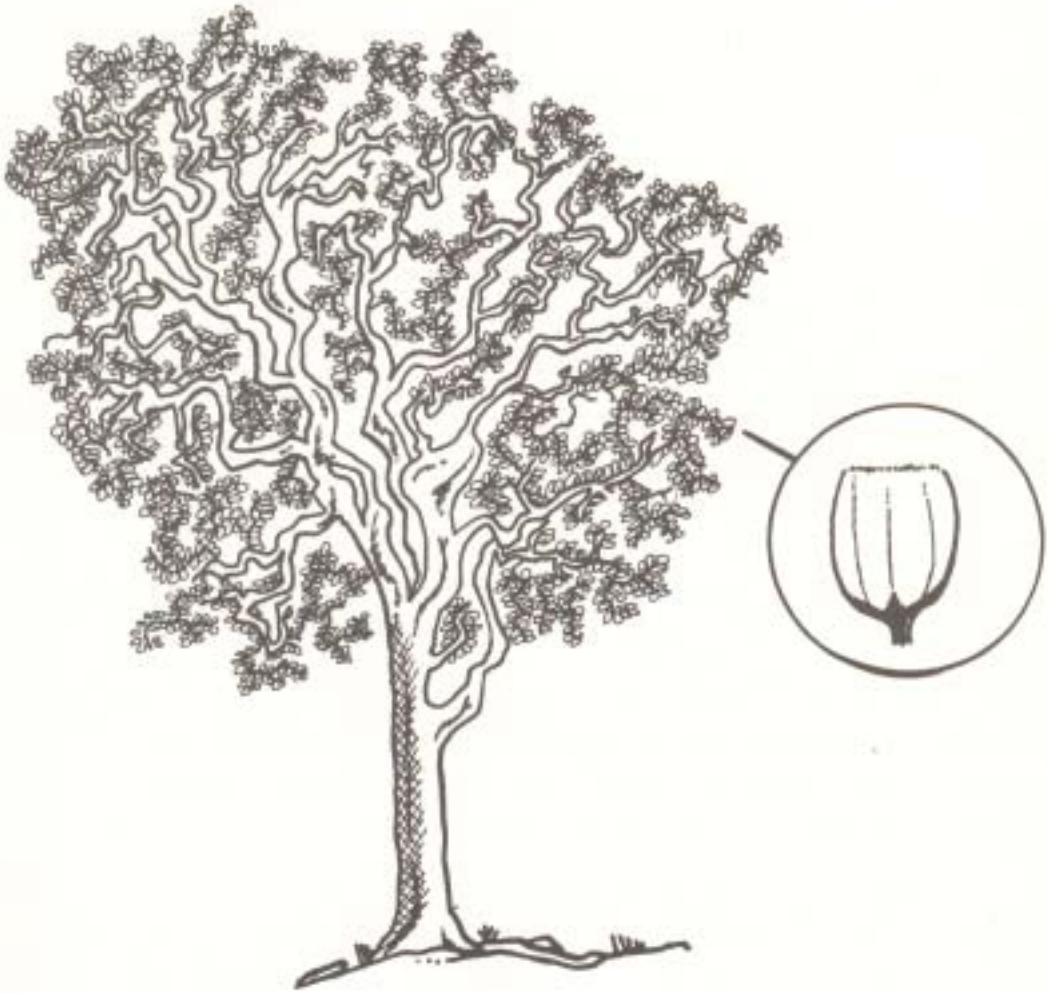
Prepared for the
Joint Forest Management Support Program

in collaboration with

Gujarat Forest Department
Society for Promotion of Wastelands Development
Ford Foundation

"When the flowers wither, fruits stay on the tree
When dry leaves fall, the young leaves still smile."

-- From an Indian tribal poem



Participating Organizations

Gujarat Forest Department
VIKSAT
Society for the Promotion of Wastelands Development
AKRSP
Rajasthan Forest Department
Jammu and Kashmir Forest Department
Haryana Forest Department
IBRAD
Center for Minor Forest Products
Forest Research Institute
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Tata Energy Research Institute
Indian Institute of Management
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User's Guide to the Manual Series

This report is the second in a two-volume Field Methods Manual which is being developed to support the implementation of Joint Forest Management (JFM) programs. Volume I of the Manual elaborates on a comprehensive 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.

Volume II summarizes the learning from a field training workshop held in Gujarat between April 5-11, 1992. The primary objective of the workshop was to explore the usefulness of participatory rural appraisal (PRA) methods for assessing human-forest interaction patterns and the local forest economy, with particular emphasis on estimating dependencies, volumes and values of non-timber forest products. The contents of the workshop report are organized into an introduction, two main parts, and a summary discussion.

The introduction begins with a brief description of the research settings in Gujarat. This is followed by the rationale for employing PRA and a process approach to initiating the field research, including team formulation, site selection and team introduction to the community. Part I describes nine different classes of information collection with useful outputs which can be generated through application of PRA methodologies such as key informant and group interviewing, stratified sample surveying, sketch mapping, participant observation, and secondary background research. Based on the experiences of the workshop participants, lessons on the advantages and disadvantages of different field approaches and methods are summarized periodically in boxes throughout the report.

Part II begins with a description of the natural resource situation in Gujarat and a forest divisional history in the research area in order to provide background for the current forest management program. The report then describes three village case studies, representing different forest conditions, years of protection, rehabilitation and management strategies. While each case study team collected parallel information on community background, land use history, forest product collection patterns and volume flows, the researchers also documented more detailed information on village-specific user group dependencies, important extraction and processing activities, local institutions and key management issues. The report concludes with a summary of the methodological lessons learned through the PRA trials, and a discussion of the forest contexts, product flows, and participatory management implications which emerged through the exercise.

The Field Methods Manual series attempts to bring together current experience with diagnostic methods for improving forest management through community participation. The approaches, tools and techniques described are still in the process of development. Future volumes and editions in this series will strive to integrate new learning. The editors eagerly request readers to test the methods in the field and to send their suggestions for improvement to: The JFM National Support Group, Society for Promotion of Wastelands Development, 1 Copernicus Marg, New Delhi 110001, India.

FIGURES

APPENDICES

GLOSSARY

baadas	-	A bundle of fuelwood weighing approximately 15 kgs.
falia	-	Hamlet
FD	-	Forest Department
FDC	-	Forest Development Corporation
FLCS	-	Forest Labor Cooperative Society
Fodder Puda	-	A bundle of fodder grass weighing 1.5 kgs.
FPC	-	Forest Protection Committee
GFD	-	Gujarat Forest Department
JFM	-	Joint Forest Management
Kotwalia	-	A scheduled caste of basket-makers
Mahila Mandal	-	Village women's group
NTFPs	-	Non-Timber Forest Products
Nigam	-	FDC purchasing agent
Palas	-	Mat
Panchayat	-	Village government council
PRA	-	Participatory Rural Appraisal
Pradhan	-	Village headman
Supra	-	Basket
Topla	-	Threshing Tray
Van Kalyan Samithi	-	Forest Protection Committee
Van Kal Viroha Kutta Sahakari Mandal	-	Forest Labor Cooperative Society
Wanda	-	Small axe

INTRODUCTION

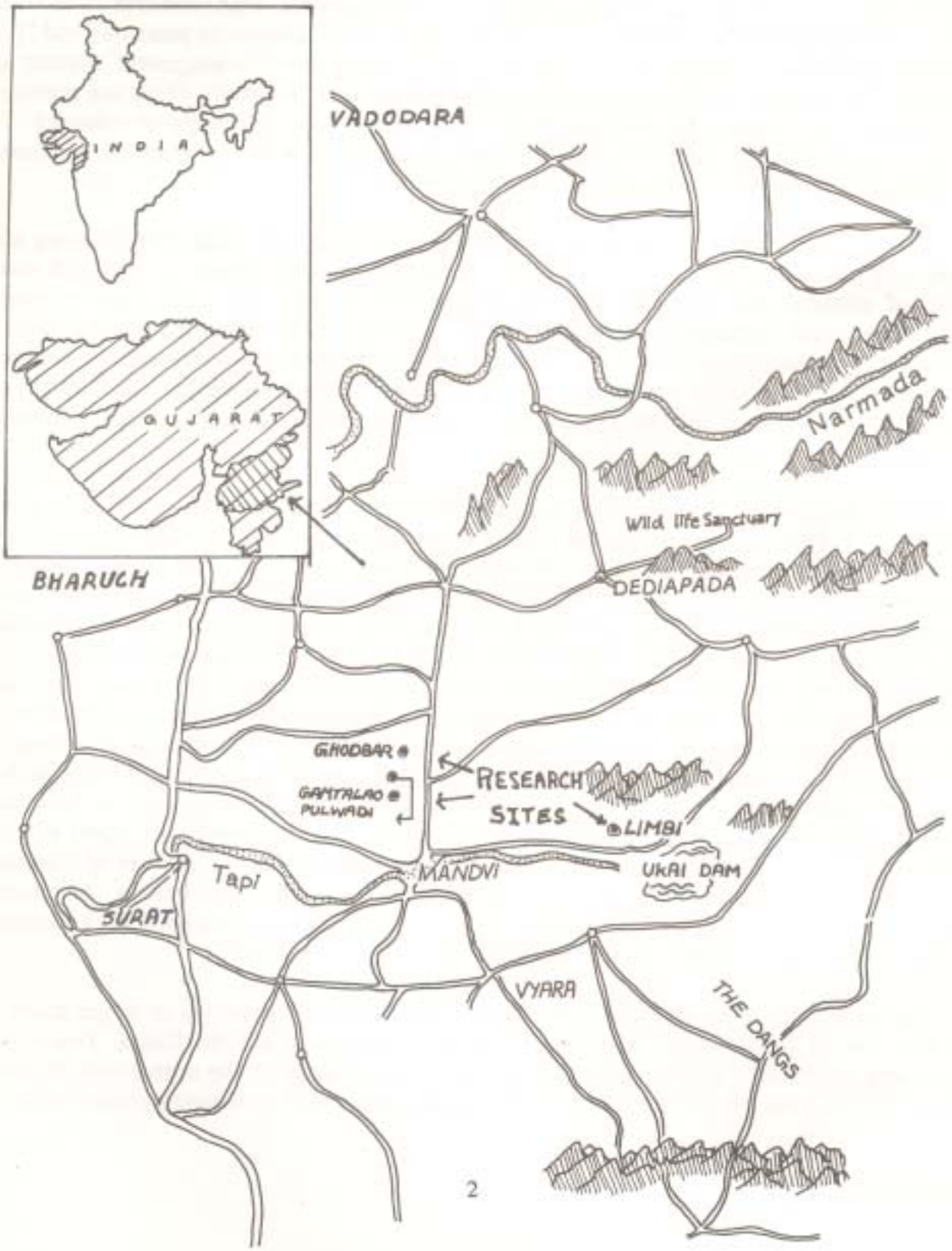
The dual objectives of this five-day workshop were: 1) to give the participants an opportunity to test and further develop participatory rural appraisal (PRA) research methods to assess forest product flows from regenerating ecosystems under community protection and 2) to generate additional comparative information on community forest management systems in Gujarat. The research methods were designed to rapidly assess community forest use practices and the economic nature of existing production systems and how they might be enhanced. To facilitate the information collection and methodology testing, the workshop participants focused on field exercises with periodic larger group discussions.

The participants worked in three teams throughout the field trials, each group studying one previously selected research area. Two of the research sites were located in areas with small tracts of disturbed but protected and regenerating forests, while the third team examined community-forest interactions and flows from a large, well-established natural forest. Researchers worked closely with community members to adapt the research tools to meet local conditions and incorporate new ideas. In order to document and analyze local forest use patterns, community and workshop participants created and utilized a range of maps, diagrams, and tables.

It was decided that the field trials should be conducted in southeastern Gujarat (see Map, Figure 1). For the past five years, the Gujarat Forest Department (GFD) has been developing collaborative management systems with tribal communities in the area. The program received state government approval in March 1991 when a resolution was issued endorsing village forest management and product-sharing agreements. Consequently, the region provided a setting where community protection, natural regeneration, and enrichment planting were already well underway. Two representative forest management contexts were selected for study. The first reflects areas with small tracts of degraded forests, usually located on hilltops. In such settings, communities are establishing access controls on grazing and fuelwood cutting in an attempt to facilitate natural regeneration of teak (Tectona grandis), complemented by gap-filling with a range of valuable local species. This type of situation is particularly apparent in Surat and Bharuch Districts, which are characterized by undulating plains bordering the Satpura hills on their western rim. Methodological field trials were conducted in the communities of Ghodbar, Gamtalao, and Phulwadi to reflect this scenario and approach to forest regeneration. An attempt was made to select sites with differing years of community protection in the hope that a sequence could be developed to reflect the change in economic flows over time.

The second forest management context involves community protection of larger tracts of existing natural forest. Such conditions occur in Vyara Range and the Dangs. Due to the continuing commercial timber orientation of these larger forests in the state forest Working Plans, the GFD has yet to clarify how sharing arrangements with community groups might

Figure 1. Map of Research Sites



operate. Logging has provided important state revenues in the past, as well as comprising a major component of the local economy. While exploitation practices of the past have not proven sustainable, a productive and sustainable management system based on multiple wood and non-wood products has yet to be developed. For the field trials, several communities neighboring the 8000-hectare Limbi Forest Round were selected for study. All three research teams were able to both test the utility and limitations of the participatory appraisal methods and rapidly learn a substantial amount about forest use practices in the study areas.

Why PRA?

Participatory Rural Appraisal (PRA) methods are useful for gaining a preliminary understanding of the research area in a relatively short period -- usually between three days and three weeks. PRA is based on interdisciplinary, exploratory studies relying on a high use of community interaction and indigenous knowledge. PRA methods attempt to build on the increased understanding emerging from each field visit by sequentially pursuing issues raised in previous interviews through probing and cross-checking to verify and elaborate. For that reason, the approach utilizes semi-structured interviewing techniques with extensive data analysis and debriefings immediately after each data collection activity. PRA can help generate information on the socioeconomic and ecological conditions prevailing in the research site prior to the collection of more quantitative biophysical and economic data. In contrast to conventional surveys, some comparative methodological studies have indicated that PRA methods can produce approximately the same types of data with equal levels of accuracy but considerably faster, while providing a better understanding of the human-ecological context in which the study occurs. It is this contextualization, or framing of activities within the larger social and environmental system, which is a particularly valuable component of PRA. The approach tends to present a picture of community resource use as a system because it allows the community to speak for itself to a greater degree than most research methods. Furthermore, it allows the researcher to learn iteratively while in the field and sharpen the focus of the study progressively. Finally, if properly conducted, PRA can create a forum for communities to pursue discussions among themselves concerning their own goals and objectives for the protection and management of forests and other natural resources. It, therefore, can provide an excellent basis for initiating participatory planning, leading to the formulation of joint forest management (JFM) agreements with the Forest Department.

The Research Team

In the case of the Gujarat workshop, prior to initiating the field trials the participants divided into three teams of eight persons each, one for each of the study areas. To facilitate interviewing, the area teams sub-divided further into two, four-member teams. A Gujarati speaker and one woman were assigned to each team and an attempt was made to ensure an interdisciplinary mix of members, including a forester, social scientist and ecologist. The advantage of selecting a woman for the team is that it may enable the researchers to more easily approach an all women's group for interviewing, as well as encourage village women to participate in mixed gender discussions. Since JFM is designed for the broad-based participation

of key user groups and collectors, the majority of which are poor women, the strategy of ensuring a woman team member may enhance their participation from the design and planning stage of the program. At the same time, local language ability within the team is an essential requirement for eliciting indigenous information, especially for understanding local references and units of measurement, as well as capturing people's feelings in their own words.

Site Selection Methods

Selecting research sites is a very important step in designing a PRA. Site selection criteria may vary depending on the objectives of the research. For general diagnostic studies of community forest use practices and their implications, researchers may choose to investigate communities and forests which represent dominant management contexts in the region. Such sites can better illustrate common management problems and opportunities.

The Gujarat PRA Team worked with local District Forest Officers and Range Officers to identify ranges and beats where forests have been disturbed but still have good regenerative potential. Research areas were selected where communities had significant forest product dependencies, and had expressed community interest and ongoing activities in forest protection and management. Prior to the workshop team's arrival, Gujarat Forest Department staff had already selected a number of candidate sites which met the criteria discussed above. The team reviewed the site options and finalized the selection of three villages. Two were chosen from areas with small patches of disturbed forests that are both naturally regenerating under community protection and have also been heavily replanted. A third site was selected in a large natural forest which is still undergoing some extraction and is experiencing heavy use pressures from neighboring communities. This choice of study sites allowed the research team to represent and comparatively analyze the two major types of forest management contexts present in south Gujarat.

In order to better understand how forest product volume levels and flows change over time, the team also sought to identify research sites under different periods of protection and stages of regrowth. It was hoped these areas would have well-defined boundaries with forest tracts ranging from 25 to 200 hectares, and a clearly delineated community user group. Given the limited time available, the research teams had difficulty identifying a series of ecologically similar forest tracts under varying periods of protection. Also, the presence of numerous user communities and many small forest patches of varying degrees of disturbance or stages of regeneration made it difficult to assess specific levels of productivity or utilization per hectare based on community recall alone. In order to more effectively estimate production and utilization rates, population data on individual species' productivity and harvest flows need to be determined through the companion vegetative research methods (see Diagnostic Tools: Field Methods Manual, Vol. I, Part III).

Introducing the Team to the Community

The success of community forestry-oriented PRA studies is dependent on the active participation of villagers and forestry field staff. Team members need to explain the purpose of the activity, describe how it might assist the community, and develop a friendly relationship with them. To explore the advantages of different approaches to gain community and FD participation in the field methods trials, the research team experimented with several approaches. In Ghodbar, the villagers had been informed of the visit in advance by the FD and had prepared an agenda that included a formal gathering of community members and visitors. This planned activity, while time-consuming, provided an opportunity for the team to be welcomed and broadly introduced to the village, after which they were able to describe the study's purpose and ask the community if they would be willing to teach the team over the next few days. Following this, the forest management history exercise began, quite typically with a core group of men. Seeing that the women were standing at a distance, a second exercise by a sub-team was begun simultaneously with the women. On the second day, over two hundred people gathered at the community center for tea, followed by a short formal meeting and introductions of the group and community, including village headman and panchayat members, Mahila Mandal, and the Executive Committee and members of the van kalyan samithi (Forest Protection Committee).

In Gamtalao and Phulwadi, the community welcomed the team in a more traditional manner by holding a tea drinking ceremony. The Chaudary tribal landowners and the Kotwalia untouchables gathered with the researchers and the team requested them to draw a sketch map of their community and forest lands. This preliminary mapping exercise provided an excellent lead-in opportunity to the study. In contrast, in Limbi village no prior notice concerning the visiting research team had been given to the community. The local district forest officer introduced the team first to the former Gram panchayat headman (pradhan), noting that the group had come from all over India to learn from the community about the forest. The pradhan proceeded to provide a useful overview of the community, assisting the team in obtaining background information on the social composition, population, economy, and institutional infrastructure of the village. A sub-team then broke away after 20 minutes to interview some village elders regarding the community's forest history. A family invited this sub-team to sit on its porch and several older neighbors were called to join in the discussion.

Both the formal and informal approaches to introducing the research teams were successful. Whereas the informal approach may have caused less disruption and taken less of the community and researcher's time, it may also have resulted in a more limited introduction of the team and explanation of its purpose. The more formal approach encouraged many members of the community to gather and learn about the study. By initiating research immediately after the ceremonies, the teams were able to enlist the involvement of many villagers.

PART I: EXPERIENCES WITH PRA METHODS

Part I reconstructs what was learned regarding the methodologies through field trials, debriefings, available notes, and post-workshop discussions with participants. The methodology used in this study was designed to allow the researcher to adapt the methods to respond to conditions and issues relevant in the study area. To help document and analyze local forest use practices and systems, and to further engage the community through visual illustrations, emphasis was placed on the collaborative creation of maps, charts, and other pictorial diagrams. The research team understood that to assess the importance and economic value of forest products to communities, the researcher must assume the position of student, with the villagers as his/her teachers. In this context, it becomes crucial for the research team to approach the community with an open mind, an ability to listen, and a willingness to adjust the research design as data are collected to allow the community to best express its knowledge.

Community Background Information

Before initiating PRA fieldwork activities, it is useful to review such secondary information as reports, case studies, FD Working Plans, books, and other documents about the study area. Reviewing existing information on the social and physical environment can speed up and inform fieldwork. Information on human and livestock populations, soils, climate, rainfall, geography and forest species composition is usually available in government reports, including in Working Plans (see Box 1). University-based researchers may have already documented the social and historical conditions in the area. The workshop planners also developed a Community Profile Background Information Sheet for the teams to use in order to yield comparative sets of basic demographic, socioeconomic, and institutional information (see Appendix 1).

Community and Forest History

By understanding historical changes in forest condition, population, resettlement patterns, and the local economy, it is assumed that forest management problems and the forces driving them will be better identified and resolved. A number of different PRA methods were utilized. In-depth interviews with community members and local forestry field staff allowed the team to begin reconstructing changes in forest use and management over the past 50 to 100 years, using historical transects, trend lines, and time lines to depict patterns of change (see Box 2). These diagrams are presented in the case studies in Part II. Appendix 2 provides a set of Interview Guidelines to help assess community and forest history.

BOX 1: Lessons from the Field

For the study areas in southeastern Gujarat, a number of books and articles were available on the region's history, social movements, forest ecology and species compositions. Unfortunately, many of the researchers did not have sufficient time to review this material prior to entering the field. While in the field, one team obtained a copy of the GFD Working Plan for the Vyara Division (1972), which provided a useful history of forest activities, use patterns, and exploitation levels.

The Community Profile Background Information Sheet proved useful in developing an overview of some important features of the village, while also involving community members in a discussion of household-oriented topics. The researchers learned how essential it is that the background information be shared and analyzed by all the members of the PRA team early in the exercise. Socioeconomic background helps to identify key informants and social groups who should be involved and represented in the PRA process. In this study, inadequate information was collected on size and composition of livestock populations, but this was noticed only after it was too late to return to the village because it had not been reviewed early enough. This underlines the need for continuous information-sharing and analysis sessions, which should probably be allocated an equal amount of time each day as field data gathering. On a cautionary note, because the collection methodologies (i.e., profiles or questionnaire guidelines) are more structured for such specific types of information, they have the danger of creating a less open and participatory atmosphere than some of the other PRA exercises.

Community Forest Perceptions and Attitudes

While forest use practices are in part determined by the role of forest resources in the local economy, they are also influenced by villager's beliefs, knowledge, and attitudes regarding the forest. It is therefore essential to explore the position of the forest in the community's worldview. While it is possible to place a value on forest products, labor absorbed by the forest, and its related economic functions, it is difficult to impute a price on the forest's religious or socio-psychological significance. Furthermore, the ecological functions the forest plays in moderating hydrological, soil, and microclimatic conditions and their effects on agriculture and residential life are difficult to value monetarily. Yet in some cases, these functions may be perceived to be so valuable that they outweigh the economic importance of exploitation activities. As a consequence, the community may ban or tightly regulate such actions. This may be particularly prevalent in areas where forest disturbance has diminished the value of further exploitation, and where deforestation has had direct negative impacts on the environment and villagers' livelihood strategies, especially their agricultural activities (see Box 3).

BOX 2: Lessons from the Field:

All three research teams conducted individual and/or group interviews with older members of the communities to document changes in forest cover and use patterns. As an opening strategy, it was effective to ask a group of older people what the forest was like when they were children. The Ghodbar research group found that community members perceived major changes in the forest cover over the past fifty years. An exercise was undertaken to determine the changes in the character, productivity and management of forests around Ghodbar. The methodology involved preparing a historical transect and an accompanying chart by members of the community. Information was collected in two separate groups, one consisting of men and the other of all women.

The team began by asking the male and female groups to each draw a picture of the forest as it existed prior to 1965 (before intensive logging began), after it had been logged (but before the forest protection group was organized (1964-1989), and as it currently existed under village protection and management. Depictions from both groups showed similar images of the forest in terms of size and species composition. The team then asked for a list of the types of species available during each period, which produced revealing information on the rate of decline in a range of useful forest species.

The team found that through the exercise of visually representing the current vegetative state on a large piece of poster paper, people's attention became focused on the topic. Once a picture of the present forest was completed, it was easier to visually portray the forest earlier when it was both badly degraded and when it was dense and tall. The historical information followed naturally from the sketches. This data was later utilized to formulate a trend line of species diversity in the forest at different periods. Finally, the discussion groups reviewed the types of management systems, rights, and forest department relations prevailing during each time sequence. The Ghodbar team concluded that the historical transect exercise was quite successful as a step toward understanding the present condition, historical use, and current and past management systems which have governed the relationships between the people and the forests.

BOX 3: Lessons from the Field

The Ghodbar research team learned a substantial amount regarding community perceptions of the forest's environmental importance while conducting a forest product scoring exercise. The team began this activity by walking through a three-year protected forest with village members and then holding an informal discussion under a tree. Rather than initiating the exercise by referring to the species list prepared earlier, the team asked village members about the relationship of the community to the forest and its importance. The ensuing dialogue elicited a range of social and environmental functions the community perceived the forest to play. The team encouraged the villagers to construct a typology of benefits, which were given in the following order: peace, clean environment, protector of the water table, nest for birds, shade, green manure, fruits, fuel, grass, timber, and income-earning opportunities. It is interesting to note the preponderance of social, environmental, and non-commercial values mentioned by the community participants. Although the Ghodbar team did not request the villagers to score the relative importance of each of these types of benefits, this may have generated a deeper understanding of their perceived significance.

Sketch Maps, Product Flow Charts, and Transects

As part of the PRA exercise, the team wished to investigate the spatial aspects of forest resource use. Through interactive exercises with the community and participant observation, the researchers tested a number of methods to develop sketch and flow maps of resource use patterns and land use transects. Sketch maps provided a rapid understanding of the distribution of villages, forest lands, farm fields, markets, roads and other features of the landscape (see Box 4). Maps were also used to record management information regarding the condition of forest vegetation, protected and unprotected areas, and the source sites of specific forest products. By conducting interviews and observing the landscape from the top of a hill, it was also possible to develop a land use transect by delineating the forest and community area by use practices and ecological zones on poster paper.

BOX 4: Lessons from the Field

All three teams experimented with participatory sketch mapping, beginning with maps drawn by villagers on the ground using local materials and then copying them onto poster paper. In Limbi, the sketch mapping exercise was held in the school courtyard. The gravel cover provided a good base for the map, and a fence around the yard kept cattle and dogs away. The mapping exercise was led by the local school teachers initially, as they may have felt more confident taking a leadership role. However, once the prominent geographical features were outlined and a large crowd began to gather, several other male and female members of the community joined in the process. A wide range of local materials were used to depict features, such as red earth for roads, brown soil for agricultural lands, white lime for forest boundaries, bamboo sticks for hand pumps, and brick chips for mahua trees.

In Ghodbar, while two sub-groups worked on forest management history and a time line, a third sub-group started a village mapping exercise in a courtyard corner. As the schoolhouse was close by, chalk was obtained and a small scale map was quickly sketched, locating the village in the context of the road and nearby villages. It was decided that this was too small, so a much larger version was outlined beside the first map, with the result that a small box in one corner showed a location map, while the larger version focused on the village and surrounding forest land. After the four cardinal directions and the Netrang-Mandvi road were laid out as reference points, the main village roads and the major **falias** (hamlets) of the village were outlined, followed by streams, community landmarks, notable trees, protected forest patches, and unprotected, degraded forest lands.

The map also provided an opportunity to discuss management issues relating to patrolling, protection, and silvicultural operations. Information on the fuelwood volumes resulting from initial cleaning operations (one cartload per family) vs. singling operations (5-10 headloads per family) were useful as a cross-check during the volume flow exercises conducted later on. Once the men grew tired of mapping, the women's group, who had finished its forest management history chart, was invited to come over. They were requested to add anything to the map which would reflect women's perceptions of important features and patterns. Although the women did not choose to change the map, some discussion was generated about the limiting resource for the village, identified by the women as water. Unfortunately, the mapping exercise could not be followed by a walk-through of the entire village. This exercise could have generated renewed discussion and, perhaps, modification by the community of the original map.

Activity Schedules and Seasonal Calendars

To supplement the historical data collected on long term changes in forest cover and management practices, the team assessed how communities used the forest during the year and their daily and weekly work routines. Seasonal forest collection activities were identified through group interviews. Twelve stones were placed on the ground or on a poster paper to indicate months of the year and villagers indicated which products were collected during each month and how the volumes flows changed through the year. Daily calendars were also developed to indicate time and labor allocation. Developing a daily activity schedule with women fuelwood collectors revealed how much time was spent in collecting wood and walking to the market to sell it (see Box 5).

BOX 5: Lessons from the Field

With the assistance of community members, all three teams prepared seasonal calendars describing farm and forest-related activities, and the duration of forest product collection periods. The calendars underscored the important role forests play in the off-agricultural season, as well as in absorbing underemployed labor, particularly in the Limbi area. Ghodbar PRA sub-teams helped develop seasonal calendars with three stratified community groups: women, landless men and landed men. While each PRA team approached the methodology somewhat differently according to the circumstances, in each case community members took the lead filling in the calendar themselves by charting the seasonal availability of the highest scoring income-generating products from the previous exercise. Information was collected from each group on the number of collectors, number of trips, amount collected per trip, total volumes and prices. Some additional information on specific products and their processing was also gathered. Comparing seasonal calendars for three different groups of users within the village, several important differences emerged such as the relative amount of time spent collecting fuelwood by women and the landless vs. landholding men's families. This triangulation also increased the level of confidence concerning data on the number of collectors, collection time, prices and volumes of different products, which were then used to calculate volume and income flows.

In Moti Pipal (Limbi panchayat), a daily activity schedule was prepared by holding a group discussion with women fuelwood headloaders. The exercise initiated an engaging conversation about familiar routines, promoting group consultation by providing an opportunity for the women to reach consensus regarding their typical day-to-day schedules. Their responses were revealing in terms of forest use systems, as the collection of mahua flowers appeared conspicuously absent in these women's lives. Probing the reason uncovered the fact that this hamlet was primarily displaced by the Ukai dam and rendered landless; consequently it had no rights to mahua trees as did their neighbors in Limbi falia. The activity schedule underscored the heavy time allocation to the women's headloading and provided a suitable entry for further probing of the topic.

Inventories, Ranking, and Scoring Forest Products

Participatory inventory methods allow researchers to learn about villagers' knowledge of the forest species diversity and important products generated. Inventories are an effective way to illuminate the wealth of indigenous botanical knowledge and provide a rapid overview of the composition of forest ecosystems. Species lists should 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. Conducting a walk-through also allows the researcher to observe the location of different species.

BOX 6: Lessons from the Field

PRA teams worked closely with community members to develop listings of important forest species, products, and their uses. In Limbi, with its older natural forests, women were able to identify 130 species and men identified 123. In Ghodbar, community members generated an innovative range of categories for classifying different species uses. For example, they subdivided fodder species by the types of livestock for which they were used (e.g., cattle, goats, water buffalo). Ghodbar villagers also identified species which were no longer found in the forest but had once been utilized. Since it typically required 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. In Limbi, separate groups for men and women created a competitive atmosphere which facilitated a more thorough listing. A forest walk in Ghodbar proved to be a valuable exercise as it helped to develop a more thorough inventory of the potentially useful species available. It also provided insight into the community members' familiarity with over 50 tree species and gave the PRA team a better picture of the current age and productivity level of the forest, providing a baseline for future projections. Given more time, a quick vegetation profile along a transect, or a set of small quadrats to measure density and species diversity, could have been very useful.

Community participants had little difficulty in understanding the scoring method and once familiar with the procedures, conducted the exercise with considerable interest. Most of the scoring exercises were carried out in small group discussions. In Ghodbar, the scoring exercise proved very participatory, with several people changing each other's distribution of stones until a consensus was reached. One immediate innovation, or mid-stream correction was made by the community, which decided that it was fairly difficult to rank individual timber and fuelwood species and that these should be clustered.

Prior to the field work, a reference list of species should be compiled with local and botanical names. Source books such as The Useful Plants of India (Publications and Information Directorate, New Delhi, 1986), with its extensive index of local Indian plant names, provides a helpful reference in identifying the botanical equivalents. Where communities offer their own use classification typologies, it is interesting to examine how and why they divide uses into different categories. It is also valuable to assess the number of species named in each use class to establish the level of diversity and the special use characteristics of the classified products (see Box 6).

Ranking or scoring the perceived importance of different forest products provides insights regarding their relative value. Rankings indicate the order of importance among items. In contrast, scoring provide an indication of the perceived values of each item in relation to the others. Products are often ranked or scored by use categories such as fodder, fuelwood, and medicinals. For the species or products in each category, the discussion group members are asked to give a value relative to the others. Seeds or stones can be used as counters. As an example, for construction purposes teak may be rated highly with seven seeds, while eucalyptus may have an intermediate score of three seeds.

Product Volume Flows, Labor, and Capital Costs

PRA studies have proven to be effective in gaining a general understanding of forest product volumes and flows. Group and key informant interviews can generate information on collection practices (who, what ,when, where, how, and why), and the members of the community involved. Recall estimates of the average amount of each forest product collected and the assessment of the number of collectors involved can give some indication of the total volumes of non-timber forest product (NTFP) yield.

Due to recall error, it is important to cross-check production estimates with knowledgeable people in the community including the local forester, village headmen, NTFP agents, and school teachers. If time permits, researchers can also conduct small stratified sample surveys with families from different social and economic backgrounds. A number of PRA studies have also shown that it is helpful for research team members to participate in the collection process. This allows researchers to directly observe collections, photograph processes, and measure the time requirements, volumes and weights. While data collected through these methods is a rough estimate, it can sketch a picture of the relative levels and patterns of different product flows which, when combined with ecological data on stocking levels and productivity of different species, can lead to an assessment of sustainable harvesting and potential income levels (see Box 7).

Forest Product Prices, Processing, and Marketing

The PRA trials indicated that collecting information on wholesale prices for commercial forest products was not difficult. However, prices varied considerably across markets and among buying agents, and need to be carefully cross-checked to establish average product prices over seasons. Predictably, prices were generally lower close to the collection area. Government agencies dealing in forest products tended to offer lower prices, but not always. Prices for forest products tended to be low, and provided a correspondingly low return for labor in contrast to the minimum state wage. For this reason, many villagers either consume the product directly or process it in an attempt to capture the value addition. This was particularly apparent in the case of mahua flowers, which are used in "country wine" distilling.

BOX 7: Lessons from the Field

Most of the PRA group interviews were held in the village; however, in Limbi, researchers accompanied a group of mahua flower collectors and interviewed them while they were harvesting. This provided an opportunity to cross-check information previously collected, and helped generate some of the sub-team's richest and most detailed information on the mahua collection, processing, and marketing system from a cross-section of male and female collectors. While in the field, the researchers were able to assess flower basket weights, clarify the sex and age composition of collector groups, and further confirm the time spent in collection activities.

Team members found it useful to begin with the 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 community members of different socio-economic backgrounds, it was discovered that collection activities and forest dependencies vary significantly across households. Given more time, following up with a stratified sampling of households would have provided important information concerning such variations.

PRA trials were conducted in early April, corresponding with the beginning of the flower, fruit, seed and leaf harvesting seasons for many important forest products in South Gujarat. Despite the satisfactory results obtained, the research group felt that a follow-up visit of 3-5 days, especially if conducted during the mid or latter part of the collection season (May through June), would provide an ideal opportunity to further cross-check initial flow estimates, fill gaps in production figures, and provide greater detail regarding collection processes, harvest volumes, market prices, labor and capital costs.

In order to calculate the profitability of different community-based forest product activities, information on the labor invested in specific tasks and the costs of equipment and materials utilized must be gathered. PRA trials in Limbi indicated that labor allocation for forest product collection and processing could be best approximated by drawing a daily or weekly activity sequence with key informants or a 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 developed. Since the Limbi sub-team was able to meet a group of mahua flower collectors in the forest, it could observe the collection process as well as interview several subsets of collectors passing through regarding many issues, including labor and capital costs.

Understanding the processing and marketing systems for timber and NTFPs is essential for the planning and design of programs to improve quality and linkages. Case studies from many parts of India indicate that these systems are often inefficient and produce low profits for producers due to raw material supply problems, middlemen and market access. Often these difficulties stem from rigid regulations which constrain efficient market operations. PRA methods can help document how these processing and marketing structures operate and identify where constraints might be removed.

Box 8: Lessons from the Field

While the pricing of commercial goods was relatively straightforward, attributing a value to subsistence-oriented forest products was much more complicated and required additional time. Large volume items like subsistence fuelwood and fodder could be estimated by using substitute prices, although those also tend to vary. For example, in Limbi, fuelwood sells in the market for approximately .50-.60 paise per kilogram, whereas in Ghodbar the price was Rs.1 per kg. Products that were harvested irregularly or in small quantities were much more difficult to value. Medicinals, animal and some plant food products, and domestic construction materials require additional time to assess volumes and attribute economic values. Hence, it may be advisable to defer the valuation of subsistence goods and complete the data collection and analysis during a follow-up PRA.

The Ghodbar team collected information on prices, markets and linkages through market visits, community group discussion, and thorough individual interviews with the village nigam. Due to the degraded nature of the forest, the overall sale of NTFPs was restricted to tendu leaves, bill leaves (monopolized by an entrepreneur of the village), mahua, asitra leaves, and puwadia seeds collected from field margins. More extensive study of marketing was not possible in this study, but would be an essential prerequisite before making any management decisions affecting commercially-oriented forest production systems.

PRA field trials included the documentation of a number of forest product processing activities, including bamboo basket-weaving, kakra leaf plate-making, and mahua liquor distillation. Daily or weekly activity schedules helped to determine the steps involved in collection, processing, and marketing, while providing a cross-check on labor allocated during each step. For important commercial activities like bamboo basket-making and liquor distillation, villagers engaged in these operations generally described with some accuracy volumes produced, materials used, and prices received. Documentation and analysis of such forest product processing and marketing systems can help pinpoint weaknesses and potentially contribute to the effort of improved product quality, availability, and economic returns to collectors and producers.

Analyzing Forest Product Benefits and Costs

Economic analysis of the profitability of forest-based activities can utilize case study and market research information, as well as secondary data regarding the current benefits and potential economic returns from forests under community managed production systems. The economic analysis can indicate the macroeconomic 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 can be calculated by assessing estimated volume flows of selected commodities over time under different assumptions, including both natural capacity as well as enhanced capacity through silvicultural management techniques.

To more accurately calculate the benefits and costs of different forest production activities, it is helpful to use data emerging from interviews and observations regarding labor allocation, collection, processing, and marketing practices. By analyzing the relative employment, income generation, and environmental benefits of different management options, programs and policy recommendations can be formulated for the consideration of government

planners. To improve access of forest policy makers and managers to the research findings, they need to be involved and supportive of the study from the design phase (see Box 9).

BOX 9: Lessons from the Field

The research team met with senior officers of the Gujarat Forest Department during the planning of the study, worked with them in the field, and discussed the implications of the results. This collaboration effectively allowed for an exchange of information and ideas regarding research priorities, site selection, management issues, and future opportunities. The limited time available to the research team did not allow detailed assessments of the economic implications of different production systems. Still, several production activities were examined, illuminating a number of management issues that require both research and policy attention.

Both the Limbi and Ghodbar teams attempted to analyze information on forest production activities to compare the net income generated from each activity. While the estimates are probably subject to some error in reflecting precise income levels, they may adequately reflect the comparative levels of profits generated to collectors and help explain why some forest-based activities are more attractive than others.

The production of graphics, tables, charts, calendars, and other visuals proved worthwhile, not only for preparing presentations of research findings, but also in organizing field data and beginning analysis. The PRA trials demonstrated that research teams greatly benefit from opportunities to organize their notes throughout the field work process in order to synthesize learning and plan further. Drawing up rough tables, maps, charts, and other graphics provides a quick, visual mechanism to integrate and analyse information generated through the PRA. If the methodology of conducting the workshop itself had any serious flaw, it was the need to schedule more time for group analysis and discussion following each field exercise. More analysis time would provide opportunities to correct assumptions, fill in gaps, share perceptions, corroborate data and re-evaluate methods. Specifically, the sharing of preliminary data analysis with the participant communities at the close of the workshop, especially in terms of implications for community management, was inadequate due to time limitations. In addition, a consistent observation by team members by the end of the exercise was the regret that they had not spent any village overnights to supplement their more formal learning about the community, its practices and beliefs. Finally, it is inevitable that short PRAs will leave gaps in information, not allow sufficient time for analysis, and most importantly, not provide adequate opportunities to discuss learning and management issues with community members. For these reasons, follow-up visits should be planned from the outset as an essential component of the PRA.

PART II: THREE CASE STUDIES

Understanding the Management Context: Natural Resources in Gujarat

Before beginning a PRA exercise, the research team may want to explore the social and ecological context in which the study is to be conducted. This might include background information of the socio-political history of the area and past forest use and management practices. To learn about the research setting, several members of the PRA team were assigned the task of reviewing the literature and interviewing knowledgeable individuals working in the Forest Department, local NGOs, and research institutions. The following sections describe the natural resource situation in Gujarat and present a history of forest management in Mandvi and Vyara Forest Divisions in southern Surat District where the PRA exercise was conducted.

The forests of Gujarat have been significantly reduced over the past three hundred years. With a population of 38 million, the per capita forest area is only 0.05 ha., or less than half the Indian average of 0.11 ha. and far below the world average of 1.04 ha. Less than 10 percent of Gujarat's land is designated forest area, and much of that is seriously degraded. Commercial and rural pressures on Gujarat's forest lands have gradually eroded timber stand density and quality. Visual interpretation of Landsat Satellite imagery from 1985-87 indicates that 40 percent of all state forest land had less than 10 percent crown density and an additional 31 percent had a crown density of only 10-40 percent. There are only three zones with extensive higher quality forest cover of over 40 percent crown density (covering a total of 5259 sq. km.): the southeastern border, southern Saurashtra, and the north and central eastern border.

Most of the forested areas now classified as Forest Department land were inherited from some 200 ex-princely states. Historically, local rulers leased out the forests to contractors for timber felling. During the British regime attempts were made to bring forests under some form of scientific management. But the timber demands for shipbuilding, particularly during World War II, resulted in the harvest of larger trees. Until recently, 10,000 hectares were harvested each year. However, it was observed that the harvested coupes or compartments did not regenerate satisfactorily due to continued pressure of hacking, grazing and illicit felling. The failure of logged areas to regenerate led to the suspension of most of the state's FD Working Plans, except in south Gujarat. Introduction of fast-growing trees such as eucalyptus also caused the sites to deteriorate. In general, illicit cutting, pilferage, uncontrolled grazing, and excessive exploitation of forest lease areas resulted in severe disturbance. By 1990, almost 50 percent of the forest lands were in various stages of degradation, primarily in the state's arid, semi-arid, and drought-prone areas. Primarily due to the progressive problems of degradation, a state ban was placed on further felling on public forest lands in 1986.

In a related development, recent reports from Gujarat indicate that water resources are under similar pressures. An estimated 20 million people are confronted by water scarcity, exacerbated by droughts over twenty of the last twenty-eight years. While deforestation may have negatively influenced rainfall, runoff, and recharge patterns, accelerated tubewell drilling for irrigation has drawn down water tables in many parts of the state. In Mehsana district,

certain water tables are falling at a rate of 4-5 meters per year, with tube wells being sunk over 1000 feet deep. Irrigation and hydroelectric dam projects provide alternative sources of critically needed water, but they also have inundated some of the state's best remaining forests while displacing thousands of tribal communities. When inundation occurs, communities may completely lose their agricultural and forest resources, and become displaced for years. In order to survive, these families are frequently forced to headload fuelwood and illegally fell timber in the state's shrinking southeastern forest patches.

Mandvi and Vyara Forest Division: 1838-1992

The Mandvi and Vyara Forest Division in Surat District first came under the British in 1838. In 1851 a formal order initiated the conservation and protection of the area's forest. Despite this legal action, the area was subject to rapid and uncontrolled exploitation by Ijardar timber contractors. In 1863, forest management responsibilities were formally transferred to the newly established state forest department. However, there was still minimal supervision over the contractors. The contractor system was abolished by the state in 1877, and in an attempt to bring some control over forest exploitation, the service of a professional forester from Bombay, Shri Ukidway was enlisted. As a result of Ukidway's recommendations, all greenfelling was stopped in forest areas and a process was initiated to formally register the area as reserve forest. When Ukidway was transferred, however, green felling was resumed and continued from 1885 to 1891. Once again, contractors had full liberty to fell large-sized green timber from all ranges, resulting in further overexploitation of the remaining natural forest.

In 1891, the state Forest Act was introduced; settlement and demarcation of lands was renewed, and the official felling and sale of green timber was stopped once more. However, incentives and concessions under rules for new cultivators resulted in further forest clearing. In 1904, the first Working Plans were prepared for Mandvi and Vyara Forest prescribing selective felling using coppice with reserve system. Ten years later, it was found that this management regime was resulting in an increase in inferior species and depletion of large-sized teak. In 1945, a Working Plan introduced the goal of increasing medium-to-high forest stock (i.e., commercially valuable timber species), enhancing the forest's potential economic and ecological value, and arresting soil erosion. The subsequent selective felling and plantation system faced heavy biotic pressures in both artificial plantations and natural forest. At the same time, between 1975 and 1985 clearfelling was periodically undertaken in certain areas with disturbed and vulnerable forest for replacement planting with fast-growing species such as bamboo and Acacia catechu, as well as the major forest species, teak. The clearfelling system, combined with increasing human and livestock pressure, exacerbated soil erosion and depressed natural regeneration, further degrading the forest. As a response to the ecological imbalance, the Gujarat Forest Department (GFD) imposed a felling ban in 1986, still in operation today. However, over the past few years the GFD has employed Forest Labor Cooperative Societies to fell dead and dry timber. In addition, many landless families remain highly dependent on fuelwood headloading, which places additional pressures on the already disturbed forest ecosystems. In Figure 2 a time line of Mandvi and Vyara Forest Division History summarizes information collected from secondary sources such as the Working Plan and research papers, supplemented by PRA interviews of FD officials and communities.

Figure 2. TIME LINE OF MANDVI AND VYARA FOREST HISTORY

1838	Mandvi and Vyara forest areas come under British Rule; Ijardar contract felling system. (Rapid exploitation of forests.)
1851	Conservation and protection of forests ordered. (Contractors continue felling.)
1863	Forest management officially transferred to State Forest Department.
1875	Dhamni falia established in Limbi.
1877-81	Ijardar contract system abolished. Shri Ukidway of Bombay Forest Service takes over management. Green felling stopped and reservation and demarcation process initiated.
1885-91	Ukidway transferred; contract felling resumes.
1891	Forest Act introduced; settlement and demarcation of reserves starts again.
1895-1903	Incentives and concessions under Abadi rules for new cultivators result in forest conversion to agriculture.
1904	First Working Plan drawn up and selective felling started (i.e., coppice with standards of forty years).
1914	Working Plans result in an increase in inferior species and depletion of large-sized teak.
1922	Gamtalao falia established near Mandvi.
1945	Working Plan to implement and improve forest management.
1950	Chaudhary and Gamit tribal families arrive in Limbi.
1956	Forest labor cooperatives established; timber felling increases.
1960-70	Ukai Dam constructed; 270 sq.km. of forest land submerged.
1970-71	Selective felling and plantation carried-out to improve quality and stocking of forest crop. Poor success due to disturbance from grazing and fuelwood cutting.
1971	Displaced Bhils from Ukai Reservoir arrive in Limbi.
1972	Current Working Plan issued.
1975-86	Clear-felling in forest area. Soil erosion increases and natural regeneration reduced. Attempts to establish plantations fail.
1985-89	Drought.
1986	State felling ban to improve soil condition and stocking .
1987-90	Forest Protection Committees formed in Gamtalao, Ghodbar, Limbi, and Phulwadi.
1991	Low rainfall and drought, with regeneration in protected areas.

SMALL REGENERATING FOREST PATCHES: GAMTALAO AND PHULWADI VILLAGES

Gamtalao Gram Panchayat and associated forest areas were selected as one of the research areas due to community efforts to initiate participatory management systems over the past five years. Aside from describing the broader forest management history, setting, and use patterns, this case study highlights local basket-making and fodder production systems.

Community Background

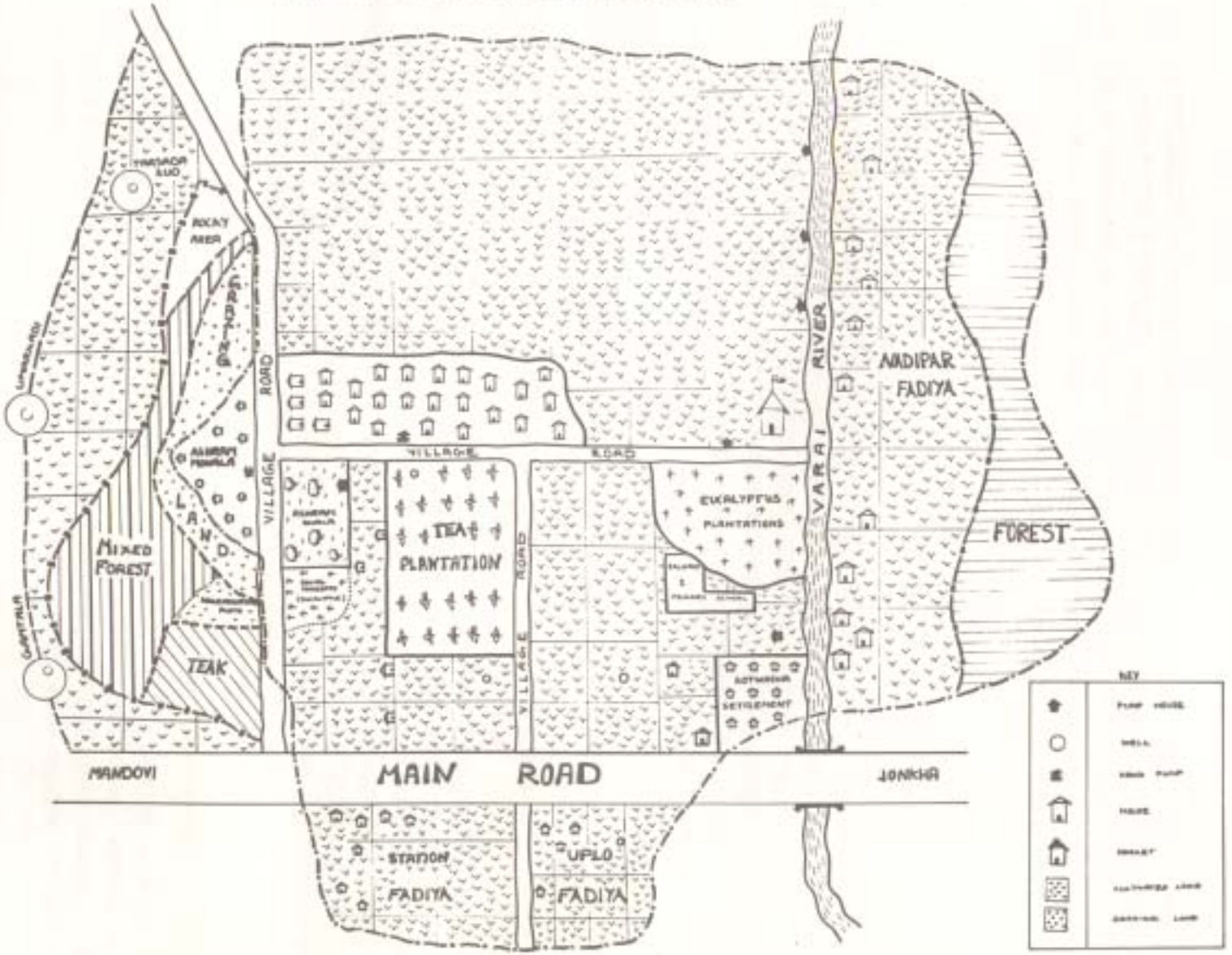
Gamtalao is located in eastern Surat district, adjacent to a paved road ten kilometers from the town of Mandvi. The Panchayat is comprised of the original settlement of Gamtalao and the subsequently established village of Phulwadi. In turn, Phulwadi is comprised of Ashram and Kotwalia falias (see Figure 3). There are 124 families in Gamtalao village, with a population of about 800. All families in the village are Chaudhury tribals. Gamtalao has 32 landless households while the remaining 92 families cultivate their own agricultural lands. Land tenure patterns indicate a skewed distribution of resource-poor peasant farmers with 26 percent landless, 46 percent with holdings of 1-5 acres, and 28 percent with 5-9 acres. Of the 270 acres of farmland, ninety percent, is rainfed. Only 8 families (6 percent of the population) benefit from irrigation, covering approximately 30 acres. The villagers of Gamtalao formed a Forest Protection Committee (FPC) in 1988 and are currently protecting 6 distinct patches of regenerating forest.

The Phulwadi community consists of 58 families. Ashram falia is comprised of 45 Chaudhury households, all of whom own 1-5 acres of farmland and are related to Gamtalao's families. The landless Kotwalia falia was established in 1970 by 13 households of this scheduled caste of bamboo basket-makers. The Chaudhury families own 70 buffalo, 120 cows, 100 bullocks, and 125 goats and, like their neighbors in Gamtalao, have high fodder requirements. The buffalo are generally stall-fed; each day they produce approximately 500-600 liters of milk which is purchased by the cooperative.

Land Use History

The first Chaudhury tribal households were established in Gamtalao around 1922. At that time, there were dense forests covering the hills and plains which had not yet been cleared for agriculture. The forest was comprised of teak and associate species such as amla (Emblica officinalis), khair (Acacia catechu), sadad (Terminalia tomentosa), mahua (Bassia latifolia), bel patri (Aegle marmelos), tamarind (Tamarindus indicus), neem (Azadirachta indica), and ground flora.

Figure 3: Sketch Map of Phulwadi Area



In the 1950s, land allotment programs formally allocated lands for cultivation to the local population and demarcated panchayat/village common lands. Commercial exploitation of the forests by labor cooperatives was initiated during this period, and clear-felling was widely practiced. Land use patterns in Gamtalao Panchayat has undergone significant change over the last 25 years. In the past, the main crops were rain-fed bajra (millet) and jowar, supplemented with a small amount of farm forestry. Currently, eucalyptus, teak, and khair are being raised on farmlands in combination with newer agricultural crops of wheat, sugarcane, ground nuts, and paddy. Ownership of the village's 300 acres of agricultural land has also changed over time. In the 1950s, there were about 25 families cultivating this land. Currently, 92 families are cultivating land in the village, and the size of individual holdings has declined to an average of less than 2 acres.

In the late 1960s and early 1970s there was large-scale clear-felling of teak, leaving in its wake degraded scrub land. Conditions were further worsened by fuelwood cutting, overgrazing, and periodic burning. A growing scarcity of fuelwood and timber resulted in overcutting of private trees on farmlands as well. Encouraged by the GFD, in 1988 Gamtalao formed an FPC. While considerably disturbed, the scrub forests on the hill above Gamtalao possessed approximately 2000 teak, dhak (Butea monosperma), and other coppicing stools per hectare. With protection from fire, cutting, and grazing, the teak coppice shoots grew vigorously. Today, after 4 years of protection the stand has attained an average height of 15 feet and girth of 15 cms. In 1989, the GFD worked with the FPC to fill gaps in the regenerating forest with bamboo, khair, mahua, and other species suggested by the villagers. To date, 56 ha. have been enrichment planted, while the community-protected forest area has increased to 140 hectares.

In addition, neighboring Phulwadi village formed a FPC in 1990. Its members have been protecting a forest patch of 35 hectares. On a single day, four members are responsible for protecting the area. As a result of this protection, the natural regeneration of teak (Tectona grandis), ber (Ziziphus jujube), bauhinia (Bauhinia racemosa), haldu (Adina cordifolia), sadad (Terminalia tomentosa), dhak (Butea monosperma), neem (Azadirachta indica), kharaya (Sterculia urens), and timru (Diospyros melanoxylon) is evident. In addition, areas with poor root stock have been artificially planted with teak seedlings, khair (Acacia catechu) and eucalyptus.

Forest Products and Collection Patterns

While fodder has been very important to the communities in the past, the growth of commercial dairying has further increased the need for grasses and leaf fodders. The forest, especially as it has regenerated during its early years of protection, has substantially increased the amount of fodder available. Still, only 25 percent of Gamtalao's total demand for fodder is currently met from the forest. In a scoring exercise by the community, fodder was chosen as the single most important forest product (fuelwood was considered second). Several dozen other forest products are harvested for small industrial activities such as leaf plate-making and basket-weaving, as well as supplemental foods, medicines, building materials, and oils.

For the researchers to understand the relative importance of different species, community representatives were asked to score them according to use, categories selected by the community. The results are presented in Figure 4. Teak scored as the best source of timber for furniture, construction, and agricultural tools due to its hardness and durability. Sadad received the highest score as a source for fuelwood, while mahua scored highest as a source of oil and flowers for liquor distillation. Mango scored well as a food source. Kakra received the highest score for medicinal use (seeds) and was also the only source of material for leaf cup-making, an important cottage industry in Gamtalao. Bamboo was given the highest score as a source of supplemental fodder. While bamboo was not considered best from a nutritional standpoint, the greater availability of its young leaves during the fodder-scarce summer enhanced its value.

Seasonal collection patterns for important forest products, and their uses for commercial sale, subsistence or most frequently a combination of both were determined and recorded on a linear seasonal calendar. NTFP were collected during April to August. The flowers, fruits, and seeds from many of the more valuable forest tree species are primarily available during the driest months of April through June. During the monsoon, from July through September, forest tubers were reportedly harvested from the jarakalli, dodka, vayo, and thumblo plants. This seasonal availability provides the community with an important source of nutrition prior to the post-monsoon harvest season. Fodder grasses are also harvested from July to September and bamboo is harvested for basket-making and commercial sale from September through March. Finally, tree gums and resins are collected during the winter months of November and December from the kharaya, khair, and neem trees.

Volumes, Flows, and Prices of Forest Products

As another part of the PRA field trials, the team attempted to assess the level of forest product flows from community-protected forests. The regenerating teak stools produced some fuelwood during the initial stool cleaning and subsequent multiple shoot-cutting at the beginning of the program. However, little additional fuelwood will likely be available from the teak until the first thinning operation is carried out when the coppice stems reach 15 years of age. The GFD plans to harvest the stand after 60 years, hence the teak will yield minimal timber before that time if current plans are followed.

Households in Gamtalao Panchayat primarily obtain fodder, fuelwood, fruits, seeds, and leaves from the forest. At present, fodder grasses are deemed the most important product. The two most important non-timber products from tree species are mahua and kakra. Mahua flowers, collected from approximately 25 mahua trees in the village, are the key ingredients in the distillation of liquor. During the 2 weeks in April when trees are flowering, they generate

Figure 4
Scores of Important Forest Species by Use

Use	Species	Score 1-5 (in ascending importance)
Furniture	Teak	5
Construction timber	Teak	5
	Khair	1
	Sadad	1
	Bamboo	1
Poles	Teak	5
	Khair	5
Fuelwood	Sadad	5
	Tamarind	3
	Kakra	2
	Modad	1
	Kharaya	1
Oil	Mahua	5
Liquor	Mahua	5
Medicinal	Kakra	5
	Neem	3
	Umra	2
	Billi	2
Edibles	Mango	5
	Tamarind	1
	Billi	1
	Khazari	1
	Bordi	1
Leaf cup	Kakra	5
Fodder	Bamboo	5
	Peepal	1
	Neem	1

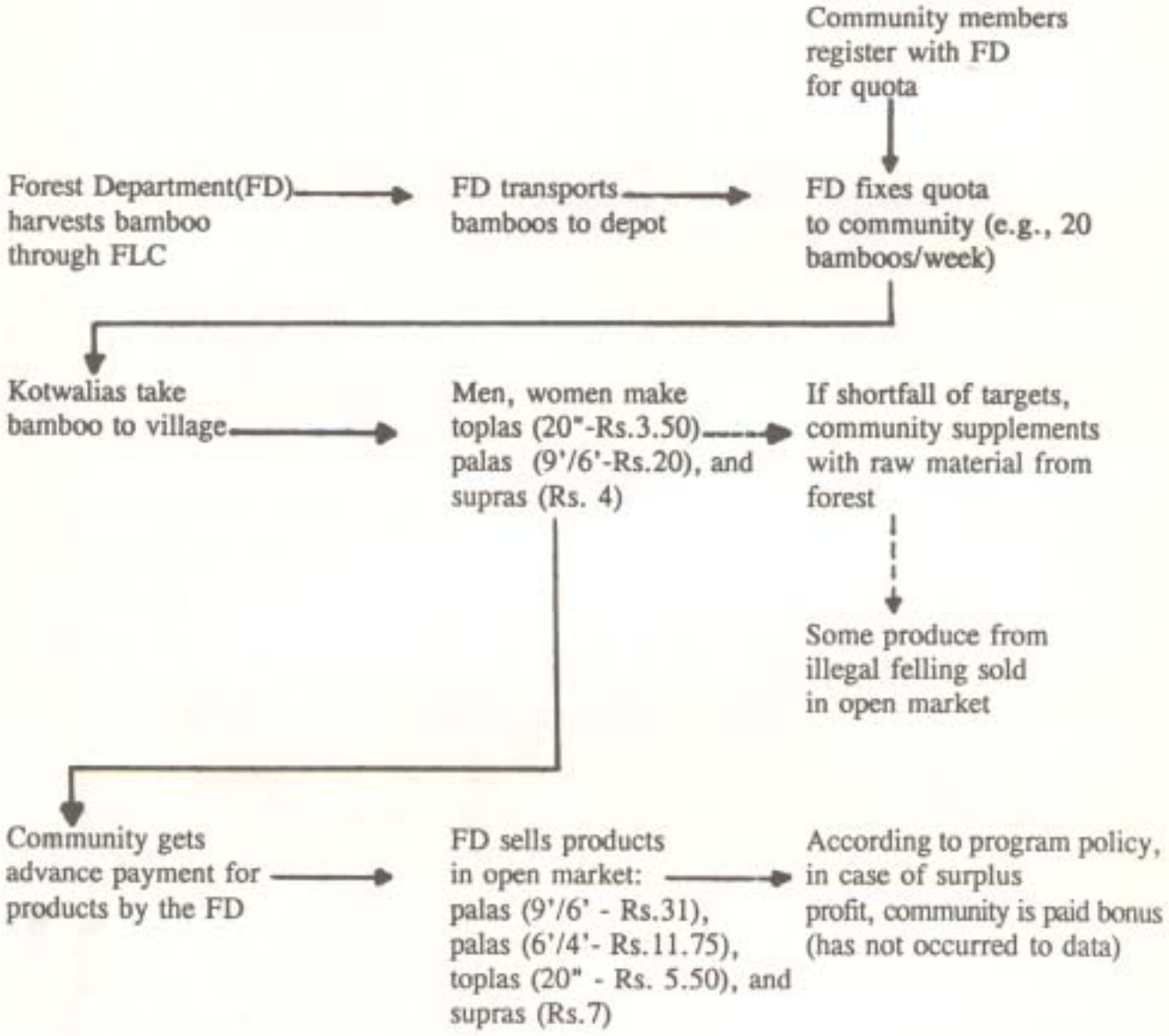
approximately 375 kilograms (30-year old trees, average 1 kg. per tree per day x 25 trees) of wet flowers, which are collected by most village households. In May, the mahua trees produce an additional 500 kilograms of valuable edible oil seed. During the season, most families are able to collect 15-30 kgs of mahua flowers and a similar amount of seed. Kakra leaves are collected in April for leaf cup and plate-making. It is estimated that collectors on average harvest 30,000 leaves during the one-month season.

The Gamtalao/Phulwadi combined PRA team also collected information on NTFP prices from a number of sources, including the Forest Development Corporation (FDC) agent or Nigam at Mandvi, local merchants in the Mandvi and Deogarh markets, and Gamtalao's collectors. They found that FDC prices had risen 20-100 percent over the past one to five years. For example, the cost of 1000 bundles (about 25,000 leaves) of tendu leaves had risen from Rs. 110 in 1987 to Rs. 200 in 1992. Prices for most grades of kharaya gum had increased approximately 20 percent over the past year. The FDC has also raised its purchasing price for mahua dry flowers from Rs. 1.40 per kilo in 1991 to Rs. 2.00 in 1992, while the free market retail price in Mandvi was Rs.4.50. The retail price for karanj oil seeds was also twice the FDC wholesale buying rate. The FDC reported its biggest NTFP volume was tendu leaves, followed by mahua flowers, karanj seeds, ratanjot seeds, and kharaya gum.

Kotwalia Basket-Making

The Kotwalias of South Gujarat are generally landless people who depend primarily on bamboo basket-making for their livelihood. Their products include split bamboo mats (palas), threshing trays (topla), and baskets (supra). Some Kotwalia communities still reside within forest areas, while others have shifted to agricultural villages but maintain their traditional cottage industry. In the past, Kotwalia communities received low prices from contractors and middlemen for their products. The GFD has attempted to break this exploitative relationship by harvesting and supplying bamboo quotas to basket-making communities and guaranteeing a market by buying back their products. The objective of the GFD's program is to reduce illegal felling, abolish middlemen, provide employment opportunities to the community, and establish a guaranteed market and better price for the finished product. The process of bamboo harvesting and marketing is presented in Figure 5.

Figure 5
Flow Chart of Kotwalia Basket Production and Sale

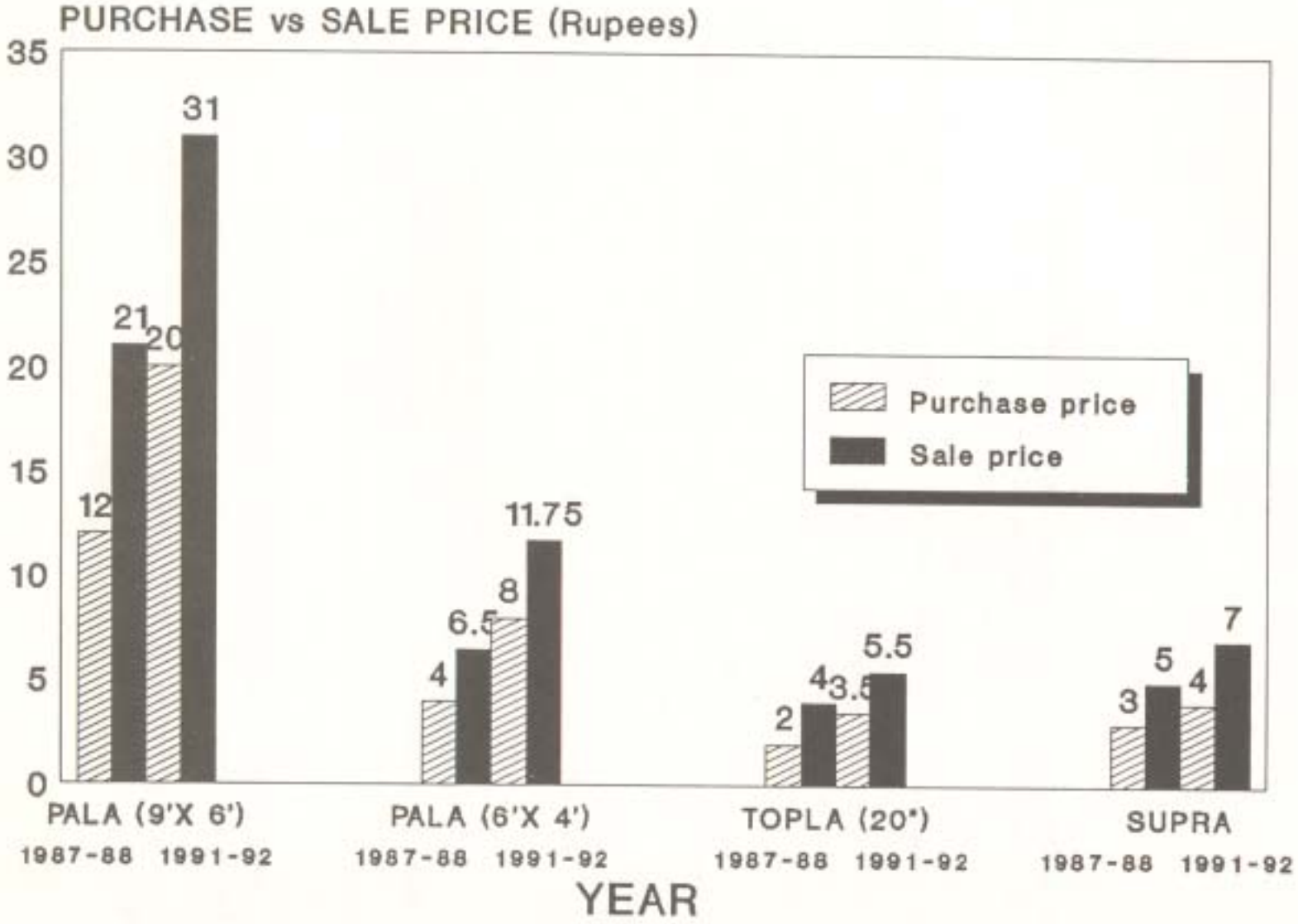


The FD supplies the bamboo at a subsidized price to Kotwalia communities. The rate fixed by the GFD takes erratic jumps. In 1987, the cost per 100 bamboo poles was Rs. 20; this rose sharply to Rs. 66 the following year but has remained constant since that time. Kotwalia basket-makers noted that the problem was not the price, but rather the limited quota and the erratic quality of the supply. Normally, the GFD will hire laborers from the Forest Labor Cooperative to cut the bamboo, which is then stored at the depot until distribution. In the process of transport or storage, it may split or become overly dry, making it less useful for the industry. In receiving the raw material, the villagers must agree to provide the GFD with a fixed output of processed goods. For example, if the Forest Department provides the village with 20 bamboo poles, the community must produce 20 threshing trays in return. In order to gain access to more raw materials in better condition and to free itself from production obligations to the GFD, many Kotwalia communities circumvent the system by illegally felling bamboo and selling poles and woven goods for higher prices in the open market. The wholesale prices paid by the GFD to the producers have risen 40-50 percent over the past five years. At the same time, the FDC has successfully maintained a profit margin of 30-50 percent (see Figure 6). Although the FDC program is legally responsible for returning excess profits to producer communities in the form of bonus payments, community members claim this has never occurred.

In analyzing the implications of the current arrangement, several issues come to light. First, the demand for value-added bamboo goods produced by the Kotwalia seems to be strong, with market prices rising. Kotwalia producers, however, are dissatisfied with the current GFD monopoly over the legal supply of materials and feel forced to illegally fell bamboo on state forest lands. They do so to increase their supply of raw materials, gain higher quality bamboo, and avoid a built-in obligation to produce for the FDC. Kotwalia members participating in the PRA also noted that the FDC wholesale purchase prices were substantially below open market rates.

Based on this information, the research team felt that the GFD's policy to control harvesting operations resulted not only in poorer management of bamboo stands and an inadequate supply or low quality raw materials, but also in community sentiment that protection was the department's responsibility and not theirs. By developing collaborative management systems, controls over both supply and marketing would necessarily shift. If Kotwalia communities were given responsibility for bamboo clump-cleaning and thinning operations, with the incentive that any increases in productivity would benefit them directly, the system would facilitate healthier growth and higher production, better protection, and a more sustainable and higher quality supply of raw material. Attention also needs to be given to the marketing system currently operated by the FDC. In order for Kotwalia producers to attain better prices, they could be allowed to sell their products on the open market instead of being subjected to FDC production targets. The FDC would then become more competitive in terms of prices and services provided.

Figure 6: MARKET PRICES OF BAMBOO PRODUCTS 1987-1992

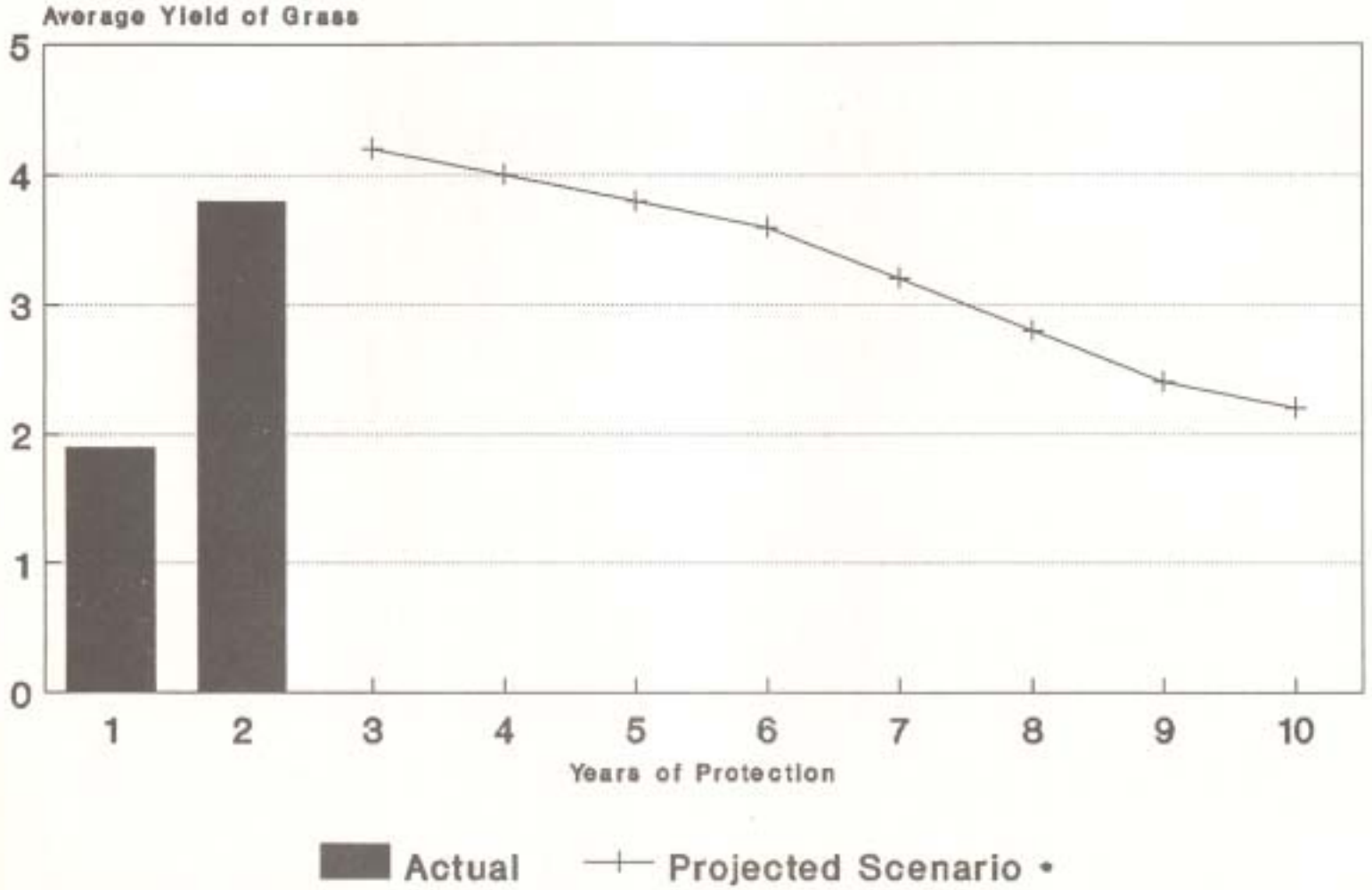


Fodder Grass

Given the importance of fodder grass to the households in Gamtalao and Phulwadi, special group and key informant interviews were carried out to better understand community requirements and the grass productivity of the forest area. Phulwadi forest tract was selected for study. Each family is allowed 1500 pudas of grass (one puda = 1.5 kgs.), harvesting approximately 2250 kg. annually. The community's total annual grass harvest is estimated at roughly 130.5 metric tons, or 3.7 mt per hectare. The grasses are used for cattle feed and are not sold in the market. However, if the substitution value of fodder in the dry season at Rs. 0.50 per Kg were used, the total market value of the fodder collected from the 35 ha. forest would be Rs. 65,620 or almost Rs. 1,864 per ha. While this replacement value assumes a ready market, it does appear significant in terms of economic return on a newly regenerating hectare of forest land. Furthermore, this fodder supply satisfies a significant proportion of the raw material subsistence requirements per household in the program's early years.

The fodder yield from the entire forest area of 141 ha. is presently about 80,000 kgs. per year -- an average yield of 567 kgs. per hectare. After two years of protection, tree species of coppice and seed origin, including teak, khair, and eucalyptus are growing well. However, as the crown cover closes, the yield of grasses may fall substantially. Aside from decreasing productivity due to shading effects of regenerating tree species, grass yields may also decline as a result of the aging of grass tufts, infestation of weeds, and such external effects as drought and erratic rainfall. If the community continues to protect the forest area effectively, the average yield of grass may approximate the following scenario based on data from regenerating forest lands in Pinjore range, Haryana (see Figure 7). Based on such projected declining fodder yields, the management strategy for the protected forest area may need to be adapted in various ways in order to ensure future sustainable fodder supplies. For example, a multi-pronged program targeted to increase fodder production could include: continual thinnings and wider spacings of planted and regenerating tree stock on forest lands; agroforestry interplanting of fodder trees, shrubs, and grass on private farmlands; utilization of living fences such as acacias for fodder; leaf and grass fodder development on village common lands; stabilizing soil and water conservation bunds, trenches, or small check dams with local fodder grasses and shrubs; and a controlled system of rotational grazing in the forest area to enable rapid grass regeneration.

Figure 7: Projected Trends of Grass Yield Under Community Protection



• based on data from Pinjore, Haryana representing a decline in grass yields in areas upto 10 yrs. of protection

Summary

The PRA exercise in Gamtalao and Phulwadi raised a number of important management questions regarding the future supplies of fodder grasses to communities with a growing dependence on commercial dairying. As the tree canopy closes, grass productivity will predictably fall. In addition to maintaining a less densely stocked forest, planting a larger number of fodder leaf trees and grasses on forest, agricultural and common lands will help ensure future supplies. The PRA also indicated that GFD and FDC assistance programs to the Kotwalia communities were not fully achieving their objectives, primarily due to problems of low productivity, supply and marketing. It seems apparent that alternative collaborative management arrangements could increase bamboo productivity, enhance Kotwalia participation, and improve the product quality and income of the Kotwalia communities.

Given the growing fuelwood needs of village members, a sixty-year rotation of teak on these small forest patches may not meet local energy requirements. The growth of community needs for fodder, fuel, timber, and other forest products may require a policy shift away from attempts to raise commercial timber. Further analysis of community requirements and the advantages and disadvantages of different management strategies might be carried out to identify optimal ways for meeting village needs and environmental objectives.

SMALL REGENERATING FOREST PATCHES: GHODBAR VILLAGE

The Ghodbar area was chosen as a research site due to community forest protection activities and the presence of a number of small plots of regenerating forests patches. The Ghodbar case study highlights experiences in eliciting community perceptions of forest management history and changing species availability. The researchers also raise questions regarding how mixed-species forest systems can be optimally managed to maximize fuelwood and fodder availability, as well as a range of NTFPs.

Community Background

Ghodbar is nestled in a western spur of the Satpura range in Surat district of southern Gujarat, 3 km. west of the Netrang-Mandvi road. The village is surrounded to the northeast, southeast, and south by a horseshoe of 107 ha. of FD land, mostly located on gently sloping hillocks. Figure 8 shows a sketch map of Ghodbar drawn by members of the village FPC and later reproduced by an artist. The original was returned to the community. The lower land is mostly taken up by rainfed fields on relatively fertile black cotton soil. These fields support three major crops: rice, jowar, and groundnuts. In addition, pulses are grown in both the monsoon and winter seasons, and the few fields irrigated with tubewells grow wheat and a variety of vegetables.

Until 1989 the entire forest around Ghodbar village was degraded, open grazing land. Scattered teak and associated species, which have been naturally selected for their ability to coppice survived as small shrubs less than one meter in height. Several rotations of eucalyptus plantations on different patches have come and gone with little sign of their passing. Two separate patches totaling 79 ha. have now been taken up for protection and regeneration jointly by the forest department and the village FPC. Of these a 42 ha. plot close to the Mandvi road has been protected for three years and is covered with an impressive regrowth of grasses, shrubs, and over 56 species of trees. Scattered in the 37 ha. of open degraded land which remains are solitary mahua, palash, bel and tendu trees.

Ghodbar is a large, predominantly tribal village consisting of 392 families. Contrary to the popular notion of a homogenous tribal village, it presents wide social diversity in terms of its settlement history, social composition, land ownership, and occupation patterns. Ghodbar has seven hamlets with different tribes and a lone Harijan family. Among the tribal families, 340 are Chaudhurys, 30 Vasavas, and 20 Kathodia. In addition, members of the Nayak tribe migrate during the harvest season to cut sugarcane for several days.

Approximately 60 families are landless in Ghodbar: all Kathodias, the Harijan family, and 40 families among the Chaudhurys and Vasavas. Landholding among the remaining families is quite uneven, with approximately 50 families owning 12-15 acres each and the rest with 2-4 acres per family. Cultivation is the main occupation for 72 percent of the families. Thirty

Figure 8

landless families work as laborers full time; another 25 are in service, and the remainder are engaged in a variety of other trades. Among those involved in small resource-based industries, 15 families seasonally brew local liquor from mahua, 10-15 work as diamond cutters to nearby cities, 7 are involved in carpentry, and for 20- 25 families, NTFP collection provides a major source of livelihood.

Ghodbar has a number of local service shops and institutions. The nearest market is at Jhankhuvav, which is 3 kms. from the village, while a more developed market is at Mandvi, approximately 22 kms. from the village. The Nigam, an agent of the Forest Development Corporation (FDC) purchases most NTFP items from the village and outside, although a second agent purchases exclusively for a timru leaf contractor.

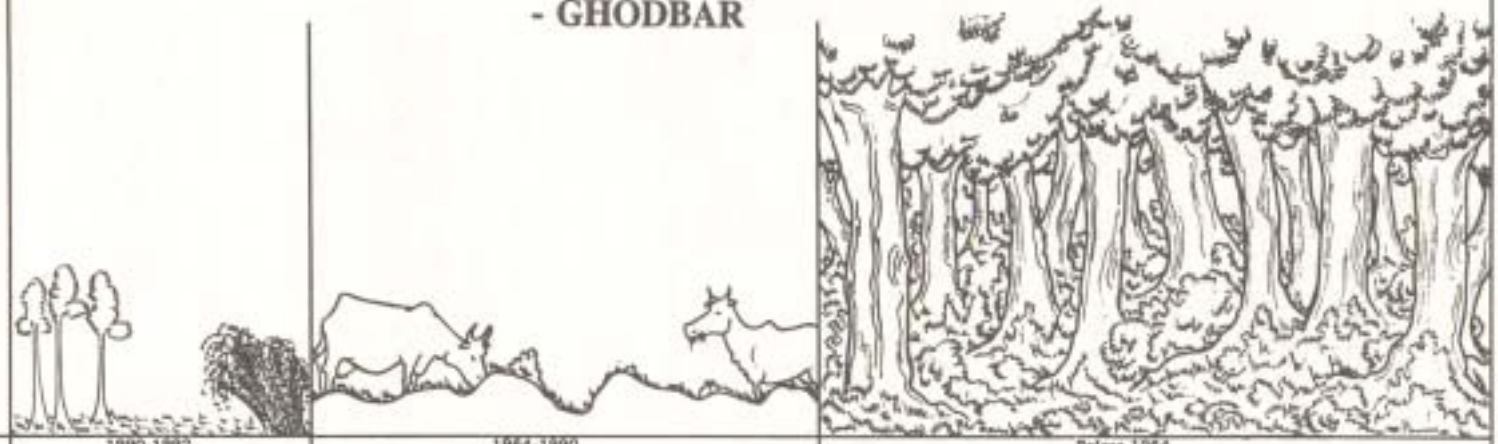
Forest Management History

The forests of Ghodbar have become badly degraded over the last twenty-five years. Several elderly women recounted how on marrying into the village many years ago, they lived amid a dense forest of big trees and a variety of animals and plants. They noted many changes since then, and groups of both men and women in Ghodbar provided rich information about the area's forest management history (see Figure 9). Before independence, the forests of Ghodbar fell under the jurisdiction of Maharajah Gaekwad of Baroda. The villagers did not protect the forests as there was a guard appointed by the Maharajah. However, the villagers were forced into voluntary labor for forest work, such as path clearance and soil preparation. Selective felling of poor quality or dead trees was undertaken and the village forest guard would beat a drum to call the villagers to assist if a fire broke out. In return they were allowed to graze animals within the forest for a charge of four annas (Rs.0.25) per animal annually. Headloading of dry twigs was also permitted. Timber contractors were given contracts for harvesting in selected areas, and villagers would have to procure their timber from the contractors. However, trees from village and farmlands supplied most of the villagers' timber needs, although permission was required to fell these trees as well. Timru leaf rights were given to contractors, whereas villagers had rights to mahua and other products.

After independence selective felling continued until 1965. From 1967 the *van kal viroha kutta sahakari mandals*, Forest Labor Cooperative Societies, were formed. By agreement, net revenue from timber was shared, with the societies receiving 20 percent. This felling and sharing arrangement continued coupe by coupe according to the Working Plans, marking the period of maximum forest destruction. All the teak stock was cut to the stump and cleared to make space for eucalyptus, the first plantation of which was established in 1975. Clear-felled in 1981, this began a pattern of eucalyptus plantations establishment and felling on a 6-7 year cycle. From this time on, local people also cut heavily in the degraded plantations for fuelwood. While people were not allowed to graze their animals in plantation areas, open grazing was permitted in the remaining standing forest where protection was the sole responsibility of the

Figure 9

COMMUNITY PERCEPTIONS OF FOREST MANAGEMENT HISTORY - GHODBAR



	1990-1992	1964-1990	Before 1964
USEFUL FOREST SPECIES	Grasses Fuelwood Fruits, flowers, leaves (8 species) Gum	Useful wood (2 species) Fuelwood (7 species) Livestock Fodder * Bullocks/cows (3 species) * Goats (4 species) * Buffaloes (2 species) Fruits (4 species) Medicinal (5 species) Religious (2 species) Tubers (6 species)	Useful wood * For plough making (3 species) * For carts (1 species) * For construction (4 species) Fuelwood (11 species) Fruits (17 species) Medicinal (7 species) Religious (2 species) Useful leaves (5 species) Marketable fruits (5 species) Other products (3 species) Livestock Fodder * Bullocks/cows (5 species) * Goats (6 species) * Buffaloes (6 species)
MANAGEMENT HISTORY	PROTECTION — BY PEOPLE BY ROTATION IN GROUPS THROUGH A MANAGEMENT COMMITTEE WHERE EVERY HOUSE IS HAS REPRESENTATION MANAGEMENT RIGHTS — COLLECTION OF GRASS FROM PROTECTED AREAS; GRAZING IN NON-PROTECTION AREAS; COLLECTION OF FUELWOOD FROM UN-PROTECTED AREAS AND TIMBER FROM PROTECTED AREAS; COLLECTION OF WFP POWERS IN CONNECTION — TO FINE UPTO RS. 101/- FOR ILLICIT REMOVAL OF TREES AND BRANCH AND NEGLIGENCE IN LAST THREE YEARS RELATIONSHIP WITH FOREST DEPARTMENT — GOOD RELATIONS WITH F.D.	PROTECTION — BY FOREST DEPARTMENT; WATCHMEN FROM VILLAGE EMPLOYED FOR NEW PLANTATIONS; COMMUNITY NOT INVOLVED MANAGEMENT — BY FOREST DEPARTMENT RIGHTS — GRAZING IN UNPROTECTED AREAS; GRASSES FROM PROTECTED AREAS AUCTIONED. VILLAGE PEOPLE HAS TO PURCHASE FROM AUCTIONS; RIGHT TO COLLECT WFP/FUELWOOD POWERS — TO EMPOWERED TO FUNISH RELATIONSHIP WITH FOREST DEPARTMENT — RELATIONSHIP NOT GOOD; FIRE AND THEFT USED TO TAKE PLACE BUT COMMUNITY WAS NOT HELPING IN PREVENTION; A MAJOR CONFLICT WITH F.D. TOOK PLACE 10-12 YEARS BACK	PROTECTION — BY FOREST DEPARTMENT. COMMUNITY NOT INVOLVED MANAGEMENT — BY F.D. SELECTION FELLING WAS THE MAIN ASPECT OF FOREST MANAGEMENT. THIS CHANGED TO CLEAR FELLING 1965. DESTROYING FORESTS RIGHTS — TO COLLECT FUELWOOD; BAMBOOS WERE SOLD @ RS. 1/- PER 100 PIECES; TIMBER COULD BE PURCHASED FROM THE CONTRACTORS POWERS — TO EXTRACT FORCED LABOUR FROM COMMUNITY FOR FORESTRY WORK; GRAZING TAX @ 4 ANNAS/CATTLE. GRAZING TAX WAS WITHDRAWN AFTER INDEPENDENCE RELATIONSHIP WITH FOREST DEPARTMENT — RELATIONSHIP WAS GOOD AND MUTUAL AT THE TIME OF FIRE, DRUMS WERE BEATEN TO ASSEMBLE PEOPLE TO FIGHT FIRE

forest guards. Foresters in uniform were considered "the enemy" of the village. If there was a fire, there was no community interest in lending a hand. In 1982 a major conflict arose in the area when two tribals were chased by the forest guard and drowned while trying to escape via the lake. As a result of this incident, a great deal of resentment was generated.

Over the last ten years, however, there have been little conflicts because the forest has no valuable timber left. In 1989, at the suggestion of the Forest Department, a Forest Protection Committee (FPC) was formed, and the first patch was taken up for plantation and community protection. Since then two more patches have been planted each year. As part of the regeneration strategy, the plantation quota of 2000 trees per hectare (consisting of 21 indigenous species) has been used to fill extensive gaps between coppicing stools. The quota allocated for 28 hectares in 1989 was stretched to cover 42 hectares because of the relatively good stocking levels of existing trees. The area, with a relatively high site quality index, is naturally regenerating over 20 species of trees.

Currently the management of the protected patches involves a range of activities. The FPCs protect the forest from fire, cattle grazing, and illegal cutting. Every household of the village is a member of the committee. An executive committee of 15 men makes most of the routine decisions, while actual forest protection is undertaken by rotating groups of four men in twelve-hour shifts. The two larger sites, located further away from the village, are patrolled by three people, and the closer site by the remaining volunteer. One male from each household takes his turn on a protection shift. Patrolling is organized by the hamlets so that every household in one falia completes a turn before involving men from the next falia. Given 392 household, each male member has approximately 5 shifts per year. Committee members periodically monitor the patrolling.

In exchange for protection, the villagers have rights to dry fuelwood, fodder grasses, and other NTFP including mahua, timru, asitra leaf. In addition, all fuelwood produced through initial cleaning and other cultural operations, like singling and multiple-shoot cutting, is given free to the village. Cattle grazing is not allowed in the protected forests until the regenerating and planted trees reach a certain size, after about five years of protection. Cutting of trees in the protected patch is strictly forbidden, including free cutting of bamboo. Instead, harvested bamboo is made available at a subsidized rate of 60 paise per pole, with an upper limit set of 25 bamboos annually per household.

The committee has certain "powers" to detain anyone caught breaking the rules and may impose fines according to the nature of the offense. In the case of illegal tree cutting the fine depends upon the size and species of tree cut. The fine for a large tree is Rs. 151. The tree is then confiscated and handed over to the department. Offenders from a neighboring village are detained until the fine is collected. So far fines for illegal timber cutting have not been levied, and there have been no recent incidents of tree-cutting. If animals are found grazing in the protected forest, they are impounded and fines between Rs.5-15 are levied according to the type of animal. Interactions with neighboring villages are smooth at present. Three of the four neighboring villages (Deoghar, Luarvar, and Bhaleji) have their own FPCs and have not

bothered Ghodbar's protected forest. However, a few hundred rupees have been collected from cattle graziers, mostly from adjoining villages in the first year of protection.

The major sources of shared usufructs are fodder and fuelwood from silvicultural operations, and to a lesser extent non-timber forest products. The only sections of the regenerating forest currently available to the village are the one and three-year-old patches to the northeast and southeast. This means that area residents all depend on the same area for cut and carry fodder and fuelwood. Small fuelwood is gathered from the degraded forest lands, and free grazing of cattle takes place. Grass harvests are undertaken once a year, at a date mutually agreed upon just before or after the Diwali festival. The harvesting is done by a male or female representative of each household for up to fifteen days or until all the fodder is cut, whichever comes first. The grasses are bundled into **pudas** and distributed equally among all the village households. If any household fails to participate in the fodder cutting, it will be excluded from the distribution. In 1991 each household received 350 **pudas**. As noted, fuelwood is available from initial clearing or cleaning operations, in which all coppicing species are cut back to the stump, and from singling operations, in which deformed and less vigorous sprouts are removed to favor one or two major stems. In both of these operations villagers voluntarily contribute their labor. Again, one member from each household participates, and the bundled **baadas** of fuelwood are distributed equally among all households. Experience with the singling operations on the three-year protected plot in 1991 took two days and yielded 5 headloads per household. Fuelwood volumes resulting from initial cleaning operations can be much larger as shown by the cleaning operation on the one-year protected plot which yielded 1 cartload (15 headloads) per family.

Non-timber forest products are collected by individual households, and either consumed directly, marketed to one of the two collection agents in the village, or sold directly at the Jhankhivau market. As the protected forests mature, an intermediate thinning of teak poles will take place; bamboos will be ready for selective harvesting within several years; a number of fruit, gum, and useful leaf-producing trees will become more productive, and eventually a rotational harvest of the teak trees will occur. The exact details of management pertaining to these important events are not yet well understood by the village FPC; although they understand that they are to be given a 25 percent share of timber, they have no real idea of when and how this will take place. They currently receive a limited number of bamboos, but it is not yet clear what percentage of bamboos will be theirs in the future, although some individuals mentioned they would be given all bamboos grown in the protected forest patch. The FPC is a forum for a variety of activities and decision-making. The members meet regularly. Meetings include discussions of village problems in addition to forest protection matters. To implement a biogas project with the assistance of the FD, lists are drawn up for allocation of biogas units, with first priority to those who have helped with village forest work. These are distributed equally across the falias.

Forest Products and Collection Patterns

Combining the information provided by men and women during interviewing of the forest history, Figure 9 also illustrates the dramatic changes in forest species diversity over different time. The women listed a larger number of species for each time period and used a very detailed typology for forest products, especially those providing fuelwood, fodder for cattle, goats, buffaloes, fruits, and medicinals. In the regenerating forest, male community members demonstrated an intimate familiarity with over 50 tree species. Currently only eleven species are in sufficient quantity and size, down from fifty-seven species in the pre-1964 period. Figure 10 graphically illustrates the change in forest species diversity according to usage. However, over fifty useful species are present in the forest under the JFM program. This suggests that the potential to increase the number of available and useful products is considerable. Despite the restricted utility of the protected forest at present, people's perceptions of the current management system are very positive, in contrast to prior systems. While current diversity of species in the forest is recovering, product availability is at its lowest because most of the planted and regenerating species have not yet matured for harvest. It is clear, however, that the range and quantity of future product flows will increase substantially. An appropriate understanding of people's needs and choices will help in determining the required silvicultural practices to maximize the availability of desired products when they are needed.

FPC members in Ghodbar have a sophisticated appreciation for the many benefits and services the forest provides. In descending importance they cited: peace, clean environment, protection of the water table, nests for birds, manure/fertilizer for farms, fuel, timber and income opportunities. The executive committee also scored forest products according to income generation and their home-consumption value (see Figure 11). Amongst the species providing cash income, the most important to the community members is mahua (Bassia latifolia) with a score of 12 for the flowers and 7 for the seeds, for an aggregate of 19. This is followed by timru (Diospyros melanoxylon) and grasses, asitra (Bauhinia racemosa), khakar (Butea monosperma), bili leaves, and khakar flowers. For household use, fuelwood ranked highest with a score of 17, followed by fodder grass and mahua. The collection and processing of forest products in Ghodbar occurs throughout the year. Fuelwood is collected from degraded forests, common land and field margins from September to June. Fuelwood collection tapers off during the monsoon months during which time people depend on their personal stockpiles. The major collection of fuelwood from protected forest patches takes place during silvicultural operations such as initial stool cleaning, singling and intermediate thinnings. These are usually undertaken on a date determined collectively, typically in January or February of the relevant year, depending on the age of the protected patch. Livestock graze freely in the degraded forest lands throughout the year, but are stall-fed at night with a combination of agricultural residues and fodder grasses collected from the protected forest during an annual cutting in October-November. Flowers and fruits are available throughout the spring and summer months, the major fruits in sequence of availability including: timru (Diospyros melanoxylon), bel (Aegle marmelos), mahua (Bassia latifolia), umb (Miliusa tomentosa), and al (Mirinda tomentosa).

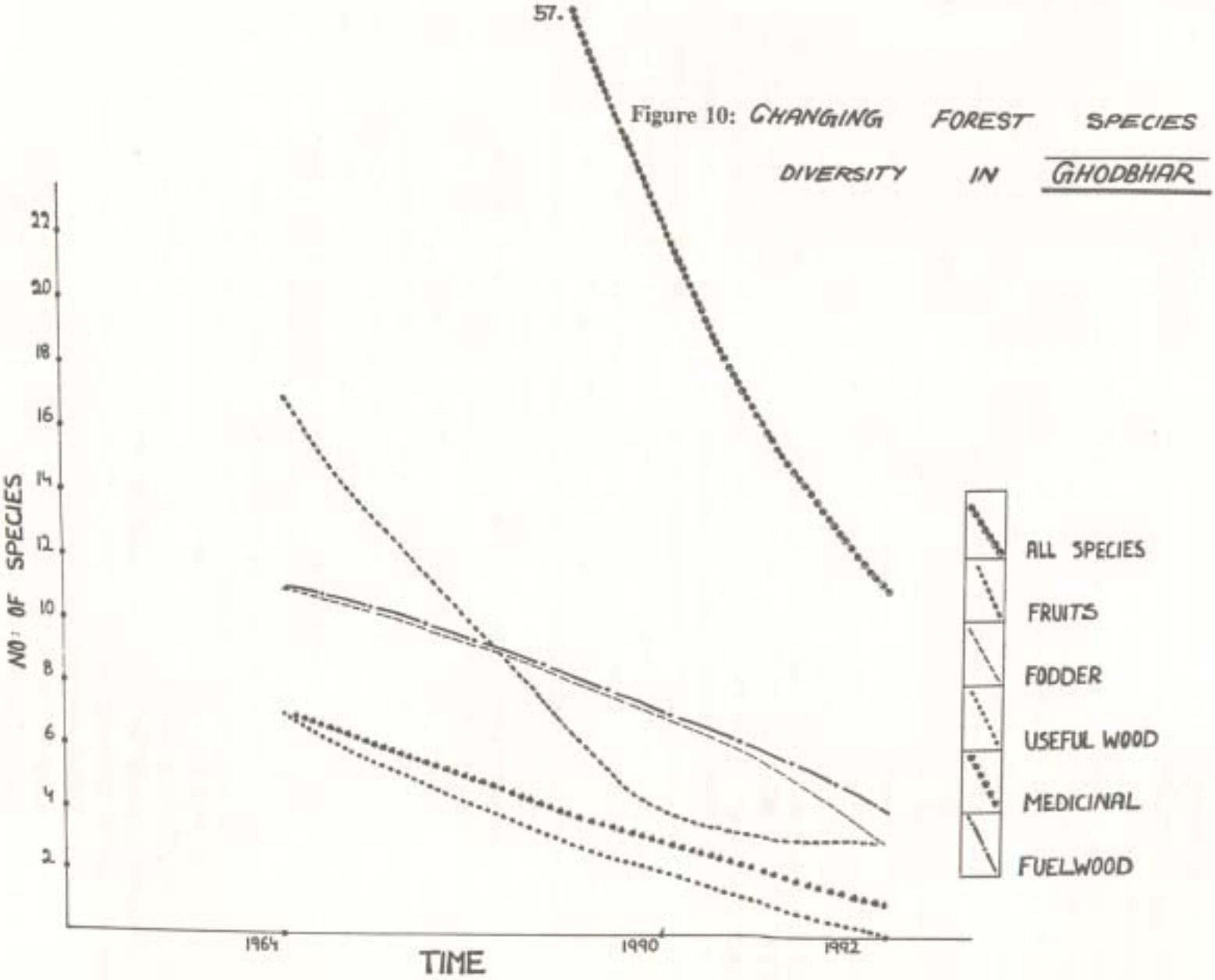
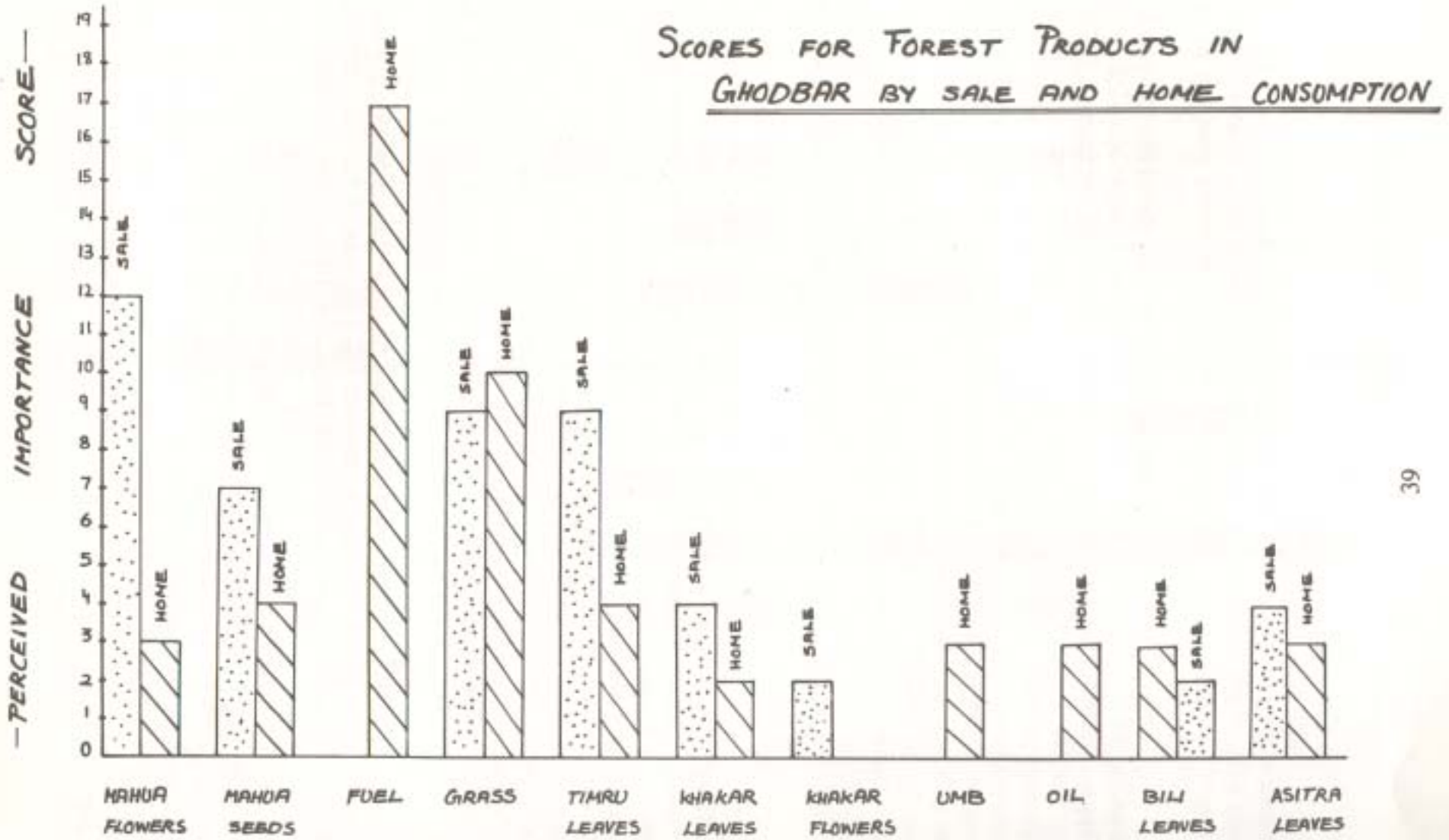


Figure 10: CHANGING FOREST SPECIES DIVERSITY IN GHODBHAR

Figure 11:


SCORES FOR FOREST PRODUCTS IN
GHODBAR BY SALE AND HOME CONSOMPTION
—PERCEIVED IMPORTANCE SCORE—
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
SALE
HOME
MAHUA FLOWERS
MAHUA SEEDS
FUEL
GRASS
TIMRU LEAVES
KHAKAR LEAVES
KHAKAR FLOWERS
UMB
OIL
BILI LEAVES
ASITRA LEAVES

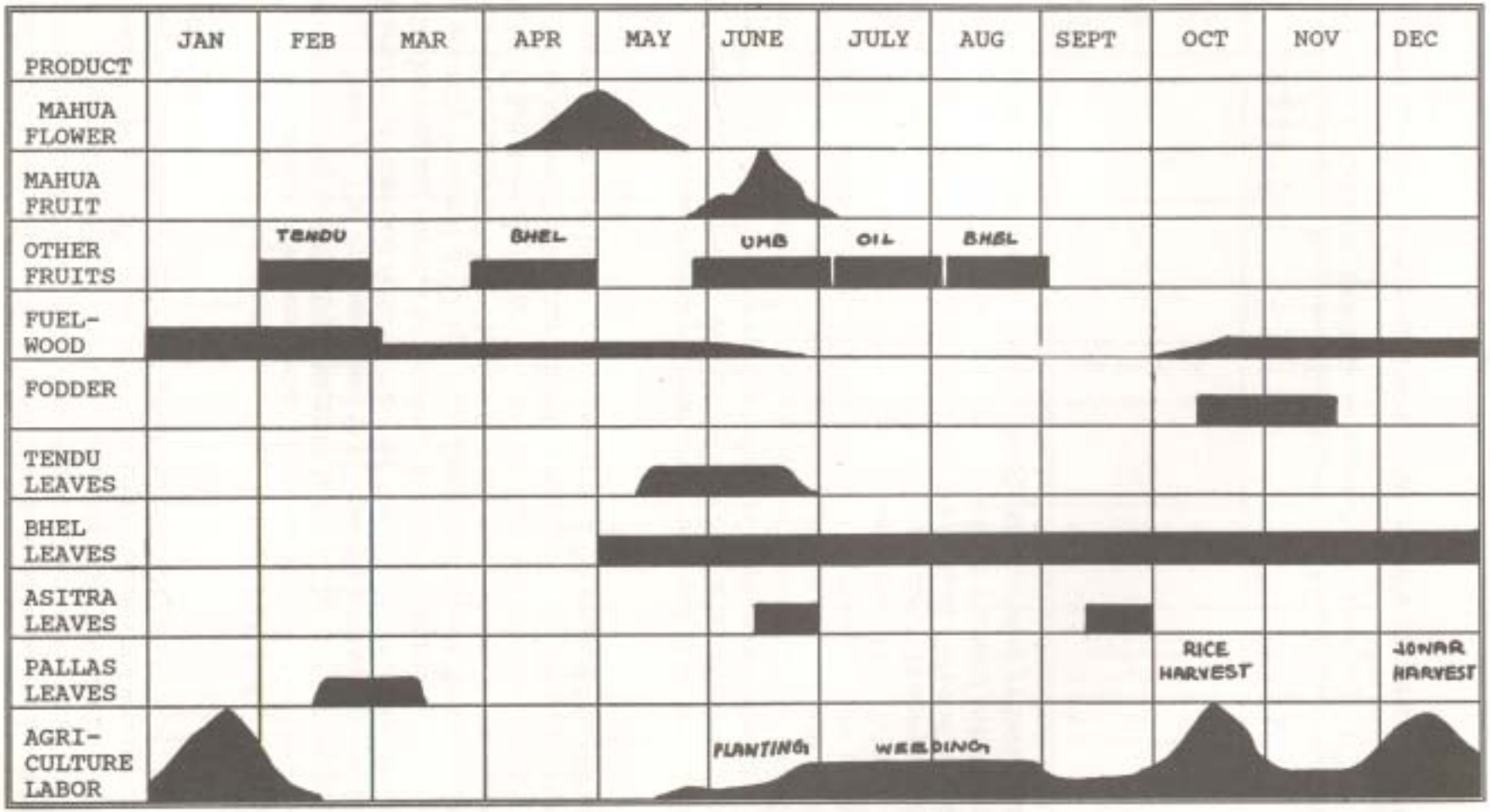
(Seasonal calendars show slightly different collection patterns for women, landholding men and landless men.) The seasonal calendar for landed men is given in Figure 12. Peak periods of collection and agricultural activity are indicated by curve elevation. Because of the importance of agricultural work for landed men, there are several periods where peak farm activity occurs at the same time as forest based activities. Fodder collection in October-November and the peak period of fuelwood collection in January and February, which involves harvesting these products from the protected forest by at least one member from each village household, conflict with periods of intense agricultural harvesting. Landed men report that they must schedule forest activities carefully during this hectic time period. Mahua, tendu leaves and bel fruit collection takes place in the early summer months when labor demands are lower. Fuelwood is gathered throughout the year, with the exception of the monsoon months, but this is mostly done by women and does not represent a major component of landed men's time schedule.

In comparison, the seasonal calendar constructed by the landless of Ghodbar shows the major benefits derived from the forests include fuelwood, grasses, a very small quantity of NTFPs (seasonal), and wage opportunities provided by bili leaf collection. Some of the NTFPs become available at a time when demand for labor within and outside the village is high, making the opportunity cost of the collection of NTFPs substantially greater compared to wage labor. The current limited availability and uncertain marketing of NTFPs also contribute to the high opportunity cost. However, the landless people do meet most of their fuelwood requirements from forest land (protected and unprotected), not having access to supplemental agricultural residues. Fuelwood is collected even in the busy labor season, mainly by women in the early morning hours. The landless do benefit from the equal distribution of grass and they sometimes sell their share to cattle owners. The main benefits from the forest for the landless are goods for subsistence survival and not for sale.

Timru or pan tendu (Diospyros melanoxylon) leaves are plucked from mid-May to mid-June, mainly by women who leave at 5 in the morning and spend about 8 hours collecting. They spend another 4 hours processing and packaging the leaves into **pudas**, bundles of 50 leaves each which are sold to the agent for Rs. 0.25. Khakra (Butea monosperma) flowers were occasionally collected and sold for use as a dye in the past, and their leaves are still sewn into plates for village functions. The wood is valued for fuel, and khakra is one of the few residual trees left in degraded forest patches, attesting to its hardiness, ability to regenerate, and value to the community. Asitra pan leaves (Bauhinia racemosa) are occasionally collected from mid- to end-June and mid- to end-September, dried, bundled, and sold for bidi wrappers. Bili (Oogenia eugenensis) leaves are collected almost year round, except during the months of May, June and July. Most people collect a few leaves for worshipping Lord Shiva. One entrepreneur in the village purchases bili leaves from collectors for sale at Surat market.

Due to the degraded nature of the forest, the overall sale of NTFPs from Ghodbar's forest is currently limited to tendu leaves, bili leaves, mahua, asitra leaves, and puwadia seeds (collected primarily from field margins). In studying the total flow of economically important

FIGURE 12: SEASONAL CALENDAR FOR FOREST PRODUCT COLLECTION AND AGRICULTURAL ACTIVITIES, GHODBAR VILLAGE



products from the forest to the village, it is clear that fuelwood and fodder must also be included. The results of volume flow calculations and estimated incomes are presented in Figure 13. While a select number of NTFPs are currently available from the Ghodbar forest, in the division a much wider range of products are sold. The GFD monitors and sets purchase prices for sixty-five different commodities, including: gums, pulp, seeds, grass, bark, lac, flowers, pods, leaves, fruits, and resins.

Fuelwood is the most valuable product obtained from the forest by Ghodbar villagers. Much of this resource currently comes from unprotected, degraded forests in the area and private farmlands. However, thinning and singling operations in the 42 hectares of protected forests also contributed significantly. The team attempted to estimate the total village consumption of fuelwood and the amount of fuelwood extracted from the forest by using information from men and women from landowning and landless households. The analysis found landowning families with 8 members annually collected 1013 kg. from forest and private lands, while landless families collected approximately 675 kgs. In part this difference represents the larger size of the landowning families and their use of carts to carry the fuelwood from the forests.[1] The total fuelwood utilized during the year by Ghodbar families is estimated to be 334 tons for landowners and 51 tons by landless, for a total of 384 tons. Out of this, the protected forests provide 44 tons.

While other patches of protected forest in the area will also need to be thinned in the next few years, in the longer term fuelwood availability may decline as thinning becomes less frequent, especially if insufficient fast-growing, fuel appropriate species are planted or naturally regenerate. Currently, the two main silvicultural activities of stool cleaning and multiple shoot cutting or singling take place in year one and year three in protected forests. With a limited area (37 hectares) available for future protection and enrichment plantation, yields of fodder and fuelwood from these operations will inevitably decline (see Figure 14). Whether eventual thinning and harvesting operations will compensate for this is not clear. In comparison to other forest products, fuelwood is the most valuable. In 1991, the value of fuelwood harvested from the 44 ha. protected area was Rs.385,000 representing 66% of the total value of all forest products. Timru leaves were second with a value of Rs.95,000, followed by fodder Rs.68,600, bili leaves Rs.23,220, asitra leaves at Rs. 6,000, and mahua flowers and seeds at Rs.5,560 (see Figure 15).

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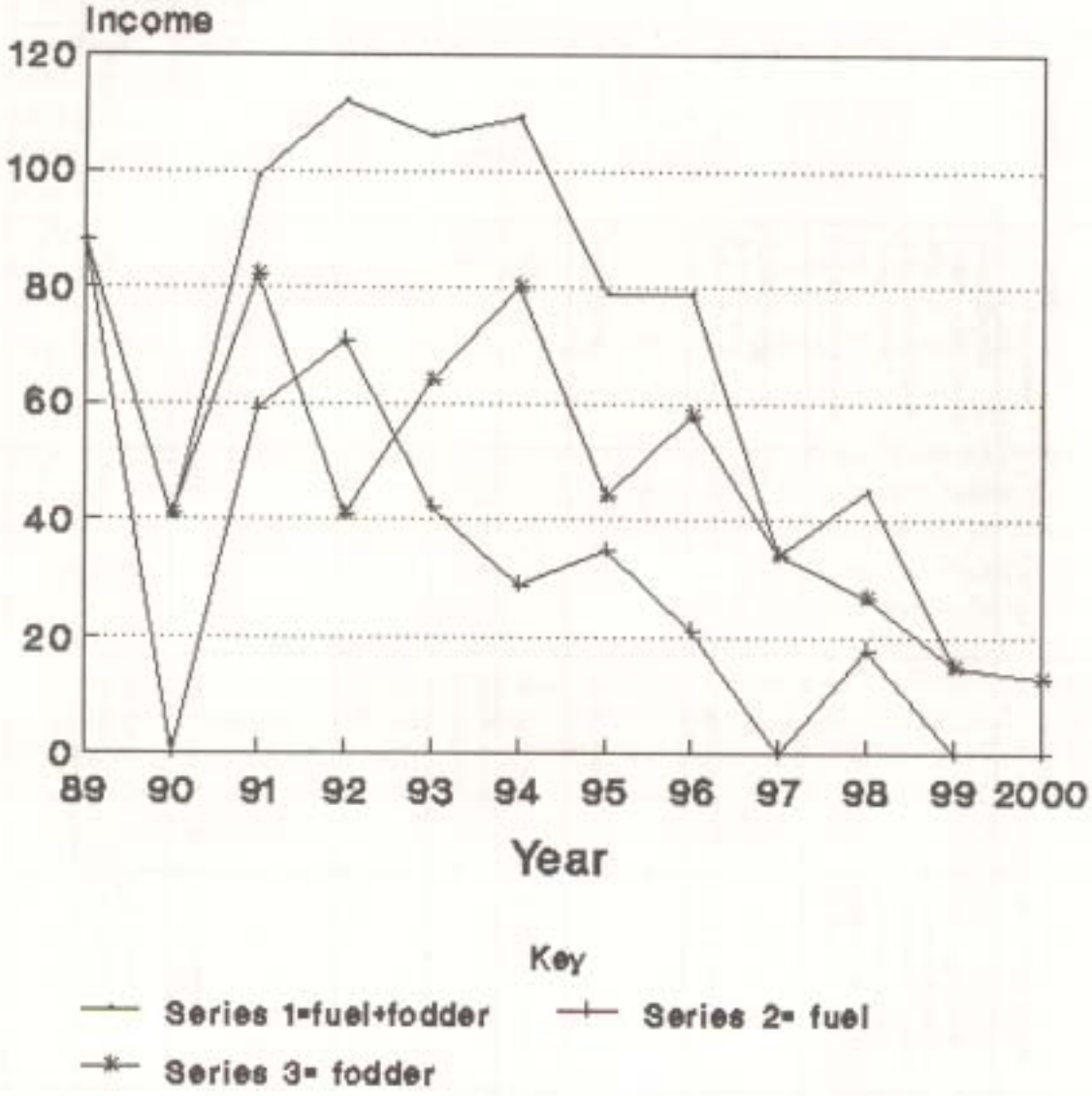
[1] The total volume of fuelwood: (1) For a landowning family which has 8 members and requires 4 cart loads of wood/year. 1 cart load has 15 head loads. Each head load weighs 15 Kgs. 1 cart load : 15 X 15 = 225 Kg dry weight. 225 X 4.5 = 1012.5 kg. X 330 landowning families =**334 tons.** (2) Landless families need to collect fuelwood for 45 days at 2-3 headloads/day. This means 45 X 2.5 (headloads) X 15 kg/headload) or 675 kg per family X 25 families = **51 tons.**

Figure 13: Volume Flows and Estimated Income from Forest Products in Ghodbar

	Fuel	Fodder	Mahua Flowers	Mahua Fruit	Timru Leaves	Aaitra Leaves	Bili Leaves
Importance Score	17	19	13	11	9	6	2
Collection Period	Oct-May (peak season Jan-Mar for male)	Oct-Nov	Apr-May	May-Jun	Apr-May May-Jun	Apr 15 days Sep 15 days	May-Jan
No. of Collectors	392 families	392	200 households 1-2 per household including 15 landless collectors	200?	240	15-20 (Women)	One collects and engages 20 workers in Sahan and 3-5 lab/day for rest of the season
No. of trips	From plantation - 5 days during Jan and Feb	15	8-30	15-20	15-20	30	115
Hours per trip	From plantation - 9 to 10 hours	9	3-4	3-4 (Collection) 0.5-2 (processing)	8 hrs collection 4 hrs processing		8 hrs per day
Amount per trip	10-20	20-25	1-6 kgs	2-3 kgs	100-150 pudas	25-50 phuli per day	12-15 judi/day
Total collected	385 tons/yr 334 tons consumed landowners 51 tons landless	350 pudas* /household 132,000/village	min 1530 kgs	5000-6000 kgs (25-30 kgs/tree X 200 trees)	478,400 pudas		11610 judis
Price per unit	Rs. 1/kg	Rs. 0.5-1.00 in village Rs. 0.75-1.50 (outside village)	Nigam (procurement) price-Rs. 2/- Market price-Rs. 4.50	Nigam - Rs. 5.00 Open market price - Rs. 6.00	Rs. 20 per 100 pudas	Rs. 1.50/kg	Rs. 2/judi
Comments	1. No collections during monsoons 2. Landless consumed more fuelwood than from biomass	Grass is sold only in village 30 households sell some fodder	60-145 trees on private land 30-40 in forest 30-35 trees on pasture land. Collection area extends beyond the area		Good	Only women are collecting the leaves. Estimated income is exaggerated. It seems that the collectors are only landless labour	Only one person does the business and pays Rs. 13900/- towards wages
Estimated income	Max fuelwood value 385,000 at market value	Fodder value = 68,600/village	Min potential income Rs. 3060/village	Rs. 2500 @ Rs. 5/kg	95680.00 Rs. 398/collector Rs. 700/family 2 persons/family	Max possible income Rs. 6000/-	23220.00

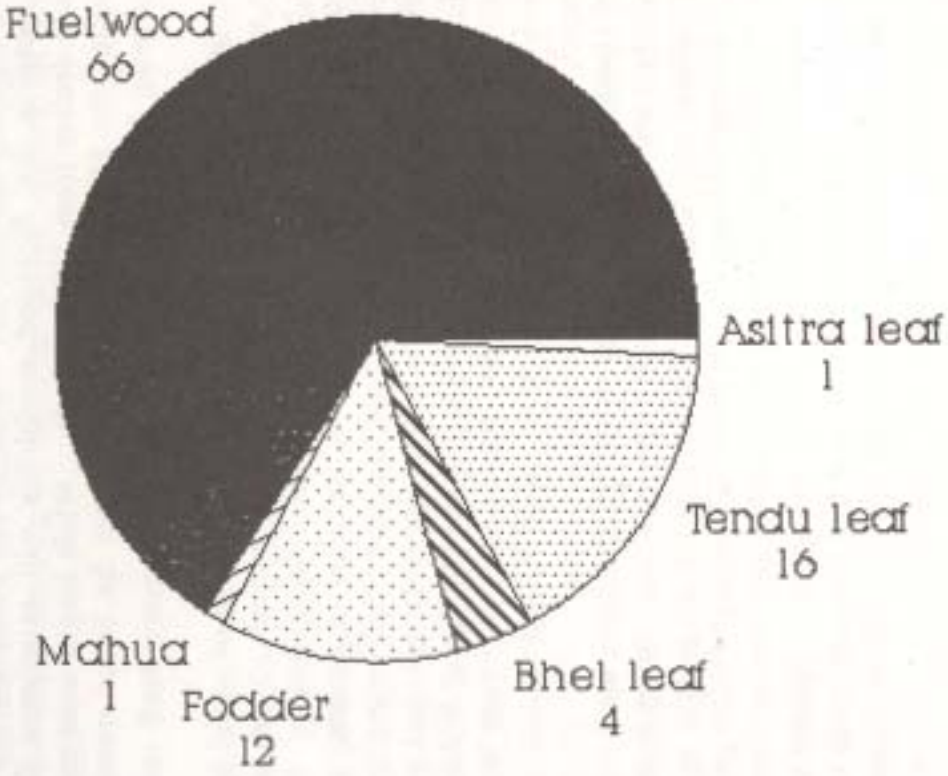
* 1 Dry puda - 400 gms

Figure 14: **Fuel and Fodder Trends**
Under Current Silvicultural Management
Ghodbar



in '000s Rs.,

Figure 15: Value of Forest Products
By Percent Income, Ghodbar



Percent of income from protected forest

Summary

A number of issues with important management implications emerged during the course of the Ghodbar PRA. The high level of demand for fuelwood and fodder, and the limited ability of the protected forests to meet these needs as currently managed deserves attention. Protection of large portions of the neighboring forest land has already reduced the regular availability of fuelwood and landless families complain that they are forced to rely increasingly on the small degraded patches, even digging up stumps, further reducing the regenerative capacity of these lands in the process. As more areas are protected, less open access fuelwood collection sources will be available. This implies that communities will only have access to fuelwood during the thinning and singling operations, which will reduce in frequency as the forest matures under the current management system. When more land is brought under protection and thinning opportunities decline, it is possible that fuelwood availability will experience fluctuating production and begin a definite decline from 1996 onwards. While biogas units may reduce some of the fuelwood pressure, the 107 ha. of forest land may be better managed with enrichment planting of fast-growing fuelwood species.

While the fuelwood projections are not encouraging, over 50 species of useful leaf, fruit, gum, and seed-bearing plants will begin producing within the next ten years. More attention is needed to understand how to best manage these mixed natural and artificial forests. Fruit trees need more light and a lower stem density than trees grown for poles or timber. Improved varieties of mahua, ziziphus and other fruiting species now exist and could be incorporated in the species mix. A variety of rotation lengths could be tested to provide fuelwood and fodder on a more regular basis from certain stands within the area. Cluster planting of timber, or fast-growing fuelwood trees surrounded by bamboo, fruit and economically important leaf-bearing trees like tendu or asitra would also provide for both timber and NTFP needs.

In Ghodbar and neighboring communities involved in the FPC program, there is an urgent need to maximize fodder production and NTFPs from the protected forest. Given more detailed information on various silvicultural options, it would be possible to project commodity requirements and the ability of different systems to meet them. The village FPC is proud of its forests and feel they are worth protecting, although the potential for income from NTFPs remains unfulfilled and only imperfectly measured. Future management options should be jointly discussed and designed by the FD and the FPC to ensure that resource needs are met in an equitable manner and that the ecosystem can be sustainably and productively managed.

LARGE NATURAL FORESTS UNDER PRESSURE: LIMBI VILLAGE

Limbi Forest Round in Vyara Forest Division, south Gujarat, was selected for field method trials because it represents a large natural forest under growing local pressures. The GFD has made somewhat slower progress encouraging communities to form FPCs in such areas. This case study describes forest use dependencies and practices among tribal communities surrounding the forest. Due to their particular socioeconomic or ecological importance, the case highlights more specific studies of mahua collection, fuelwood headloading, and the Forest Labor Cooperative Society (FLCS). The PRA information collected in Limbi raises critical management questions concerning the productivity, sustainability, stability, and equity of current forest use patterns. The exercise provides a basis for further diagnostic research for micro-planning in order to derive options for improved collaborative forest management.

Community Background

Limbi Gram Panchayat is located on the northern bank of the Tapti River, approximately 14 kilometers from Songardh and just a few kilometers downstream from Ukai dam and reservoir. The panchayat is comprised of 4 major hamlets, including Dhamni (500 pop.), Chaudhari (400 pop.), Moti Pipal (600 pop.), and Nani Pipal (550 pop.) and the communities are composed of Vasava, Gamit, Chaudhari and Bhil tribals. The panchayat abuts the southern border of Limbi Reserve Forest Round, a substantial 8000-hectare tract of mixed, dry deciduous forest. The villagers have historically considered the entire forest area surrounded Anjana River to the north their own to utilize for a range of timber and non-timber products. The usufruct rights for certain species such as mahua (Bassia latifolia) are held by specific families, predominantly earlier settlers in the area and landowners. Approximately 50 percent of the households in the panchayat currently own some rain-fed farmland, although only 3 percent of the land is irrigated. Landless families are dependent on agricultural labor, seasonal migration for work on sugar estates, construction labor, fishing, and forest-related activities in the formal timber sector, non-timber forest product collection, and commercial fuelwood headloading.

Land Use History

According to older members of Limbi village, including the eldest male (whose grandfather was the first settler), in the 1870s ten Vasava families cleared a small forest area and established the first hamlet, Dhamni, adjacent to the Tapti river. Over the next hundred years, other tribal families, often related to the original Vasava settlers, migrated into the area. In the 1950s, both Chaudharis and Gamits settled with the Vasavas. Meanwhile, there was a trend for extended family units to break into nuclear families, establishing new hamlets and households. The Limbi Forest Labor Cooperative Society was established in 1956 in order to provide organized tribal labor to assist the Forest Department in harvesting forest products, mainly timber. Substantial quantities of timber were extracted over the next thirty years, especially between 1975 and 1986 when widespread clear-felling was practiced.

When the Ukai dam construction was completed in 1971, over 640 square kilometers (64,178 ha) were inundated, including 22,258 ha of forestland and substantial tracts (30,352 ha) of productive farmland. The submergence resulted in major social and ecological disruptions, dislocating 170 villages. Thousands of ousted families resettled in the area, some in small satellite hamlets such as Nani Pipal and others in newly established hamlets like Moti Pipal. Many of the dislocated families who had formerly owned 5 to 10 bighas of agricultural land through joint family holdings found themselves without land because only the head of the household was eligible for compensatory land. Families also lost access to their traditional forest lands and mahua trees. While the government provided some employment to male household heads at Ukai dam and through the FLCSs, resettlement particularly affected women, who were displaced from their traditional agricultural work and offered no alternative source of livelihood.

Hence, the 1970s and early 1980s witnessed the combination of large-scale loss of agricultural and forest lands, the initiation by the Forest Department of clear-felling for commercial timber demands, an increased incidence of illegal felling, and growing subsistence pressures on the surrounding forests by more concentrated human and livestock populations. In response to a rapidly declining forest resource, in 1986 the GFD placed a ban on all logging. The ban reduced employment opportunities for members of the FLCS, creating tensions between forest laborers and the department and further reducing the economic security of the tribals.

In an attempt to control illegal felling and fuelwood headloading, the GFD facilitated the organization of Limbi's FPC in 1989. The goal of the committee is to further minimize uncontrolled extraction and provide an opportunity to increase community participation in managing the Limbi forest in partnership with the department. In order to help provide employment to displaced tribal members of the FLCS, a program for the removal of dead, dried, and diseased trees was also initiated under the supervision of the FD. Historically prone to periodic drought, the region experienced below average rainfall once again in 1991. This condition has further resulted in the depletion of the water table, drying of forest streams, and greater pressures on the forest.

Forest Products and Collection Patterns

Two focus group interviews, one with men and one with women, revealed that both sexes had an extensive knowledge of the forest flora, with the men listing 123 and the women 130 different flora. A composite list is provided in Appendix 3. Groups stratified by gender from Dhamni falia were also asked to rank the species in order of their importance in fifteen different use categories which they selected. As an illustration of their rankings, both men and women ranked kado (Wrightia tinctoria) as their first preference for fuelwood, a common deciduous tree, preferred due to its light weight, widespread availability, and ease in cutting. Teak was also ranked first by both men and women for household construction needs due to its durability and availability in the area. One of the differences that emerged was that women did not mention medicinal forest plants, perhaps because in certain villages a designated medicine man does the majority of product collection and treatment preparation. Men appeared more knowledgeable

about medicinals, ranking ragatroyan (Tecomella undulata), the bark of which is used to cure skin diseases, as their first preference. In total, the men cited 24 species of forest plants as sources of medicine. Significantly underscoring the importance of the forest for sustenance, the villagers collectively listed 22 species of plants used for food, generally fruits or flowers, and 17 species of forest animal, bird, or fish.

Many families in Limbi panchayat are engaged in forest-based activities for much of the year. There are, however, a number of peak periods when forests are intensively utilized for specific product collection. The research team was interested in identifying periods when the forest absorbed more labor, generated more income and benefits in cash and kind, and was subject to greater disturbance levels. A group interview was held with a cross-section of the community men, women, and children to generate a seasonal calendar of farm and forest activities (See Figure 16). Agricultural activities begin in July with the onset of the southwest monsoon during which farmers plant tur (Cajanus cajan) and rainfed paddy, later harvested in November. In October, tribals collect teak leaves to use in winnowing and cleaning grains. A second cropping season, with jowar (millet) as the main crop, begins in December and continues until late March. The major fuelwood collection period begins in November as the main cropping season comes to an end, and continues until the onset of the June monsoons. Cattle are more intensively grazed in the forest in January and February, when agricultural residue fodders are depleted.

The peak NTFP season occurs in the summer from April to June. The mahua flowers and beda (Terminalia bellerica) fruits are collected throughout April and sold in local markets. Tendu leaves and karanj oil seeds are harvested between mid-April and mid-May. Households collect mahua seeds during the month of May. Bamboo shoots for making pickles, palash leaves (Butea monosperma) for making leaf plates and cups, and gum collection all occur between April and June. An analysis of the seasonal calendar indicates that forest product collection activities fill in the gap when there is little agricultural work available. Fortunately, the flowering, fruiting, and seeding patterns of many important forest species occur during the dry season, following the winter food crop harvest and preceding the monsoon crop. Unfortunately, due to the lack of employment opportunities, particularly for women of landless families, commercial fuelwood headloading extends for 8 months and often results in overcutting and degradation of the ecosystem's productivity.

To better understand the flow patterns of forest resources, labor, and wages, the researchers attempted a systems flow chart based on information shared by the community and forest staff (See Figure 17). The diagram illustrates the product flow of ten major forest use activities, indicating intermediate processing steps and user or purchasing institutions/groups. All the product flows are driven by communities based in Limbi, with the exception of the Kotwalias, who visit the area to cut bamboo. While identifying illegal activities that engender sources of conflict, the flow chart effectively underscores the diversity of forest product collection, processing and marketing linkages. Members of the community also explained that their activity

Figure 16:

SEASONAL CALENDAR

OF AGRICULTURE AND LIMBI FOREST USE PATTERNS . SOUTH GUJARAT

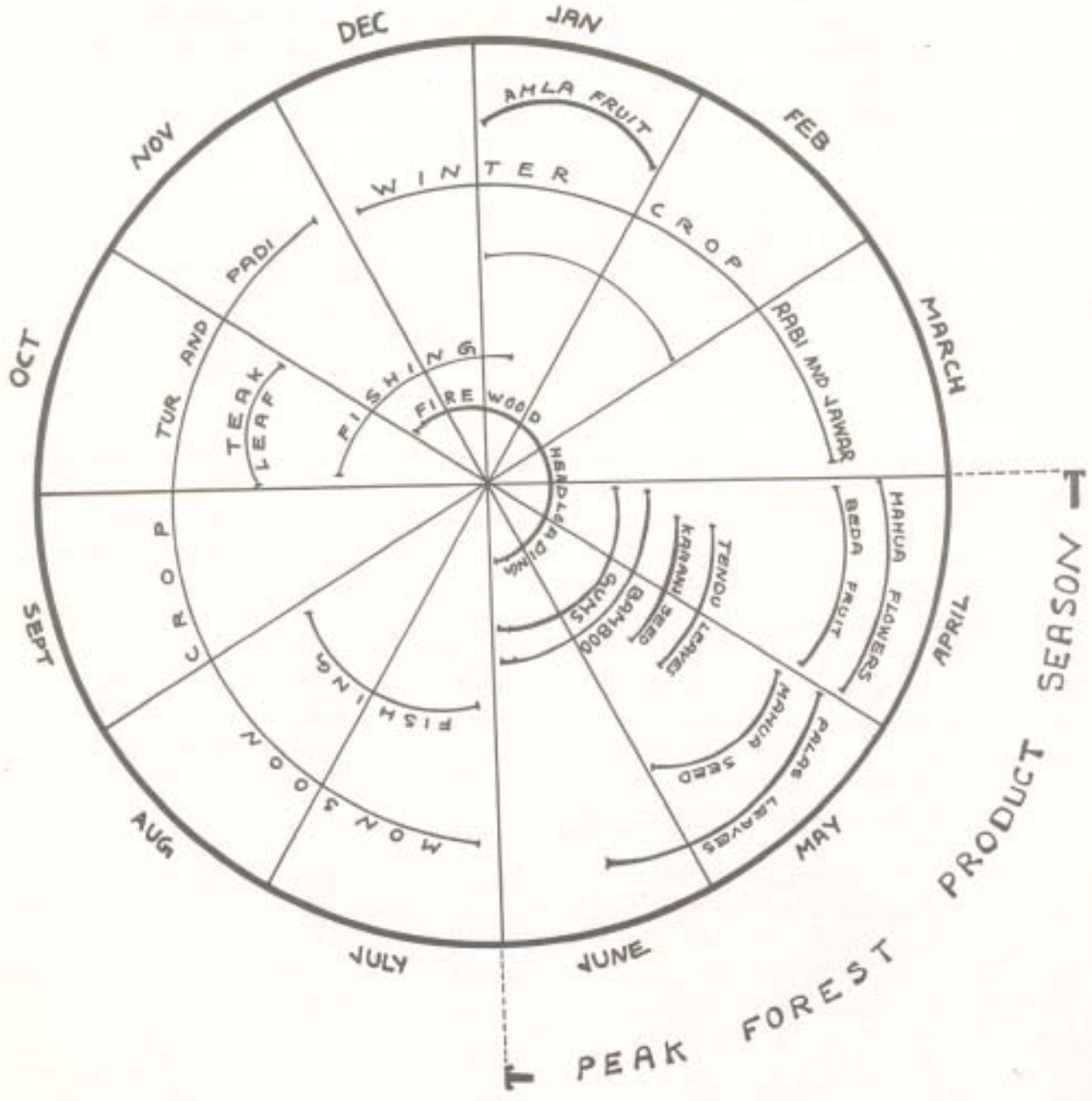
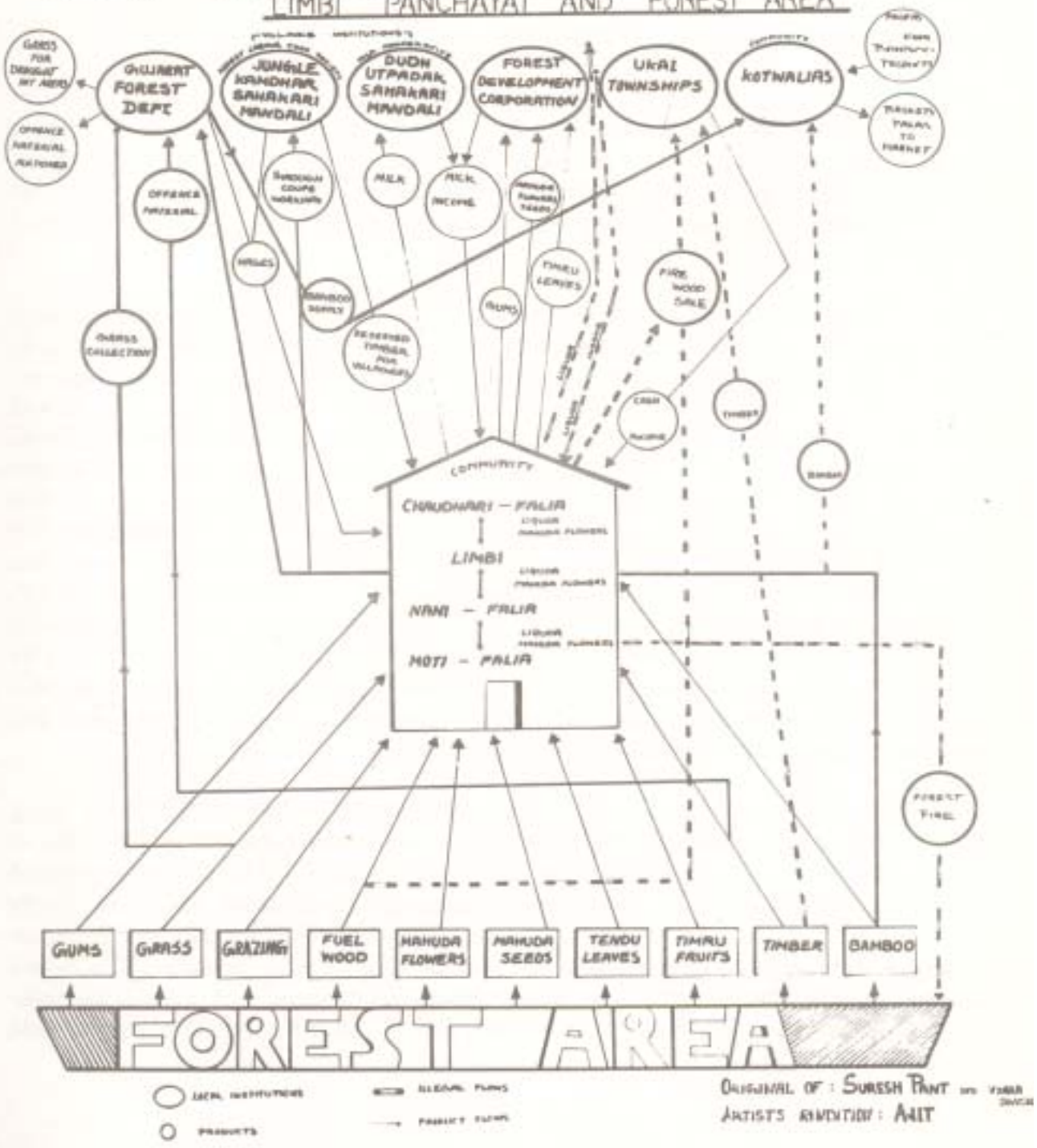


Figure 17: FOREST PRODUCT FLOW CHART
LIMBI PANCHAYAT AND FOREST AREA



range in the forest depends on both the types of products and the season (See Figure 18). Whereas they may travel as far as 15 kilometers into the forest to collect gum, amla, timber and mahua flowers, more typically for mahua and fuelwood they travel up to 5 kilometers. For cattle grazing, the villagers normally go up to 2 kilometers, although this range extends to five kilometers when fodder becomes scarce in January and February.

Mahua Flowers, Seeds and Other NTFPs

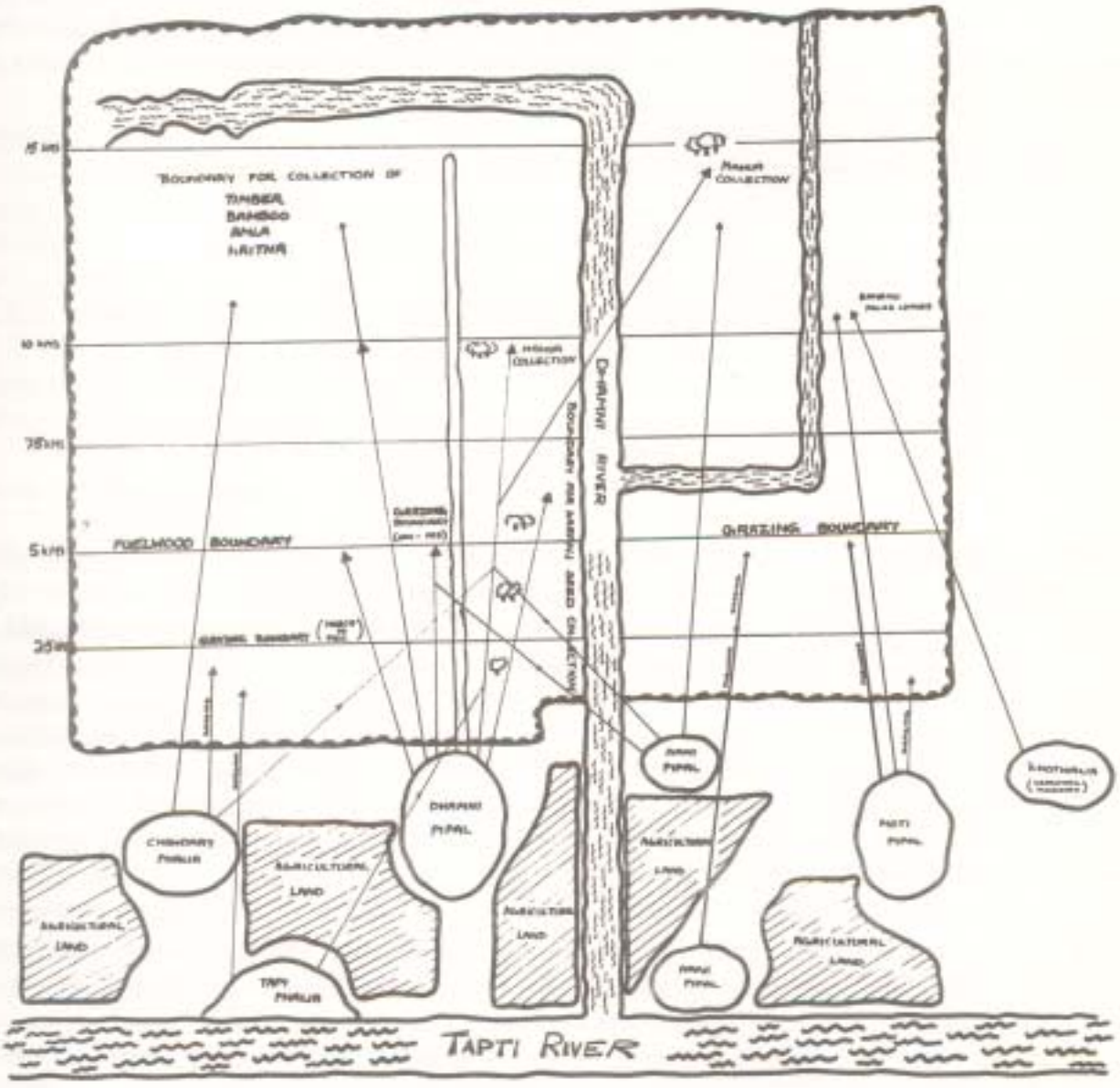
The mahua tree (Bassia latifolia) is the most highly valued among tribal communities of Limbi. Due to its economic importance, British forest administrators historically spared it from felling, a policy still observed today. As a consequence, mahua trees are some of the largest, oldest and most common in the fields and forest. The former panchayat headman estimates that there may be between 1500-2000 mahua on the 360 hectares of farmland and 3000 hectares of forest utilized by Limbi.

Most of the older settlement families in Dhamni and some of the other village hamlets hold flower harvesting rights to at least one mahua tree, although a few families have rights to as many as 15. Even trees ten kilometers into the forest are recognized as formally associated with certain families. Apparently, rights to specific trees were determined at least several generations ago. One sixty-five year old informant recalled that rights were passed down from parents to children. In addition, rights to the trees are sometimes used as dowry for women getting married. While a family may enjoy rights to a mahua tree, it also must state its intention to harvest the flowers just before the season begins by burning or clearing the area where the flowers will fall. Even under marked trees, neighbors collecting in the area may violate use rights and take the flowers. As another informant referred to a neighbor's mahua tree five kilometers into the forest when she is not there, "I'll take some flowers, but if she comes I'll start running. If Gulbhen gets upset and starts crying, I'll give the flowers back." This informant noted that it is important to come early each morning to collect during the four-week flowering season since others will collect the flowers otherwise. "Sometimes I come back with an empty basket because others have taken my flowers."

While neighbors from the older settlements will supplement their collection by taking flowers from the unattended trees of their neighbors, it seems that outsiders with no trees of their own are reluctant to engage in collection. Some of the dislocated families who resettled in the area in 1971 said they did not participate because rights to all of the trees were held by older, well-established families. One 60-year old man from Nani Pipal explained, "Whatever mahua trees are there belong to people from Limbi falia. Our trees are submerged. It would be stealing to take their flowers and they would chase us away." At times if a family is unable to harvest its flowers, it will pass the rights to another family, requesting 50 percent of the yield in exchange.

Figure 18: LIMBI FOREST

PRODUCT RANGE MAP



Collectors typically leave the village at 5 a.m., reaching the forest trees after an hour or more. They first pick the fallen flowers from their own tree, and then collect whatever has fallen from neighbors' trees provided they are not being watched. Aside from establishing use rights, the burning or sweeping of litter away from a tree's fall zone facilitates flower collection. Normally, flower collection requires about three hours, and collectors reach home around 10 am. Collection is primarily carried out by women and their children, although unemployed men also participate. In Limbi falia, approximately 50 percent of the community is involved in flower collection during April. According to one collector, a tree produces the most flowers soon after it begins bearing, and the yield gradually declines toward the end of the average two-week flowering period. Figure 19 below presents one informant's estimates of daily yields per collector from one or more trees.

Figure 19: Estimate of Daily Mahua Flower Harvest per Collector

Period	Yield per day
Day 1-5	8-10 kgs.
Day 6-10	5-6 kgs.
Day 11-14	3-4 kgs.
Total:	80-90 kgs. (40-45 kgs. dry)
Average:	3 kgs dry/day

In neighboring Karwaria village, community members reported that mature mahua trees yield an average of 100-120 kgs. of flowers in a drought year and 140-160 kgs in a good year. After collection, mahua flowers are dried, reducing their weight by 50 percent, and then sold to shopkeepers for Rs.2.50 per kg or to the FDC which reportedly pays Rs.3.50 per kg. Out-of-season value of dried flowers may rise to Rs.6 per kg.

The uses of the dried flowers vary. They are traded in the place of cash and eaten, particularly when there is a drought or food shortage. In Limbi, agricultural laborers are sometimes paid in mahua flowers (3 to 4 kgs. of dried flowers daily plus one meal). However, by far the most prevalent use is distillation of the flowers into "country wine." A collector explained that he can make 5 to 6 bottles of liquor from 2-3 kgs. of dried flowers, mixing and heating palm sugar, urea and water with the flowers. The liquor can be sold for Rs.3-4 per bottle within the village, or for Rs.6 in the neighboring town of Ukai.

The multi-purpose mahua tree also bears useful seeds which are collected from May through June. Unlike the flowers, there do not appear to be any exclusive harvesting rights for the seeds. Men and women often enter the forest as a team to harvest; the man climbs the tree to cut down branches, while the woman strips the seeds from the stem. One tree can yield 5-6 kgs. of seeds, which are processed into edible cooking oils. Seed crushers extract the oil at no charge, selling the pulp as livestock fodder. Over the two-month harvest season, most

households collect approximately 20 kgs. of dry seed, yielding 9-10 kgs. of oil, generally used for home consumption. Dry mahua seeds are occasionally sold in the market for Rs.10 per kg.

The tribals also collect tendu (Diospyros melanoxylon) leaves for bidi making (Indian cheerot) from mid-April to mid-May. The operation involves the men climbing the tree and shaking down the leaves, while the women below collect and carry the leaves home. On average they collect 2000-2500 leaves every day for 30 days, making bundles of 50-60 leaves each and producing 40-50 bundles. The bundles are sold to the FDC agent for 10 Rupees per fifty. About 25 of Limbi's 45 families are involved in this activity.

Gum kharaya (Sterculia urens) is an important source of income for four families in Dhamni falia. It is collected during April, May, and June. Before collecting, a knife insertion is made on the stem, and gum is allowed to exude for 2-3 days. After resinous content is saturated on the bark incision, the gum is harvested, producing 3-4 kgs. per month. During each collection, the tribals spend about 8-10 hours in the forest. The gum is sold at the rate of Rs.25 per kg to the FDC agent, producing a monthly income of about Rs.100 per family. There were no indications of temporal regularity in the gum collection. It may be that the time required in the forest for collection, and the relatively high opportunity cost in terms of other income sources discourage more families from such activities. Figure 20 summarizes relevant economic data on Limbi's major NTFPs.

Fuelwood Headloading

In contrast to the women of Limbi, a day in the life of most women of Moti and Nani Pipal does not include the collection of mahua flowers. Except for 5-10 percent of the households, the families of these hamlets have been displaced by the dam and are landless, lacking tenurial rights to the mahua usufruct. Instead, these women spend their time engaged in fuelwood collection and sale. Ever since they lost their farmlands, which had previously provided steady agricultural work, commercial headloading had become the only employment opportunity available to them for most of the year. While they are keenly aware that felling and collection of fuelwood for sale is illegal, the activity has become an everyday, essential livelihood strategy for these women.

The majority of landless women headload from November to June. August and September typically provide seasonal agricultural labor opportunities in other hamlets (for 10 Rs/day plus food), as does December during the harvest period. A small number of women manage to procure casual labor in sugar factories or on public works during part of the year, so may resort to headloading only during the three driest summer months, April through June. Typically undertaken 7 days a week, headloading is supplemented by seasonal collection of other NTFPs, including dhak (Butea monosperma) and tendu (Diospyros melanoxylon) leaves and fruits in April, tubers and mushrooms during the rainy season, and leaf and grass fodder post-monsoon for the minority of families (15 percent) who own cattle and/or other livestock.

Figure 20: Economic Data for NTFPs in Limbi

Species	Forest Product/ Part	Period of Gathering	Quantity Gathered per Trip	Number of Gatherers	Total Number of Trips/Yr.	Price per Unit
1. Kharaya	Gum	April, May, June	3-4 kgs./ household	20 (5%)	25	Rs.25/kg
2. Mahua	Flower	April 1-15	6-7 kgs./hh	192 (@3/family for 64 hh)	15	Rs.2.5-3.5/kg. of dry flowers
3. Mahua	Seeds	May 1-30	2-3 kgs./hh	128 (@2/family for 64 families)	15	Rs.10/kg. FDC agent (but for home consumption)
4. Karanj	Seeds	April 15-May 15	2-3 kgs./hh	60	15	Rs.3/kg.
5. Tendu	Leaves	May 1-15	40-50 bundles/hh	135 (@3/family for 45 families)	15	Rs.10/50 bundles

panchayat of 550 households, the ecological severity and economic implications of the current fuelwood pressures on the Limbi Forest Round can be appreciated (see Appendix 4 for calculation methodology).

As an alternative to fuelwood, the women acknowledged that during the winter they used more dung, but availability was a problem because only some families owned livestock and collection from free grazing in the forest was time-consuming. While no biogas plants exist in their hamlet to date, they expressed concern that water scarcity would be a second important limiting factor. In recalling the history of their community-forest relationship, the women described the forest as recently as fifteen years ago as "thick and good," but cited the Ukai dam, population expansion, and the FLCS's clear-felling as factors which had since progressively degraded the forest. According to these women, the FLCS was managed inequitably by a few, and Moti Pipal was denied access to its employment opportunities. Perhaps the most significant change revealed was the fact that prior to the dam, these women collected fuelwood only for their own subsistence, never for sale. This activity used to take one hour or less, in contrast to the daily average of 5-6 hours that commercial headloading demands today. Well aware of their strong forest dependency, the women understand that their activities are rapidly depleting the resource base, estimating that at current extraction rates the forest would be gone in another 5-6 years. What would they do then? Two neighbors expressed their combination of doubt and faith: "Right now we don't know what else to do. In the future we will no longer be able to earn from headloading, and will have to find something else. We will use more dung, or maybe even get gas. But how will we earn?"

Timber Extraction and the Forest Labor Cooperative Societies

FLCSs are among the most important institutions functioning in many of the villages surrounding the Limbi Forest Round, and more widely in Vyara and Dangs Forest Divisions. There are approximately 2000 societies in south Gujarat alone, with average memberships of 1000 men each. A small society exists in Limbi with 600 members, however this study was based on discussions with members from a neighboring society based in the villages of Karwaria, Patwara, and Junai. Founded in 1956 with 150 members, this organization now consists of 2,021 people. Until 1986, when the logging ban was enacted, the Karwaria FLCS was active in the commercial felling operations outlined under the FD Working Plan. Since the ban, employment opportunities have decreased, but the society members have been involved in cutting dead and dry trees, as well as in silvicultural operations such as enhancing regeneration (multiple shoot cutting, stool cleaning), digging pits for seedlings, planting, and weeding.

At the time of the PRA exercise, five blocks were being cleared of dead timber in Limbi Forest Round. Each block employed 25 to 50 tribals. The Range Officer estimated that the FLCS extracted 500-600 cubic meters of timber annually and 1000-1200 cubic meters of firewood valued at Rs.4,200,000. This biomass extraction (although primarily dead and dried trees) of an average 1500 cubic meters/year (or 1.2 million kg) is equivalent to another 11.5 hectares of well-stocked, 40-year-old forest. Combined with the commercial and subsistence

extraction by headloaders of Moti Pipal, this annual removal would entail a theoretical clearcut of 18.9 hectares of forest biomass.

Tree felling takes place during the dry season, January through May. Given the reductions in felling operations, most FLCS members receive only 1-2 months work during the season. Villagers employed by the society live in dhak (Butea monosperma) leaf houses in the forest. Wages are paid by the society based on the amount of timber that is cut, loaded, and unloaded by the work crew. Timber payments are based on a fixed rate according to girth size. Society members who work long hours may get up to Rs.30 to 40 per day, in contrast to the official government daily labor wage of Rs.27. Every three years, workers also receive bonuses for additional profits made by the FLCS; these may generate an additional 30 percent more income. The FLCS receives 20% of the value of timber and firewood extracted, which it uses to pay the salary of the workers. Additional income is kept in reserve. In 1991 the reserve funds totalled Rs 4,416,000, while net income yielded Rs 277,000. One member of the society noted that in 1991 he only obtained two weeks of logging work which paid Rs.750. Some loggers remembered when a full 5-6 months of logging work was needed annually and villagers could receive Rs.3000 to 4000 in a season. The Ranger reported that the forest area had been opened to dead tree cutting only two years earlier, and would soon run down the existing stock, reducing extraction by 50 percent. Currently, the combined income from logging and silvicultural work generates approximately Rs.1000-1500 per year for each laborer.

When asked how the logging ban had affected them, FLCS workers stated that they had definitely lost income through reduced timber extraction. They were not particularly upset by the policy however, as the government continued to provide them with some employment under the silvicultural program. When asked whether the policy to restrict cutting had influenced the environment, they felt that while the vegetation had improved, the drought and irregular rainfall of the past three years had caused premature drying of seasonal streams and a decline in well water levels. The leaders of the FLCS were aware that a Forest Protection Committee had been formed to protect and cooperatively manage the forests, however when asked, they laughed and said they were in the cutting business, not conservation.

SUMMARY

Assessment of Forest Productivity and Income-Generating Activities

Due to the short duration of the field study, it was not possible to gain detailed quantitative data on product flows and labor allocation. The use of multiple sources so that responses could be cross-checked, however, allowed the researchers some confidence that the information on forest activities reflected the relative importance of each and a rough approximation of gross annual income and daily wage equivalents generated (See Figure 21). An economic analysis indicates that employment by the FLCS in the logging sector still generates the highest income of Rs.28-40 per day, somewhat above the state's minimum wage.

Figure 21: Estimated Annual Gross Income and Daily Wage Equivalents for Forest-Related Activities, Limbi

	LIMBI			
	Annual Income/HH Rs.	Collector Population	Income/ Day (8hrs.)* Rs.	Total Annual Harvest
FLCS logging	1000	Men, (50% HH)	28-40	300-400 mt. timber 600-700 mt. fuelwood
Commercial fuelwood headloading	4800	Landless women (50% HH)	14	1,728 mt. commercial
Mahua flower collection	135 per person	Family (60% HH with rights)	12	18 mt. flowers
Mahua liquor distillation	300		16-32	1500 - 3000 litres
Mahua seed collection	200	Men and women (75% HH)	16	10 m^3. seed
Karanj seed collection	120	Women and Children (75% HH)	10	
Gum collection	250	Men (10% HH)	9	
Tendu leaf collection	300	Women and men (50% HH)	8	

* State wage rate: Rs.27.00/day; Agricultural labor rate: Rs.11.50/day.

HH = Household

Yet due to the limited number of work days granted since the logging ban, fuelwood headloading is by far the most lucrative forest product income-generating activity over the course of the year. Following logging, mahua liquor distillation provides the highest daily income from Rs.16 up to 32 per day. Mahua seed and flower collection provide the next highest hourly incomes, followed by karanj seed, gum collection, and tendu leaves. It is interesting to note that NTFP collection activities generate daily income levels which approximate the local agricultural labor rate (Rs.11.50 per day), but fall far below the minimum state wage rate (Rs.27 per day). Families who participate in both logging and fuelwood headloading may derive up to Rs.6000 to 7500 annually from the forest based activities. In many households, this may represent far more than half the total cash income, especially for the landless. It is significant that those activities which generate the highest forest-based income are also the ones that are the least sustainable, namely fuelwood headloading and timber extraction.

Ecological Data

While measurements of forest vegetation were not formally part of the methodologies identified for testing during the field trials, more ecological information was needed to better understand community forest use practices and their sustainability. In order to generate some preliminary information, the team conducted two rapid measurements of species compositions using a 10 X 100 meter belt transect and two 25 x 25 meter quadrats. The quadrats were laid out on a rolling plain, close to the foot of a forest hill approximately 5 kilometers from Limbi village. The dominant species in the transect and the quadrat are bamboo (50% and 22%, respectively), followed by teak (30% and 20%, respectively). In the plains, the stocking density for trees of approximately 90 cm girth or greater is 150 per hectare, with an additional 75 trees per hectare of similar girth missing, as indicated by the presence of stumps. Field observations reveal that on average about one-half the standing stock appears felled, with a greater loss in fringe areas near the road. Most of the tree species in the forest are coppicers. It was apparent that fires are a frequent, often annual occurrence in the forest areas studied, usually breaking out during the dry season from April through June. Grazing pressures appear to be relatively light compared to lopping and felling, which seems moderately heavy. Perhaps due to firing of the area, grass growth appeared suppressed.

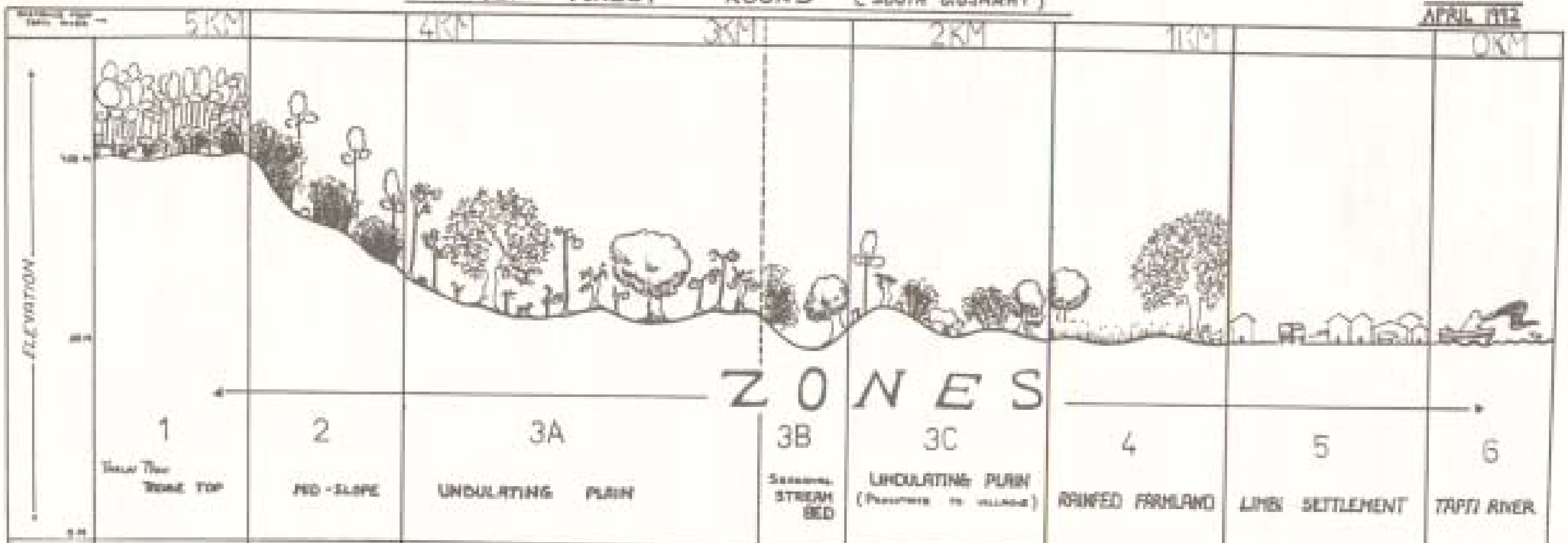
Management Implications

Upon completion of the belt transect and quadrats, a land use transect covering the full 5 km to the Tapti river was drawn from the vantage point of a hill near Torun panni, the highest ridge point (400m). The objective of the transect was to describe and analyze vegetation and land use in the Limbi area. Drawing the transect also provided a framework for synthesizing topographical land forms, natural resources and species compositions, important products and use patterns, and management implications, with preliminary options for achieving more sustainable practices combining conservation and use (See Figure 22). Given declining ecological conditions and future pressures on Limbi forest, zonal micro-planning based on ecological carrying capacity and local resource needs will call for creative, intensive

Figure 22: LAND USE TRANSECT

LIMBI FOREST ROUND (SOUTH GUJARAT)

APRIL 1992



	1 Ridge Top	2 Mid-Slope	3A Undulating Plain	3B Seasonal Stream Bed	3C Undulating Plain (Periphery to village)	4 Rainfed Farmland	5 Limbi Settlement	6 Tapti River
Use pattern	Commercial Logging	Commercial logging & illicit felling, light fuelwood & NTFP collection	Commercial logging & illicit felling, Moderate fuelwood & NTFP collection	Seasonal Fishing Grazing	Heavy fuelwood collection & grazing, NTFP collection, illicit felling	Agriculture Livestock Farm Forestry	Residential, primary education, cottage industry, transportation, homegardens	Fishing Bathing
Products	Construction materials & timber (teak), bamboo for houses, & furniture, poles, baskets, handicrafts, ag. implements [illegible]	Bamboo (houses, baskets), Timber (teak), Gum, Fruits & Bidi leaves (Timru), Fodder leaves & grasses, Fuelwood	Mahua flowers & seeds, Bamboo, Fruits & Bidi leaves (Timru), Gum, Fodder leaves & grass, Timber (Teak, Pterocarpus), Fuelwood	Bamboo, Fodder leaves & grass, Karanj seeds, Fish, turtles, crab	Bamboo, Mahua flowers & seeds, Bidi leaves (Timru), Fodder grasses, gum, fuelwood, poles, dung	Foodgrains: dal, wheat, rice, Mahua flowers & seeds, mango, Fencing material and small timber, fuelwood, agricultural residues, dung	Milk, liquor, leaf cups, baskets & mats, furniture, agricultural implements, vegetable & fruit	Fish, Turtle
Species Composition	Tectona grandis, Lannea coromandelica, Terminalia tomentosa, Wrightia tinctoria, Dalbergia latifolia, Anogeissus latifolia, Dendrocalamus strictus	Dendrocalamus strictus, Tectona grandis, Lagerstroemia parviflora, Bridelia retusa, Wrightia tinctoria, Diospyros melanoxylon (Timru)	Dendrocalamus strictus, Tectona grandis, Adina cordifolia, Pterocarpus marsupium, Bridelia retusa, Bauhinia racemosa, Bassia latifolia (Madhuca indica/Mahua), Diospyros melanoxylon	Pongamia pinnata, Terminalia arjuna, Dendrocalamus strictus, Azadirachta indica (Neem)	Dendrocalamus strictus, Tectona grandis, Diospyros melanoxylon, Acacia spp., Zizyphus jujuba, Bassia latifolia, Butea monosperma	Jowar, Millet, Tuvar, Paddy, Rice, Wheat, Bassia latifolia, Mangifera indica (Mango), Acacia nilotica, Butea monosperma	Papaya, Citrus, Gourd, vegetables	
Management Problems	Sheet & gully erosion, slow regeneration, low soil moisture, rapid runoff, fire, general ecological vulnerability	Illegal felling, fire, sheet and gully erosion, runoff, bamboo clump congestion	Illegal felling, erosion and soil compaction, fire, poor stool management, bamboo clump congestion	Stream bank erosion & sedimentation, Soil compaction, Overgrazing	Overcutting & illicit felling, lopping, overgrazing, fire, soil compaction and erosion, depletion of biological diversity, bamboo congestion, improper stool management, inadequate conservation and rapid runoff water	Low productivity, inadequate soil organic matter & field fallow time, no irrigation or water harvesting, insufficient farm forestry to satisfy domestic fuelwood/fodder needs	Inadequate community forest protection and management in adjacent forest, water scarcity, 30% landless population, underdeveloped dairy sector, lack of employment opp. for women, inadequate distribution of public services	
Management Opportunities	Strict watershed protection for ecological stabilization, promote natural regeneration, minimize human interference, gap fill with [illegible] and other hardy spp., enrichment plant with N^2-fixing shrubs and grasses, contour bunding, trenches and gully plugs stabilized with local grasses	Watershed protection, promote natural regeneration, minimize human interference, selective contour bunding and trenching stabilized with grasses and shrubs, enrichment planting with Mahua, Neem and other long-gestation spp., bamboo thinning, fire-breaks	HIGH PRIORITY MANAGEMENT ZONE : PROTECTION AND MANAGEMENT BY COMMUNITY Intensify sustainable productivity for local needs, natural regeneration and enrichment plantation with villagers' spp. preferences, focus on fodder grass and fast-growing leaf fodder, N^2-fixing trees for fuelwood, NTFP's including fruits of Amla, Mahua, Mango, Jamun and seeds, bamboo, mushrooms & tubers, contour bunding with grasses & useful shrub coppices, controlled rotational grazing	Nallah check dam construction for water storage & irrigation, stream bank stabilization through bamboo & grass plantation	Intensify production for local needs, bamboo clump cleaning and thinning, gap fill with multipurpose trees including N^2-fixers, fruit and shrub coppices, enrichment plant with bamboo, Mahua, fire-breaks, controlled grazing, improved stool coppice management, soil and water stabilization with grass & shrubs, contour bunds	Promote farm agroforestry with living fences, N^2-fixing fuelwood and fodder spp., fodder grass production, propagate high-yield varieties of Mahua, grafted mango & sitaphal, improved H_2O harvesting for irrigation with check dams and farm ponds, contour farming and conservation bunding with grass stabilization, improved crop seed varieties	Organize forest protection committees for micro-planning and joint protection, management and benefit-sharing arrangements, biogas & improved chulahs, development of dairy: replacement with high-yielding cows & buffalo, stall-feeding and marketing infrastructure, income-generation including NTFP development, commercial handicrafts in target groups for alternative livelihood options	Fisherman's cooperatives

management prescriptions. Surrounding village communities must work closely with the GFD to design and implement management strategies which raise productivity, ensure sustainability, and are supported by direct incentives and benefits channeled to the local people.

In examining conditions in the land use zones identified through the preparation of the transect, the following management issues emerged. While still relatively inaccessible and undisturbed, the ridgetop slopes around Limbi are becoming increasingly vulnerable to biotic interference and fire as degradation at lower elevations continues. Historically logged over for valuable teak and other timber for construction materials, resins, and bamboo, these ecologically sensitive areas play an essential role in watershed conservation, arresting rapid runoff and progressive sheet and gully soil erosion, and stabilizing the hydrological regime. While these upper catchment hills provide important ecological service, they typically suffer from shallow soils, low fertility and reduced water retention capacity, resulting in considerably slower natural regeneration. Consequently, management goals which minimize biotic interference would be optimal in improving overall ecological stability. Steep, eroded slopes may benefit from gully plugs or contour bunding stabilized with local grasses and shrubs, and gaps could be filled with hardy, nitrogen-fixers such as Acacia catechu, Ziziphus spp., and Dalbergia sissoo or bamboo planted in soil and water conservation contour trenches. Efforts directed toward simulating multi-tiered natural forest succession and diversity through propagation of forbe, shrub, and tree layers would enhance ecological recovery and resilience.

While somewhat less vulnerable ecologically, the midslope zone is also prone to illegal felling and runoff, leading to sheet and gully erosion. The dominant species is bamboo, followed by interspersed teak, tendu and other timber, fuelwood and NTFP species. Due to better accessibility and preponderance of bamboo, the midslope is more subject to illegal felling and man-induced fire. Watershed protection would be the optimal goal, promoting natural regeneration and minimizing human and livestock pressures. Management options might include a combination of selective contour bunding and trenching, stabilized with vegetation, natural regeneration supplemented with enrichment planting of grasses, shrubs and longer-gestation tree species such as mahua and neem, systematic firebreaks and periodic bamboo clump cleaning and thinning to reduce fire hazards and improve biomass productivity. Community protection and management in this zone would contribute to more active local participation and greater employment opportunities, while providing a continuous flow of intermediary benefits to bamboo-dependent communities such as the Kotwalias.

The undulating plains of Limbi Forest are the most intensive and important human use zone. Greater accessibility and proximity to settlements have lead to increased incidence of illicit felling for timber and fuelwood, more intensive NTFP collection, and overgrazing by livestock. The consequences of unregulated access, inadequate silvicultural management, and general overexploitation include: lower diversity and density of vegetation; soil erosion and compaction; hacked, malformed and under-productive stool and coppice; fire; and bamboo clump congestion. This area might be suitably targeted as the highest priority zone for community participation in forest protection and management, with dual goals to rehabilitate ecological processes and intensify productivity to primarily serve local needs. Where healthy root stock still exists,

natural regeneration can be supplemented by enrichment planting of multi-purpose trees, including neem, mahua, fruit species, bamboo, and other locally determined preferences. To help meet the growing gaps in fuelwood and fodder supply and demand, it may be pragmatic to promote fast-growing fuelwood, leaf fodder and grasses. Species combinations might include nitrogen-fixers for soil improvement, rapid shrub coppicers with high biomass turnover, and NFTP species which are important to the community, especially women, for both subsistence and commercial purposes. Based on village micro-planning, a diverse combination of silvicultural manipulations in the regenerating forest could be undertaken on a pilot scale. These trials can help determine appropriate multi-tiered species mixes which are resilient to steady, but controlled extraction pressures, while also offering intermediary flows of useful forest products.

Because this zone will continue to be so heavily utilized, a system of rotational grazing should be introduced to give highly compacted and degraded patches a chance to recover and regenerate. Over time, the shift from scrub cattle and goats to high-yielding buffalo and cows, and from open grazing in the forest to stall-feeding in the village, may be required. Meanwhile, this high-use area will remain subject to erosion, reduced soil moisture retention, potential desiccation, and hazards of fire, creating conditions which could benefit from soil and water conservation measures. Rotational grazing could play its part in preventing the complete loss of vegetative ground cover, while selective contour bunding and trenching with grasses and shrubs will also help husband soil and water.

Both silvicultural management practices and institutional reforms may be effectively combined to enhance ecosystem productivity in this highly pressured zone. For one, there are currently abundant stool and stump coppices in the area which have been carelessly (and illegally) hacked, but which could be at least partially salvaged with proper stool management interventions. Second, the productivity of bamboo clumps has suffered greatly from congestion, a situation that might be rectified with timely and systematic cleaning and thinning operations. If the system of daily employment for bamboo-dependent laborers were changed from a flat wage rate to a financial sharing arrangement in which the benefits of increases in gross productivity from community protection and cultural operations flow directly to the laborers, incentives for improved and sustainable management by the community would be established.

The next land use zone consists of farmland or khet, interspersed with tree species such as mahua, mango, and acacia, as well as seasonal livestock grazing on fallow or underutilized private lands. This area provides essential products for the community including food grains, mahua flowers, fruits, seeds, some small timber, fuelwood, fencing material, agricultural residues, and dung. Unfortunately, about 50 percent of Limbi panchayat is landless, with limited or no control over food production systems. Furthermore, most of Limbi's landowners have agricultural fields that are unirrigated and suffer from inadequate soil organic matter and moisture levels, leading to overall low productivity. While some farm forestry efforts have been undertaken by landowners on field boundaries with plantation of eucalyptus and acacia species, the potential for on-farm fuelwood and fodder self-sufficiency remains largely unrealized. A carefully targeted program to promote farm agroforestry may be a suitable companion strategy to the community JFM approach on adjacent forest lands. Living fences which coppice

vigorously and provide interim fodder or fuel could replace stonewalls and erosion-prone cattle trench boundaries. Nitrogen-fixing shrub and tree species interplanted with crops can improve soil fertility while generating a flow of intermediary food, fodder and fuelwood. High-yield varieties of mahua (documented through the research conducted at Forest Research Institute in Jabalpur, M.P.) and grafted varieties of mango and ber can increase productivity both quantitatively and qualitatively. Improved contour farming practices, conservation bunding with grasses, improved seed varieties, fertilization with organic manure and mulching will improve crop yields and sustain them over the longer term. Water harvesting could be improved by constructing small check dams and farm ponds for irrigation.

Adjacent to the khet are the settlements of Limbi. This zone is characterized by a seasonal water scarcity, in part a function of population growth and the declining health of the Limbi forest. Fifty percent of the population are highly dependent on the Limbi forest resource. The community could greatly benefit from increased involvement, better organization and improved micro-planning in its role as active forest protectors and managers. While protection activities by the current Limbi FPC have succeeded in reducing the number of outside violators, community involvement is not yet broad-based and inspired, and many aspects of the program such as sharing arrangements, conflict arbitration, and gender-specific opportunities still need to be developed. The potential solution to the future sustainability of Limbi forest may ultimately lie within this human habitation zone, where FPCs and FD officials can work together to derive locally-responsive joint management agreements.

As part of the JFM program, the collection, processing and marketing of value-added NTFPs could provide an important income-generation opportunity. Such programs should attempt to specifically target women who are currently involved in commercial headloading in order to offer them a more attractive employment alternative. In support of the JFM program, attention should also focus on several other allied resource management strategies. For example, crucial to alleviating the grazing pressures on the forest, which continue to seriously undermine its natural regeneration potential, would be a phased strategy to develop the dairy sector. Steps might involve introducing rotational and controlled access grazing, improving quantity and quality of grass and leaf fodder production, establishing a panchayat-wide fodder storage bank, replacing scrub cattle and goats with high-yielding cows and buffalo, shifting to stall-feeding, and further developing marketing linkages and infrastructure to process, transport and sell dairy products. Income-generation opportunities through raising other small livestock such as poultry could also be investigated. For landed families with adequate livestock, introduction of biogas plants may alleviate some of the pressure on the forest for fuelwood. If women are consulted in the planning and design phase, improved chulah stoves could also contribute to fuelwood conservation.

The final land use zone consists of the Tapti river, an important resource for regional hydropower generation, and commercial and subsistence fishing to thousands of villagers such as those of Limbi panchayat . The development of a fisherman's cooperative in the Ukai dam area may provide a vehicle to assure consistent employment, efficiency and fair prices.

Meanwhile, the forest's hydrological interrelationship with the river and its tributaries forms a crucial ecological linkage.

The rapid field appraisals of the Limbi forest-community relationship and dependencies have provided rich material for analysis and further investigation. An important revelation is the current ecological potential that remaining tracts of valuable natural forest such as Limbi provide, and their crucial role in meeting local needs in a more sustainable manner. The research underscored not only the serious pressures and progressive degradation occurring on the Limbi forest, but also the opportunities for organized, forest-dependent communities to join hands with the Forest Department in establishing participatory systems of forest protection, management and benefit-sharing.

SUMMARY

The primary objectives of the workshop involved testing PRA tools to rapidly assess forest use flows and practices, training people in their use, and collecting community and forestry data on the economics of regeneration under various stages of forest succession in southern Gujarat. In the context of the JFM support group's larger research network program, the broader goal of this ongoing series of workshops is to increase our understanding of the social, ecological and economic dimensions of community-forest relationships throughout India. By means of a participatory research process, it is hoped that a better understanding will emerge which can help inform the development of new, sustainable forest management systems that meet both local and environmental needs.

Experiences with PRA Methods

The PRA teams found the methods generated useful information concerning the forest management context and the economic dependency of communities on timber and non-timber forest resources. By the close of the workshop, the following consensus emerged among participants:

1) PRA tools may be successfully employed as a "first and rapid cut" toward understanding community-forest relationships. PRA researchers require skill-building and practice in testing and refining the methods to maximize information-gathering, reliability and data analysis, while adapting the tools to local forest management conditions and issues.

2) Currently, PRA tools seem most useful for obtaining certain types of preliminary forestry information, such as historical, spatial, temporal, and volumetric flows, but may be less suited to microeconomic analyses unless combined with statistically more rigorous research methods. These would include standing stock inventories, periodic measurements of forest product collections, minimum stratified samples for household data, and more detailed market research.

3) Given a carefully orchestrated schedule of field work, analysis and iterative planning, 3-4 days of PRA research can produce a substantial quantity of reliable information concerning community forest use practices and dependencies. Through the process of community micro-planning, this learning can offer insights into options for enhancing local participation in forest management.

Community members generally responded positively to the exercises, contributing their knowledge and skills to the activity. The field methods trials indicated that a few more days of research and analysis, followed by a second round of data collection several weeks or months later, would have allowed greater detail and improved cross-checking for accuracy in the findings. The rate of field learning during the PRA was so rapid that, at times, the teams felt

overwhelmed by the volume and complexity of the information that was being generated. They concluded that more time was needed for daily planning, analysis and note-taking, especially in between field exercises. Furthermore, certain gaps in the team's understanding of forest resource use patterns became more apparent after several days had been spent analyzing the field data. A follow-up PRA, ideally timed to correspond to seasonal forest activities, would provide an excellent opportunity to deepen the team's knowledge and cross-check findings. Field Methods Manual: Volume I recommends conducting 1-2 PRAs first to profile community forest interactions, and then following up with more comprehensive studies of forest vegetation, community institutional framework, and economic production systems. With this four-step approach, researchers would then gain a familiarity with the socioeconomic and management environment prior to initiating detailed ecological succession, institutional, and economic studies of forest products.

Following the initial PRA, forest vegetation studies would provide an overview of important species, changing diversity and stocking levels, and patterns of disturbance. This information would be important for confirming yield data, assessing the economic and ecological implications of current management practices and options, and beginning to evaluate the sustainability of resource exploitation. As a next step, a thorough institutional assessment of community organizations, the FD and any area NGOs would facilitate the identification of key institutions, leaders, and decision-makers in the area. Such background understanding will contribute to the economic study, as well as help identify socio-political opportunities and constraints in creating a more conducive institutional environment for JFM.

Perhaps one of the most positive outcomes of the PRA method trials was the opportunity for university, NGO, and FD staff to work together collaboratively with community members. The sharing of research skills, knowledge, and ideas helped stimulate learning and develop friendships for future networking. The exercise also provided a basis for FD staff to conduct follow-on activities with community management groups which could lead to the development of detailed micro-management plans. At the same time, the field trials revealed how much more experimentation is needed to further develop effective, participatory diagnostic tools for improving forest management systems and to train foresters and support staff in their use.

Observations on Forest Management Options

Small Regenerating Forest Patches

In Gamtalao, Phulwadi, and Ghodbar villages it was clear that the communities take pride in protecting and regenerating small tracts of degraded forest with the assistance of the Gujarat Forest Department. Relationships between the community and the GFD have improved markedly since the initiation of the collaboration. This cooperative action has led to rapid regrowth of teak and other species which have been suppressed through logging, fuelwood cutting, and heavy grazing. At the same time, the communities have worked with the GFD to replant gaps in the forest with valuable timber and NTFP species. The results of these efforts are observable in the increasing species diversity regenerating in the forest.

While significant progress has been made in establishing local forest management institutions, improving communication between the GFD and villages, controlling access and enhancing the biodiversity and productivity of the forests, a number of management issues deserve attention. First, there is scope for improving the culturing, harvesting, supply, and marketing of bamboo and bamboo products. Kotwalia artisans suffer from insufficient, uneven, and low quality raw material. Most bamboo clumps require more frequent cleaning, thinning, and fertilizer. If given the benefits of enhanced productivity as an incentive, Kotwalia and other tribal families in the area could perform these tasks, raising the productivity of the stands and improving their supply of raw materials under lease arrangements with the FD.

Management systems could also be improved to increase the yield of fuelwood, fodder leaves, and grasses. Initial findings from the PRA trials indicate that singling and thinning operations may need to be supplemented with sustained yield lopping and pruning activities to ensure a steady flow of firewood. More fast-growing fuelwood species may need to be planted to meet growing demands. Fodder grass and leaf production, which are expanding in importance as villages enter into commercial dairying, need to be increased. Good grass production from regenerating plots in the early years may decline as the canopy closes. Hence, it may be necessary to increase spacing and plant more fodder trees to stabilize or improve the supply over the years. Perhaps the most fundamental issue is clarifying the objectives of forest management in these small degraded, regenerating tracts. While community management systems are now in place, and a number of important steps have been taken to involve villagers in species selection for enrichment planting, in some small forests the GFD is still planning to manage the plots primarily for long rotation timber. This policy may need to be reviewed in terms of its economic implications and the requirements of communities participating in forest management.

Large Natural Forest Tracts

The large forest tracts in the Dangs and Vyara District of southeastern Gujarat are under continuing pressures, both from commercial and subsistence users. Even during the short PRA exercise in Limbi Round, it was apparent that overcutting, fuelwood headloading, and fires are gradually eroding the structure and composition of the forest. While the 1986 ban on commercial logging has slowed the pace of forest disturbance, the pressures that remain give rise to serious questions regarding the sustainability of the ecosystem under current management practices. Calculations indicate that the combination of both commercial and subsistence fuelwood needs of the headloading hamlet of Moti Pipal requires the biomass equivalent of 27.5 trees per family or the clearcutting of up to 7.4 hectares of good, 40-year old forest each year.

The Limbi case study highlighted the mounting pressures causing forest degradation, as well as the potential for ecological regeneration and community interest in establishing alternative systems of participatory forest protection, management and benefit-sharing. In terms of priorities, remaining tracts of natural forest like Limbi deserve renewed attention while the opportunity still exists to stabilize and conserve valuable resources through community

participation. In order to achieve the goals of forest rehabilitation and sustainability, while simultaneously satisfying growing local needs, the management focus on these public natural forest lands may need to shift away from attempts to fulfill demands from state and national quarters. Instead, the management regime might emphasize the twin objectives of ecological balance and equitable streams and distribution of forest products to local communities in exchange for their voluntary protection and management. If the degradation process is to be reversed, and this can only succeed with the full support of forest-based communities such as Limbi, state and national timber demands must rely less on supplies from these beleaguered public forests. Industrial concerns may need to increasingly contract with larger private farmers to supply their demands through block plantation farm forestry. Simultaneously, the Forest Department could channel special support to marginal and small peasant farmers to accelerate their on-farm forestry in order to increase self-sufficiency and better satisfy their domestic needs.

In summary, the GFD and the study communities have made commendable progress in overcoming past conflicts and developing collaborative management systems, especially in smaller forest patches. Hopefully this progress can be replicated, and expanded to larger natural forest areas. The passing of the state resolution in 1991 provides an unprecedented opportunity for FDs to reorient traditional forest management systems. Participatory management legitimizes community authority over essential natural resources and encourages cooperation between government, non-governmental organizations, and forest- dependent communities. This approach emphasizes the importance of placing priority on local needs, while providing an institutional framework to ensure the sustainability of forest ecosystems. This complex process of reform is still evolving, and while the GFD is committed to encouraging participation, many institutionalized norms, procedures and management practices still limit community involvement. In the years to come, management practices will need to be adapted to optimally support forest-dependent villages in protecting and sustainably utilizing these resources. The GFD will need further studies, guided by communities, to determine how to optimize the availability of fuelwood, fodder, bamboo and other important NTFPs. PRA methods can help inform and guide the directions of these essential changes.

APPENDIX 1

Community Profile: Background Information Sheet

		Total Population	Number of Households
Name of community (Primary forest user)	_____	_____	_____
Neighbouring communities (Secondary forest users)	1) _____	_____	_____
	2) _____	_____	_____
	3) _____	_____	_____

Size of forest area used by primary community _____ ha.

Distance of forest from primary community _____ km.

Distance of secondary user communities
1) _____
2) _____
3) _____

Social composition of primary community (by caste and/or tribe)

Group	Number of Households	Average Landholding (ha.)
1) _____	_____	_____
2) _____	_____	_____
3) _____	_____	_____

Number of landless households in the primary village _____

Livestock population of primary community

Stall-fed

Water buffalo _____ Dairy cattle _____

Open grazing

Cattle _____ Goats and sheep _____

Primary village occupations

	Type	Number of Households
1)	_____	_____
2)	_____	_____
3)	_____	_____
4)	_____	_____
5)	_____	_____

Number of households migrating annually _____ No. of months _____

Percentage of village members literate Men ____% Women ____%

Percentage of farmland irrigated _____ %

Name, days and distance to local markets:

	Name	Day	Distance (km.)
1)	_____	_____	_____
2)	_____	_____	_____
3)	_____	_____	_____

Institutions, banks, cooperatives servicing the community

	Name	Function	Distance from village (km.)
1)	_____	_____	_____
2)	_____	_____	_____
3)	_____	_____	_____
4)	_____	_____	_____
5)	_____	_____	_____

Describe past and present leadership patterns in the community/ies and the types of formal and informal leaders:_____

_____

_____

APPENDIX 2

COMMUNITY AND FOREST HISTORY: INTERVIEW GUIDELINES

Sources of Information

As a preliminary step, it is worthwhile to ask both key informants and the Forest Department about any informal historical written records which may exist on the community-forest relationship (e.g. case histories, songs, stories). Secondary data sources such as FD Working Plans, maps, and photographs should be reviewed prior to PRA interviewing to assist in formulating more site-specific interview questions.

Interviewing and Recording Information

As the interviewer elicits information from village members and key informants concerning changes in the forest, natural resource base, and community, another team member can simultaneously sketch out historical transects, timelines, and trendlines based on these descriptions to then share with the interviewees, confirm the information visually, and add details.

Cross-Checking Information

Many of the same or parallel questions should be asked of both Forest Department and community members, including stratified subgroups, in order to compare responses, improve validity and accuracy of the PRA exercise, and reveal differences in values, perceptions, and goals.

INTERVIEWING FOREST DEPARTMENT RESPONDENTS
(Source: CF, DFOs, rangers, forest guards)

Institutional Issues

1. When did the FD take over management responsibility for forests in the area?

2. Who managed the forests prior to that? What institutional arrangements existed (formal or informal), and how did they change over time?

3. What were the contractual arrangements for logging the forest?

4. How have the forest use rights of the local communities changed over time? Are the rights of the communities listed in any settlement acts or FD orders?

Forest Use History

1. Describe the history of logging activities in area.

   What silvicultural management systems have been employed, and how/why have these changed over time (e.g., clearfelling, coppice with reserve or standard, protection working circle)? What factors have contributed to successes or failures in the prescribed management systems? [TIMELINE]

2. What other silvicultural prescriptions, such as cleaning, pruning, multiple shoot cutting, and enrichment planting have been done? Obtain details on species quantity and types, survivals, utilization, employment, etc.

3. Describe the history of NTFP collection in area.

   Any major changes in availabilities? How has availability of leaf and fodder grass from forest lands changed over time?

   Have there been any shifts from subsistence to commercial uses?

   Has there been a historical development of processed, value-added products? What potential opportunities exist?

4. Describe the fire history of the area, both natural and man-induced.

   How and when do fires occur?

   How are they controlled and by whom?

   What impact do they have on ecological succession (trees and NTFPs)?

   How have these trends changed over time (e.g., increasing vulnerability to fire)? [TRENDLINE]

5. Describe trends in biotic pressures for fuelwood collection and grazing. What alternatives to fuelwood are/could be used? Any stall-feeding? [TRENDLINE]

   Describe the history of illegal felling, both for commercial and subsistence (large and small-scale) purposes, where and who in community is involved (women, men, tribals, outsiders)? [TRENDLINE]

6. Describe the history of FD-community relations: cooperation, user group conflicts, women's roles and issues, dispute resolution mechanisms?

7. Describe changes in status of floral and faunal biodiversity, including changes in species compositions and frequency with secondary succession, extinctions, etc.

8. Describe and score parameters for assessing potential for natural regeneration of forest areas (any variance across areas?) [See CHECKLIST OF INDICATORS FOR NATURAL REGENERATION POTENTIAL, Vol. I, Appendix 1]

INTERVIEWING COMMUNITY RESPONDENTS

(Sources: village leaders, other key informants, women, different castes and tribal groups, forest-dependent user groups)

Settlement History

1. When was the community first established? Who were the original settlers? Who came after? [TIME LINE]

2. Currently which groups control most of the agricultural land, and which groups are landless?

Institutional Issues

1. What institutions functioned in the village in the past and present (formal and informal)?

2. Describe the communities that utilize the forest. Are there any special groups who are more dependent on these forest resources (women, tribals, artisans, or special castes)? [TYPOLOGY]

3. What rights do the community, other communities, or specific user groups have to forest resources? How have these rights changed over time? Are there any formal or informal agreements among user groups regarding rights to products?

   What effect have these changes had on access to forest resources, product availability, and relationships between communities or subgroups within the community and the FD?

   Probe gender-related issues (e.g. gender divisions of labor, conflicts between female headloaders/graziers and forest officials, increased collection burden).

Forest Use History

1. Describe the forest use history, including the process of forest clearing for agriculture, logging, and settlement encroachment.

2. What impact has forest disturbance had on a) soil (loss, agricultural productivity, stream sedimentation); b) water (flooding, droughts, crops, surface and groundwater tables); c) species diversity; and d) microclimate (rainfall, humidity, temperature)? [HISTORICAL and LAND USE TRANSECTS, TRENDLINES]

3. Describe how the availability of fuelwood, fodder, and NTFPs have changed over time. Indicators might include changes in the number and type of products, trends in volume, utilization, and growing seasonal scarcity. [TRENDLINE]

4. Describe historical and current grazing practices (e.g. quantity and type of livestock, access regulations and restrictions such as fines, patrol, and seasonal rotation).

5. Are there nomadic pastoralists (e.g., Rebari, Maldhari) who herd flocks seasonally? (When, quantity, formal/informal agreements with community, changes over time?)

6. What socioeconomic impacts has forest disturbance had on community demographics, employment, and migration patterns (poverty and income, family cohesion, role of women as head of household, child education, etc.)? [TRENDLINES]

7. Describe history of social/cultural uses and symbolism of forest (rituals, totemic species, privacy for women, adolescents, etc.).

APPENDIX 3

Combined Forest Species Inventory by the Women and Men of Limbi falia

1. Sesum, Sissoo	Dalbergia sissoo
2. Shisham	Dalbergia latifolia
3. Sadad	Terminalia tomentosa
4. Dhaman	Grewia tiliaefolia
5. Mahua	Bassia latifolia
6. Umra, Umro	Ficus racemosa
7. Beda	Terminalia bellerica
8. Kudi	Wrightia tinctoria
9. Jamun	Syzygium jambolanum
10. Biyo	Pterocarpus marsupium
11. Bili, Bel	Aegle marmelos
12. Tanas	Oogenia eugenensis
13. Al	Morinda tomentosa
14. Nilgiri	Eucalyptus globulus
15. Hedakalam	
16. Khakar	Butea monosperma
17. Asitra	Bauhinia racemosa
18. Bodaro	Lagerstroemia parvifolia
19. Sabar	
20. Manjo	Casearia graveolens
21. Haldu	Adina cordifolia
22. Asan, Vasan	Coculus hirsutus
23. Ataru	
24. Rayan	Manikara hexandra
25. Bhavarsal	
26. Kharaya	Sterculia urens
27. Piplo	Ficus religiosa
28. Vad	Ficus bengalensis
29. Amli	Tamarindus indica
30. Ambo	Mangifera indica
31. Kubhyo	
32. Mesaro	Radermachera xylocarpa
33. Seven	Gmelina arborea
34. Kakad	Garuga pinnata
35. Modal, Modad	Lannea coromandelica
36. Amla	Phyllanthus emblica
37. Bizado	
38. Khair	Acacia catechu
39. Gundo	Cordia dichotoma
40. Kodaro	Fermiana colorata
41. Pitrali	Dalbergia lanceolaria
42. Siras	Albezzia lebbek
43. Karanj	Pongamia pinnata
44. Khati amla	Phyllanthus acidus
45. Khati kumbha	
46. Vansa	Dendrocalamus strictus
47. Segathi	
48. Pangro	
49. Garmado	Cassia fistula
50. Kelai	Albizzia procera
51. Umbh	Miliusa tomentosa
52. Dedakmanjo	Casearia elliptica
53. Tetvo	Oroxylum indicum
54. Bhoyumari	
55. Gogda	Xeromphis uliginosa
56. Gopali	
57. Musali	
58. Bor, Bordi	Ziziphus mauritiana
59. Pomegranate	
60. Fanas	Artocarpus heterophyllus
61. Sitaphal	Annona squasmosa
62. Limbu	Citrus spp
63. Gorasambli	Pithicellobium dulce
64. Almond	Terminalia catapa
65. Cashewnut	Anacardium occidentale
66. Royan	Soymida febrifuga
67. Gulmohar	Delonix regia
68. Keshyo	
69. Peltoform	Peltoforum pterocarpum
70. Bubri akni	
71. Pinpichri	
72. Kati vans	Bambusa arundinaceae
73. Saru	Casuarina equisetifolia
74. Asopalav	Poliyalthia longifolia
75. Karavo	
76. Aasuli	
77. Dinisaj	
78. Togari	
80. Kharval	Ficus asperrima
81. Tatadiyo	Veronia cinerascens
82. Borkuto	
83. Baval	Acacia nilotica
84. Kakhbilado	Capparis zeylanica
85. Katlo	
86. Bhindi	Thespia populnea
87. Rajabhindi	
88. Alvas	
89. Iso	
90. Bengalibabul	Acacia auriculiformis
91. Tavri	Avicennia officinalis
92. Tabilo	
93. Shingali	
94. Dhoni	
95. Parsinabor	
96. Ibar	
97. Dhutarakh	
98. Tendu	Diospyros melanoxylon
99. Segwan	Tectona grandis
100. Mithihekthi	
101. Almuido	Moghania lineata
102. Khalpaman	
103. Gadi	Indigofera tinctoria
104. Tahgama	
105. Tarno	
106. Champa Kothi	Bauhinia purpurea
107. Mendi	Lawsonia inermis
108. Bokho	
109. Doran	
110. Ragatroyan	Tecomella undulata
111. Arati	Sapindus emarginatus
112. Tad	Borassus flabellifer
113. Kajur	Phoenix sylvestris
114. Saragvo	Moringa olifera

APPENDIX 4

CALCULATION ESTIMATES FOR COMMERCIAL FUELWOOD HEADLOADING AND SUBSISTENCE USE: MOTI PIPAL HAMLET

Methodological Assumptions:

1. The total biomass weight of a 40-year old oven-dried tree of 90 cm GBH = 225 kg. (2.25 quintals). Since the collected wood is only partially dry, we add 15% to account for the average additional water weight. Hence, one 40-yr.old tree of partially dry biomass = 259 kg.

2. A relatively well-stocked, mixed deciduous forest of even-aged trees has density of 400 trees per hectare.

3. Average price for headload of fuelwood sold at Ukai is Rs.10 per 20 kg. = .50 paise/kg.

4. Average landless family of 6.8 members uses 6.5 kg. fuelwood per day for subsistence.

I. Extraction for Commercial Headloading:

a. 20 kg/headload x 106 headloaders in Motipipal (of 110 total households) x 30 days/month x 8 months/year = 508,800 kg wood
b. 508,800 kg ÷ 259 kg/tree = 1964 trees (40 year old)
c. 1964 trees/year ÷ 106 families = 18.5 trees/family annually
d. 1964 trees ÷ 400 trees/ha = 4.9 ha. of well-stocked forest clearfelled each year or:
   9.8 ha of well-stocked forest if 50% of trees were felled/year
   19.6 ha " " " 25% " " "

II. Profit from Headloading:

a. 20 kg/day x 30 days/mo. x 8 mo./year x 0.50 paise/kg = Rs.2400 per family for 8 mo.
   = Rs.300 /month for 8 months
   = Rs.200/month per year

III. Extraction for Subsistence Fuelwood:

a. 6.5 kg/day x 110 total families in Moti Pipal x 365 days/year = 260,975 kg/yr
b. 260,975 kg ÷ 259 kg/tree = 1007 trees
c. 1007 trees/year ÷ 110 families = 9 trees per family/year
d. 1007 trees ÷ 400 trees/ha. = 2.5 ha. of well-stocked forest clearfelled per year or:
   5 ha of well stocked forest if 50% of trees were felled/year
   10 ha " " 25% " "

SUMMARY ANALYSIS:

* **Total Clearfelled Forest Area Required for Commercial & Subsistence Fuelwood Extraction by Moti Pipal Hamlet = 7.4 ha./year**

* **Total Quantum of 40-year old Trees Required for Commercial and Subsistence Fuelwood Extraction by Moti Pipal Hamlet = 27.5 trees/family each year**

APPENDIX 5

WORKSHOP PARTICIPANTS

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Back Cover Photographs:

Logging truck and Forest Labor Cooperative Society members near Limbi forest
Community sketch mapping, Limbi hamlet
Mahua flower collectors returning home